REPUBLIQUE DU CAMEROUN
Paix-Travail-patrie

UNIVERSITE DE YAOUNDE I

FACULTE DE MEDECINE ET DES SCIENCES BIOMEDICALES

REPUBLIC OF CAMEROON
Peace-Work-Fatherland

THE UNIVERSITY OF YAOUNDE I

FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

DEPARTMENT OF OPHTHALMOLOGY, ENT AND STOMATOLOGY

ETIOLOGIES OF CHILDHOOD VISUAL IMPAIRMENT AT THE SECOND REGION MILITARY HOSPITAL IN DOUALA

Thesis written and defended publicly in partial fulfilment of the requirement for award Medicine Doctor (MD) degree by:

KINYUY FAUSTINA BERINYUY

Matricule N°: 17M074

SUPERVISOR:
Pr. KOKI GODEFROY
Associate Professor of Ophthalmology

CO-SUPERVISOR:
Dr MVILONGO TSIMI CAROLINE
Senior Lecturer of Ophthalmology

Academic year 2023-2024

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Date de soutenance:

Jury:

President of Jury

……

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Pr. KOKI GODEFROY

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SUPERVISOR:

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Associate Professor of Ophthalmology

CO-SUPERVISOR:

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Academic year 2023-2024

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DEDICATION

To my entire family,the BERINYUY family

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I am grateful to almighty God for seeing my through seven years of medical school and for granting me the strength and ability to go through these years successfully. I also wish to express my heartful gratitude to everyone who has supported me throughout this work. I also wish to express my special thanks to:

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- Dr. MVILONGO TSIMI Caroline, my thesis co-supervisor, for your motherly support, whose availability, step-by-step guidance and a true embodiment of empathy and excellence. You serve as an exceptional role model, and I aspire to one day follow in your esteemed footsteps. I am deeply grateful for all that you have done and continue to do.
- The Dean Pr NGO UM Esther Juliette épse MEKA and the entire staff of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I, for the knowledge and virtues imparted to us throughout our training. Your collective commitment to education has been instrumental in shaping us into the professionals we are today.
- The honorable jury members for accepting to read through and evaluate my work. Thank you all for all the comments you are going to make, which will be needed to improve my work. I am deeply appreciative of the time and effort you have invested in reviewing this dissertation.
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- The Ophthalmology residents of the Secondary Military Regional Hospital. Dr MBACHAM FANNY, ELOUNDOU INGRID, FOGUE MURIEL, NYATCHOU ARIEL for their friendly welcome, support and their availability and special thanks to Dr. NFOR SONE for your unwavering supports, corrections made over a short period of time and to your encouragements.
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- To all the children of this study, I express my sincere gratitude for the confidence you all had in us.
- I am deeply grateful for the collective contributions of everyone mentioned above, as they have been instrumental in the successful completion of this academic endeavor.

LIST OF ADMINISTRATIVE AND TEACHING STAFF OF FMBS (UY1) 2023-2024

1. ADMINISTRATIVE PERSONNELS

- **Dean :** Pr. NGO UM Esther Juliette épse MEKA
- **Vice-Dean in charge of programming and monitoring academic activities**: Pr. NTSAMA ESSOMBA Claudine Mireille
- **Vice-Dean for Research and Cooperation**: Pr. ZEH Odile Fernande
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- **Head of the Academic Affairs, Schooling and Research Division**: Dr VOUNDI VOUNDI Esther
- **Head of Administrative and Financial Division**: Ms ESSONO EFFA Muriel Glawdis
- **General Coordinator of the Specialization Cycle:** Pr. NJAMNSHI Alfred KONGNYU
- **Head of Finance Department:** Mme NGAMLI NGOU Mireille Albertine épouse WAH
- **Deputy Chief Financial Officer:** Ms MANDA BANA Marie Madeleine épouse ENGUENE
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- **Head of Diplomas Department:** Ms ASSAKO Anne DOOBA
- **Deputy Head of Diplomas:** Dr NGONO AKAM MARGA Vanina
- **Head of Schooling and Statistics Department:** Ms BIENZA Aline
- **Deputy Head of the Schooling and Statistics Department:** Ms FAGNI MBOUOMBO AMINA married name ONANA
- **Head of Equipment and Maintenance:** Mrs HAWA OUMAROU
- **Deputy Head of Material and Maintenance:** Dr MPONO EMENGUELE Pascale épouse NDONGO
- **Acting Head Librarian:** Ms FROUISSOU née MAME Marie-Claire
- **Materials accountant**: Mr MOUMEMIE NJOUNDIYIMOUN MAZOU

2. CYCLE COORDINATORS AND DEPARTMENT HEADS

- **Coordinator of the Oral Medicine Department**: Pr. BENGONDO MESSANGA Charles
- **Coordinator of the Pharmacy Department:** Pr. NTSAMA ESSOMBA Claudine
- **Internship coordinator:** Pr. ONGOLO ZOGO Pierre
- **Coordinator of the Specialization Cycle in Pathological Anatomy**: Pr. SANDO Zacharie
- **Coordinator of the Specialization Cycle in Anesthesia and Intensive Care**: Pr. ZE MINKANDE Jacqueline

- **Coordinator of the Specialization Cycle in General Surgery**: Pr. NGO NONGA Bernadette
- **Coordinator of the Specialization Cycle in Gynecology and Obstetrics**: Pr. DOHBIT Julius SAMA
- **Coordinator of the Specialization Cycle in Internal Medicine:** Pr. NGANDEU Madeleine
- **Coordinator of the Specialization Cycle in Pediatrics**: Pr. MAH Evelyn MUNGYEH
- **Coordinator of the Specialization Cycle in Clinical Biology**: Pr. KAMGA FOUAMNO Henri Lucien
- **Coordinator of the Specialization Cycle in Radiology and Medical Imaging**: Pr. ONGOLO ZOGO Pierre
- **Coordinator of the Specialization Cycle in Public Health**: Pr. TAKOUGANG Innocent
- **Continuing education coordinator:** Pr. KASIA Jean Marie
- **Project focal point:** Pr. NGOUPAYO Joseph
- **CESSI Pedagogical Manager**: Pr. ANKOUANE ANDOULO Firmin

3. CUSS HONORARY DIRECTORS

- Pr. MONEKOSSO Gottlieb (1969-1978)
- Pr. EBEN MOUSSI Emmanuel (1978-1983)
- Pr. NGU LIFANJI Jacob (1983-1985)
- Pr. CARTERET Pierre (1985-1993)

4. HONORARY DEANS OF THE FMSB

- Pr. SOSSO Maurice Aurélien (1993-1999)
- Pr. NDUMBE Peter (1999-2006)
- Pr. TETANYE EKOE Bonaventure (2006-2012)
- Pr. EBANA MVOGO Côme (2012-2015)
- Pr. ZE MINKANDE Jacqueline (2015-2024)

5. TEACHING STAFF

Table I: Teaching staff of FMBS, UYI

N°	NAMES AND SURNAMES	RANK	DISCIPLINE
DEPARTMENT OF SURGERY AND SPECIALTIES			
1.	**SOSSO Maurice Aurélien (HD)**	P	General Surgery
2.	DJIENTCHEU Vincent de Paul	P	Neurosurgery
3.	ESSOMBA Arthur (Interim HD)	P	General Surgery
4.	HANDY EONE Daniel	P	Orthopedic Surgery
5.	MOUAFO TAMBO Faustin	P	Pediatric Surgery
6.	NGO NONGA Bernadette	P	General Surgery
7.	NGOWE NGOWE Marcellin	P	General Surgery
8.	ZE MINKANDE Jacqueline	P	Anesthesia and Intensive care
9.	BAHEBECK Jean	AP	Orthopedic Surgery
10.	BANG GUY Aristide	AP	General Surgery
11.	BENGONO BENGONO Roddy Stéphan	AP	Anesthesia and Intensive care
12.	FARIKOU Ibrahima	AP	Orthopedic Surgery
13.	JEMEA Bonaventure	AP	Anesthesia and Intensive care
14.	OWONO ETOUNDI Paul	AP	Anesthesia and Intensive care
15.	BEYIHA Gérard	AP	Anesthesia and Intensive care
16.	ESIENE Agnès	AP	Anesthesia and Intensive care
17.	EYENGA Victor Claude	AP	Surgery/Neurosurgery
18.	GUIFO Marc Leroy	AP	General Surgery
19.	NGO YAMBEN Marie Ange	SL	Orthopedic Surgery
20.	AHANDA ASSIGA	SL	General Surgery
21.	AMENGLE Albert Ludovic	SL	Anesthesia and Intensive care
22.	BIWOLE BIWOLE Daniel Claude Patrick	SL	General Surgery
23.	BWELE Georges	SL	General Surgery
24.	FONKOUE Loïc	SL	Orthopedic Surgery
25.	MBOUCHE Landry Oriole	SL	Urology

26.	MEKEME MEKEME Junior Barthelemy	SL	Urology
27.	TSIAGADIGI Jean Gustave	SL	Orthopedic Surgery

28.	SAVOM Eric Patrick	SL	General Surgery
29.	BELLO FIGUIM	SL	Neurosurgery
30.	BIKONO ATANGANA Ernestine Renée	SL	Neurosurgery
31.	EPOUPA NGALLE Frantz Guy	L	Urology
32.	FOLA KOPONG Olivier	L	Surgery
33.	FOUDA Jean Cédrick	L	Urology
34.	IROUME Cristella Raïssa BIFOUNA épouse NTYO'O NKOUMOU	SL	Anaesthesia and Intensive care
35.	KONA NGONDO François Stéphane	SL	Anaesthesia and Intensive care
36.	MOHAMADOU GUEMSE Emmanuel	L	Orthopedic Surgery
37.	MULUEM Olivier Kennedy	SL	Orthopedic Surgery
38.	NWAHA MAKON Axel Stéphane	SL	Urology
39.	NDIKONTAR KWINJI Raymond	SL	Anesthesia and Intensive care
40.	NGOUATNA DJEUMAKOU Serge Rawlings	L	Anesthesia and Intensive care
41.	NYANIT BOB Dorcas	L	Pediatric Surgery
42.	OUMAROU HAMAN NASSOUROU	L	Neurosurgery
43.	FOSSI KAMGA GACELLE	L	Pediatric Surgery
44.	MBELE Richard II	L	Thoracic Surgery

45.	MFOUAPON EWANE Hervé Blaise	L	Neurosurgery
46.	NYANKOUE MEBOUINZ Ferdinand	L	Orthopaedic Surgery and Traumatology
DEPARTMENT OF INTERNAL MEDICINE AND SPECIALTIES			
47.	SINGWE Madeleine épse NGANDEU	P	Internal Medicine/Rheumatology
48.	AFANE ZE Emmanuel	P	Internal Medicine/Pneumology

49.	ANKOUANE ANDOULO	P	Internal Medicine / Hepatogastroenterology
50.	ASHUNTANTANG Gloria Enow	P	Internal Medicine/Nephrology
51.	BISSEK Anne Cécile	P	Internal Medicine/Dermatology
52.	KAZE FOLEFACK François	P	Internal Medicine/Nephrology
53.	KINGUE Samuel	P	Internal Medicine/Cardiology
54.	KUATE TEGUEU Calixte	P	Internal Medicine/Neurology
55.	MBANYA Jean Claude	P	Internal Medicine/Endocrinology
56.	NDJITOYAP NDAM Elie Claude	P	Internal Medicine/ Gastroenterology and Hepatology
57.	NDOM Paul	P	Internal Medicine/Oncology
58.	NJAMNSHI Alfred K.	P	Internal Medicine/Neurology
59.	NJOYA OUDOU	P	Internal Medicine/Gastroenterology and Hepatology
60.	SOBNGWI Eugène	P	Internal Medicine/Endocrinology
61.	PEFURA YONE Eric Walter	P	Internal Medicine/Pneumology
62.	HAMADOU BA	AP	Internal Medicine/Cardiology
63.	KOUOTOU Emmanuel Armand	P	Internal Medicine/Dermatology
64.	MENANGA Alain Patrick	AP	Internal Medicine/Cardiology
65.	FOUDA MENYE Hermine Danielle	AP	Internal Medicine/Nephrology
66.	KOWO Mathurin Pierre	AP	Internal Medicine/Gastroenterology and Hepatology

67.	NDONGO AMOUGOU Sylvie	SL	Internal Medicine /Cardiology
68.	BOOMBHI Jérôme	AP	Internal Medicine /Cardiology
69.	KUATE née MFEUKEU KWA Liliane Claudine	SL	Internal Medicine /Cardiology
70.	NGANOU Chris Nadège	AP	Internal Medicine /Cardiology
71.	ATENGUENA OBALEMBA Etienne	SL	Internal Medicine/ Oncology
72.	ETOA NDZIE épouse ETOGA Martine Claude	SL	Internal Medicine /Endocrinology
73.	KAMGA OLEN Jean Pierre Olivier	SL	Internal Medicine /Psychiatry

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77.	ANABA MELINGUI Victor Yves	L	Internal Medicine /Rheumatology
78.	DEHAYEM YEFOU Mesmin	SL	Internal Medicine /Endocrinology
79.	ESSON MAPOKO Berthe Sabine épouse PAAMBOG	SL	Internal Medicine / Oncology
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92.	EBENE MANON Guillaume	L	Internal Medicine /Cardiology
93.	ELIMBY NGANDE Lionel Patrick Joël	L	Internal Medicine /Nephrology
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97.	NKO'O AMVENE Samuel	P	Radiology/Medical Imaging
98.	GUEGANG GOUJOU. E.	P	Medical Imaging/Neuroradiology
99.	MOIFO Boniface	P	Radiology/Medical Imaging
100.	ONGOLO ZOGO Pierre	AP	Radiology/Medical Imaging
101.	SAMBA Odette NGANO	AP	Biophysics/Medical Physics
102.	MBEDE Maggy épouse ENDEGUE MANGA	SL	Radiology/Medical Imaging
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104.	NWATSOCK Joseph Francis	L	Radiology/Medical Imaging Nuclear Medicine
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107.	BELLEY PRISO Eugène	P	Gynecology Obstetrics
108.	FOUMANE Pascal	P	Gynecology Obstetrics
109.	MBOUDOU Émile	P	Gynecology Obstetrics

110.	MBU ENOW Robinson	P	Gynecology Obstetrics
111.	NKWABONG Elie	P	Gynecology Obstetrics
112.	TEBEU Pierre Marie	P	Gynecology Obstetrics
113.	DOHBIT Julius SAMA	AP	Gynecology Obstetrics
114.	FOUEDJIO Jeanne H.	AP	Gynecology Obstetrics
115.	KEMFANG NGOWA Jean Dupont	P	Gynecology Obstetrics
116.	MVE KOH Valère Salomon	AP	Gynecology Obstetrics
117.	NGO UM Esther Juliette épse MEKA	AP	Gynecology Obstetrics
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119.	BELINGA Etienne	AP	Gynecology Obstetrics
120.	ESSIBEN Félix	AP	Gynecology Obstetrics
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122.	EBONG Cliford EBONTANE	SL	Gynecology Obstetrics
123.	MBOUA BATOUM Véronique Sophie	SL	Gynecology Obstetrics
124.	MENDOUA Michèle Florence épouse NKODO	L	Gynecology Obstetrics
125.	NSAHLAI Christiane JIVIR FOMU	SL	Gynecology Obstetrics
126.	NYADA Serge Robert	SL	Gynecology Obstetrics
127.	TOMPEEN Isidore	L	Gynecology Obstetrics
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129.	BELLA Assumpta Lucienne	P	Ophthalmology
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132.	NJOCK Richard	P	ENT
133.	OMGBWA EBALE André	P	Ophthalmology
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155.	ABENA OBAMA Marie Thérèse	P	Pediatrics
156.	CHIABI Andreas	P	Pediatrics
157.	CHELO David	P	Pediatrics
158.	NGUEFACK Séraphin	P	Pediatrics
159.	MAH EVELYN	P	Pediatrics
160.	NGUEFACK épouse DONGMO Félicitée	P	Pediatrics

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162.	MBASSI Awa	P	Pediatrics
163.	ONGOTSOYI Angèle H.	AP	Pediatrics
164.	KALLA Ginette Claude épse MBOPI KEOU	AP	Pediatrics
165.	NOUBI N. épouse KAMGAING M.	SL	Pediatrics
166.	MEKONE NKWELE Isabelle	SL	Pediatrics
167.	EPEE épouse NGOUE Jeannette	SL	Pediatrics
168.	KAGO TAGUE Daniel Armand	L	Pediatrics
169.	MEGUIEZE Claude-Audrey	SL	Pediatrics
170.	TONY NENGOM Jocelyn	SL	Pediatrics

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173.	GONSU née KAMGA Hortense	P	Bacteriology
174.	LUMA Henry	P	Bacteriology/ Virology
175.	MBANYA Dora	P	Hematology
176.	OKOMO ASSOUMOU Marie Claire	P	Bacteriology/ Virology
177.	TAYOU TAGNY Claude	P	Microbiology/Hematology
178.	TOUKAM Michel	AP	Microbiology
179.	CHETCHA CHEMEGNI Bernard	SL	Microbiology/Hematology
180.	KINGE Thomson NJIE	SL	Infectious Diseases
181.	LYONGA Emilia ENJEMA	AP	Medical Microbiology
182.	NDOUMBA NKENGUE Annick épouse MINTYA	SL	Hematology
183.	NGANDO Laure épouse MOUDOUTE	SL	Parasitology
184.	VOUNDI VOUNDI Esther	SL	Virology
185.	BEYELA Frédérique	L	Infectious Diseases

186.	BOUM II YAP	SL	Microbiology
187.	ESSOMBA Réné Ghislain	L	Immunology and Infectious Diseases
188.	MEDI SIKE Christiane Ingrid	L	Clinical Biology
189.	NGOGANG Marie Paule	SL	Clinical Biology
190.	ANGANDJI TIPANE Prisca épouse ELLA	L	Clinical Biology /Hematolo==gy
DEPARTMENT OF PUBLIC HEALTH			
191.	KAMGNO Joseph (HD)	P	Public Health /Epidemiology
192.	ESSI Marie Josée	P	Public Health / Anthropology

193.	BEDIANG Georges Wylfred	AP	Medical Information Technology/ Public Health
194.	NGUEFACK TSAGUE	AP	Public Health /Biostatistics
195.	TAKOUGANG Innocent	AP	Public Health
196.	TANYA née NGUTI K. A.	AP	Nutrition
197.	BILLONG Serges Clotaire	SL	Public Health
198.	KEMBE ASSAH Félix	SL	Epidemiology
199.	KWEDI JIPPE Anne Sylvie	SL	Epidemiology
200.	MOSSUS Tatiana née ETOUNOU AKONO	SL	Expert in Health Promotion
201.	NJOUMEMI ZAKARIAOU	SL	Public Health /Health Economics
202.	ABBA-KABIR HAAMIT-M	L	Pharmacist
203.	AMANI ADIDJA	L	Public Health
204.	EYEBE EYEBE Serge Bertrand	SL	Public Health /Epidemiology
205.	MBA MAADJHOU Berjauline Camille	L	Public Health /Nutritional Epidemiology
DEPARTMENT OF MORPHOLOGICAL SCIENCES- ANATOMICAL PATHOLOGY			
206.	MENDIMI NKODO Joseph (HD)	P	Morbid Anatomy/Pathology
207.	ESSAME OYONO	P	Morbid Anatomy/Pathology
208.	FEWOU Amadou	P	Morbid Anatomy/Pathology
209.	SANDO Zacharie	P	Morbid Anatomy/Pathology

210.	BISSOU MAHOP	AP	Sports Medicine
211.	KABEYENE OKONO Angèle	AP	Histology/Embryology
212.	AKABA Désiré	AP	Human Anatomy
213.	NGONGANG Gilbert FranK Olivier	SL	Legal Medicine
214.	NSEME Eric	AP	Legal Medicine
215.	MENDOUGA MENYE Coralie Reine Bertine épse KOUOTOU	L	Morbid Anatomy
DEPARTEMENT OF BIOCHEMISTRY			
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217.	PIEME Constant Anatole	P	Biochemistry
218.	AMA MOOR Vicky Joceline	P	Clinical Biology/Biochemistry
219.	EUSTACE BONGHAN BERINYUY	SL	Biochemistry
220.	GUEWO FOKENG Magellan	SL	Biochemistry
221.	MBONO SAMBA ELOUMBA Esther Astrid	L	Biochemistry
DEPARTMENT OF PHYSIOLOGY			
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223.	ASSOMO NDEMBA Peguy Brice	AP	Physiology
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KEY:

- HOD: Head of Department
- P= Professor
- AP= Associate Professor
- SL= Senior Lecturer
- L= Lecturer

THE PHYSICIAN'S OATH

Declaration of Geneva adopted by the Geneva Assembly of the World Medical Association in Geneva, Switzerland, September 1948 and amended by the 22nd World Medical Assembly, Sydney, Australia (August 1968)

On admission to the medical profession:

I will solemnly pledge myself to consecrate my life to the service of humanity

I will give my teachers the respect and gratitude which is their due

I will practice my profession with conscience and dignity

The health of my patients will be my first consideration

I will respect secrets confided in me, even after the patient has died

I will maintain by all the means in my power the honour and noble traditions of the medical profession

My colleagues will be my brothers

I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my patient

I will maintain the utmost respect for human life from the time of conception, even under threat I will not use my medical knowledge contrary to the laws of humanity

I make these promises solemnly, freely and upon my honour

ABSTRACT

Introduction: Childhood visual impairment (CVI) is defined as a significant reduction in visual function that affects a child's ability to perform daily activities, participate in educational experiences, and develop normally. Globally, around 1.5 million children are blind, with a prevalence of approximately 1% in sub-Saharan Africa, including Cameroon. Factors such as vitamin A deficiency, infections, and inadequate healthcare access significantly contribute to this high incidence.

Objective: To determine the etiologies of children with visual impairment at the Second Regional Military Hospital, Doula.

Materials and Methods: We carried out a descriptive cross-sectional study with a retrospective data collection. This study included all medical records of children who consulted in the ophthalmology service at the hospital for a visual issue. The population of the study was aged between 0 to 18 years and was classified based on their age group. A total of 420 records were collected in this period and each individual's visual impairment was classified. Causes of visual impairment were classified using the International Classification of Diseases version 11. Data was collected and analyzed using IBM SPSS version 20 software.

Results: A total of 420 (840 eyes) medical records were reviewed, the mean age of participants was 11.88 ± 4.53 years, with 55.2% being girls. Most participants were in secondary school (53%) and resided in rural areas (60.3%). Clinically, 55.6% had never used corrective lenses, while 43.7% had, with an average onset age of 9.85 ± 4.39 years. Visual acuity assessments revealed mild impairment in 7.3% (right eye) and 5.3% (left eye), with blindness at 1.5% and 1.3%, respectively. Abnormal ocular motility was observed in 5%, and slit-lamp evaluations indicated cataracts in 4.7%. The intraocular pressure was mostly normal, averaging 12.79 ± 6.33 mmHg (right eye) and 15.06 ± 17.42 mmHg (left). Avoidable causes accounted for 69.9% of visual impairment, with ametropia being the most common at 57.3

Conclusion: Our study underscores the prevalence of avoidable causes of visual impairment, particularly ametropia, these highlight the urgent need for public health interventions to enhance access to corrective treatments and timely management strategies, emphasizing the importance of early detection and intervention for improving the ocular health outcomes of affected children.

Keywords: Childhood visual impairment, Visual impairment, , Douala ,Cameroon

RÉSUMÉ

Introduction : La déficience visuelle de l'enfant (CVI) est définie comme une réduction significative de la fonction visuelle qui affecte la capacité de l'enfant à effectuer des activités quotidiennes, à participer à des expériences éducatives et à se développer normalement. Dans le monde, environ 1,5 million d'enfants sont aveugles, avec une prévalence d'environ 1 % en Afrique subsaharienne, y compris au Cameroun. Des facteurs tels que la carence en vitamine A, les infections et l'accès inadéquat aux soins de santé contribuent de manière significative à cette incidence élevée.

Objectif : Évaluer les déficiences visuelles des enfants en identifiant leurs étiologies au deuxième hôpital militaire régional de Douala.

Matériels et méthodes : Nous avons réalisé une étude transversale descriptive avec une collecte de données rétrospective. Cette étude a inclus tous les dossiers médicaux des enfants qui ont consulté dans le service d'ophtalmologie de l'hôpital pour un problème visuel. La population de l'étude était âgée de 0 à 18 ans et a été classée en fonction de son groupe d'âge. Au total, 420 dossiers ont été collectés au cours de cette période et les déficiences visuelles de chaque individu ont été classées. Les causes de la déficience visuelle ont été classées à l'aide de la version 11 de la classification internationale des maladies. Les données ont été collectées et analysées à l'aide du logiciel IBM SPSS version 20.

Résultats : Au total, 420 (840 yeux) dossiers médicaux ont été examinés. L'âge moyen des participants était de 11,88 ± 4,53 ans, avec 55,2 % de filles. La plupart des participants allaient à l'école secondaire (53 %) et résidaient dans des zones rurales (60,3 %). Sur le plan clinique, 55,6 % des participants n'avaient jamais utilisé de verres correcteurs, tandis que 43,7 % en avaient utilisé, avec un âge moyen d'apparition de 9,85 ± 4,39 ans. Les évaluations de l'acuité visuelle ont révélé une déficience légère chez 7,3 % (œil droit) et 5,3 % (œil gauche), avec une cécité chez 1,5 % et 1,3 %, respectivement. Une motilité oculaire anormale a été observée dans 5 % des cas, et les évaluations à la lampe à fente ont révélé des cataractes dans 4,7 % des cas. La pression intraoculaire était généralement normale, avec une moyenne de 12,79 ± 6,33 mmHg (œil droit) et 15,06 ± 17,42 mmHg (œil gauche). Les causes évitables représentaient 69,9 % des déficiences visuelles, l'amétropie étant la plus fréquente (57,3 %).

Conclusion : Notre étude souligne la prévalence des causes évitables de déficience visuelle, en particulier l'amétropie, ce qui met en évidence le besoin urgent d'interventions de santé publique pour améliorer l'accès aux traitements correctifs et aux stratégies de gestion en temps opportun, en soulignant l'importance de la détection et de l'intervention précoces pour améliorer les résultats en matière de santé oculaire des enfants affectés.

Mots-clés : Déficience visuelle chez l'enfant, Déficience visuelle, Douala, Cameroun.

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LIST OF ABBREVIATIONS

ABREVATIONS	MEANING
ACT	Acceptance and Commitment Therapy
BLENNZ	Blind and Low Vision Education Network
CALT	Conjunctiva-associated lymphoid tissue
CVI	Childhood visual impairment
CMV	Cytomegalovirus
COF	Counting Of Fingers
CS/PB	Corneal Scars and Phthisis Bulbi
CVI	Cortical visual impairment
DR	Diabetic Retinopathy
ELM	External Limiting Membrane
ERG	Electroretinography
FMBS	Faculty of Medicine and Biomedical Sciences
SRMH	Second Region Military Hospital Douala
IAPB	International Agency for the Prevention of Blindness
ICEH	International Centre for Eye Health ILM: Internal Limiting Membrane
ICD-11	International Classification of Diseases
ILM	Internal Limiting Membrane
IRIS®	Intelligent Research In Sight
MD	Macular Diseases
NSAIDs	Non-steroidal anti-inflammatory drugs
ROP	Retinopathy of prematurity RPE: Retinal Pigment Epithelium
RP	Retinitis Pigmentosa
RPE	Retinal Pigment Epithelium
PL+	Perception of Light Positive
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
SVI	Severe Visual Impairment
VA	Visual Acuity
VAD	Vitamin A Deficiency
WHO	World Health Organization

INTRODUCTION

I.1. Background

Childhood visual impairment (CVI) is defined as a significant reduction in visual function that affects a child's ability to perform daily activities, participate in educational experiences, and develop normally. This condition may encompass a range of visual deficits, including reduced visual acuity, field loss, and problems with eye coordination or alignment.[1, 2].Childhood visual impairment, affecting millions globally under 16, is a major public health concern. Encompassing varying degrees of vision loss, from near-darkness to light sensitivity, it's a priority for the World Health Organization's 2020 goal of eliminating avoidable blindness.

According to the British Journal of Ophthalmology, 1.5 million children are blind worldwide, making it the second leading cause of vision loss. This represents 0.7% of children, being approximately one-tenth as frequent as blindness in whole population (WHO. Preventing blindness in children. Report of a WHO/IAPB scientific meeting. 1999). Despite being less prevalent, Childhood visual impairment has a huge impact, causing 70 million blind person years and adding a new child to this vulnerable group every minute, underlining the need of urgent action urgent action is needed.

In Sub-Saharan Africa, and particularly in Cameroon, childhood visual impairment often goes under-reported and untreated due to insufficient health infrastructure, lack of specialized pediatric eye care, and limited public awareness. Common causes of childhood blindness and visual impairment include refractive errors, cataracts, glaucoma, retinopathy of prematurity, and infections such as measles and rubella. In many cases, visual impairment in children is preventable or treatable if detected early. Causes differ from a region to another due to socioeconomic factors and poor access to care. Sub-Saharan Africa registers more corneal diseases from vitamin A deficiency, measles, and traditional remedies, while high-income countries have more cortical visual impairment, retinal disorders, and optic nerve problems [3].

In Cameroon, childhood blindness and visual impairment remain underexplored, with significant gaps in data collection and public health strategies tailored to this vulnerable population. Childhood visual impairment is a neglected issue that requires more attention and research to understand the specific, the etiologies, risk factors, and disparities in Childhood visual impairment across the country.

Our study aimed our study aimed to evaluate visual impairment of children by identifying their etiologies at the second military hospital Douala, largest and most populous city in Cameroon that faces many challenges such as poverty, urbanization, pollution, and inadequate health infrastructure. These factors may have an impact on the patterns of children with visual impairment at the Second Region Military Hospital, Douala.

CHAPTER I: GENERAL CONTEXT OF THE STUDY

1.1. Justification

Childhood visual impairment has a significant impact on the individual child, their family and the wider community. It can limit a child's ability to learn, develop social skills and participate in everyday activities. This can lead to long-term educational, economic and social consequences for the affected individuals and their families.

Additionally, Childhood visual impairment can place a burden on health care systems and resources, as affected individuals may require ongoing medical care, rehabilitation and support services. This can strain already limited health care resources in low and middle-income countries like Cameroon.

Furthermore, Childhood visual impairment can perpetuate cycles of poverty and inequality, as affected individuals may face barriers to accessing education, employment and social inclusion. This can have wider societal implications for economic development and social cohesion. Therefore, evaluating the etiologies of visual impairment in children is not only a matter of public health but also a social and economic imperative. By investing in early screening and intervention measures, as well as raising awareness and improving access to health care services, Cameroon can work towards reducing the burden of Childhood visual impairment and visual impairment, improving the prospects for affected children and their communities.

1.2. RESEARCH QUESTIONS

What is the epidemiological and clinical characteristics of visual impairment children at the Second Region Military Hospital in Douala?

1.3. RESEARCH HYPOTHESIS

Did epidemiological characteristics of visual impairment differ in children at the Second Region Military Hospital in Douala

1.4. OBJECTIVES OF THE STUDY

4.4.1. General objectives

To evaluate visual impairment of children by identifying their etiologies at the Second Region Military Hospital in Douala.

1.4.2. Specific objectives

1) To describe the epidemiological characteristics of visual impairment found at the 2nd Region MH
2) To identify the etiologies of children with visual impairment attending the 2nd Region MH.
3) To classify the visual impairment in children seen at the 2nd Region MH

CHAPTER II : LITERATURE REVIEW

II.1. ANATOMICAL AND PHYSIOLOGICAL REVIEW OF THE ADNEXIAE

ADNEXIAE

i. The Eyelid

The eyelids are thin folds of skin that protect the eye and contribute to vision by regulating light exposure and maintaining moisture. Each eyelid consists of several layers, each with specific functions.

Skin: The outermost layer of the eyelid is thin and highly mobile, containing hair follicles and sebaceous glands. This layer plays a crucial role in protecting the underlying structures and assisting in regulating temperature.

Muscle Layers: Two key muscles are involved in eyelid function. The **orbicularis oculi** is a circular muscle that closes the eyelid, playing a vital role in blinking and protecting the eye from foreign objects. The levator palpebrae superioris is responsible for elevating the upper eyelid; its dysfunction can lead to ptosis, or drooping of the eyelid.

Tarsal Plates: These dense connective tissue structures provide stiffness and shape to the eyelids. They support the eyelid's structure and contain the meibomian glands, which secrete oils to maintain tear film stability.

Conjunctival Layer: The conjunctiva is a mucous membrane that lines the inner surface of the eyelids and covers the anterior part of the sclera, providing a smooth surface for eyelid movement and helping to keep the eye moist.

Physiology: The eyelids perform essential functions such as blinking, which occurs approximately 15-20 times per minute in humans. This action spreads tears across the ocular surface, ensuring even moisture and nutrition to the cornea while removing debris. The rapid closure of the eyelids during a blink also protects the eye from potential harm.

Clinical Significance: Dysfunction of eyelid muscles can lead to conditions such as **ptosis** (drooping eyelid) or blepharospasm (involuntary blinking). Additionally, inadequate eyelid closure, known as lagophthalmos, can lead to corneal exposure and dryness, increasing the risk of ulceration and infection.

ii. The Conjunctiva

The conjunctiva is divided into three main parts: the palpebral conjunctiva, bulbar conjunctiva, and fornices.

Palpebral Conjunctiva: This part lines the inner surface of the eyelids, providing a smooth surface for eyelid movement and helping to keep the eye moist.

Bulbar Conjunctiva: Covering the anterior surface of the eyeball, the bulbar conjunctiva extends to the corneal limbus. It protects the eye from foreign particles and contributes to the tear film.

Fornices: These are the spaces where the palpebral and bulbar conjunctiva meet, forming a pocket that allows for eyelid movement and facilitates tear drainage.

Physiology

- Protection: The conjunctiva acts as a barrier against pathogens, dust, and harmful substances, preventing them from reaching the eye.
- Lubrication: It produces mucus that mixes with tears, ensuring a smooth surface for the eye and reducing friction during blinking.
- Immune Function: The conjunctiva plays a critical role in the immune defense of the eye, containing immune cells that respond to infections and inflammation.
- Tear Distribution: During blinking, the conjunctiva helps distribute tears evenly across the ocular surface, keeping it moist and nourished.

Clinical Significance

- Conjunctivitis: Inflammation of the conjunctiva, commonly caused by infections (viral or bacterial), allergens, or irritants. Symptoms include redness, itching, discharge, and tearing.
  - Viral Conjunctivitis: Often associated with upper respiratory infections; highly contagious.
  - Bacterial Conjunctivitis: Can cause purulent discharge and may require antibiotic treatment.
  - Allergic Conjunctivitis: Triggered by allergens like pollen or pet dander, leading to itching and redness**.**
- Pterygium: A benign growth of conjunctival tissue that can extend onto the cornea, often due to UV exposure, causing irritation and vision problems.
- Pinguecula: A yellowish, raised lesion on the conjunctiva, typically caused by UV exposure and environmental irritants; usually asymptomatic but can become inflamed.
- Surgical Procedures: Procedures such as conjunctival grafts can be performed for various conditions, including pterygium removal or ocular surface reconstruction.

iii. The Lacrimal Apparatus

The lacrimal apparatus is responsible for the production, distribution, and drainage of tears, consisting of several components.

Lacrimal Gland: Located in the upper outer corner of the orbit, the lacrimal gland produces the aqueous component of tears, which lubricates and protects the surface of the eye.

Tear Ducts: These small ducts transport tears from the lacrimal gland to the surface of the eye, facilitating the spread of tears over the conjunctival surface during blinking.

Puncta: Found at the inner corners of the eyelids, puncta are small openings that allow tears to drain from the surface of the eye into the nasolacrimal duct.

Nasolacrimal Duct: This canal carries tears from the puncta into the nasal cavity. It drains excess tears, preventing overflow and maintaining proper moisture levels on the eye's surface.

Physiology

- Tear Production: The lacrimal gland continuously produces tears, which are spread across the ocular surface during blinking.
- Moisture and Lubrication: Tears maintain the moisture balance of the eye, preventing dryness and irritation, and they help wash away debris and pathogens.
- Nutrient Delivery: Tears provide essential nutrients to the cornea and conjunctiva, which are avascular (lack blood supply).
- Drainage Mechanism: Excess tears are drained through the puncta into the lacrimal sac and then into the nasal cavity, preventing overflow and maintaining comfort.

Clinical Significance

- Dry Eye Syndrome: A condition characterized by insufficient tear production or poor tear quality, leading to discomfort, irritation, and vision problems. Treatment may include artificial tears, punctal plugs, or medications.
- Dacryocystitis: Infection or inflammation of the lacrimal sac, often resulting from blockage of the nasolacrimal duct. Symptoms include swelling, pain, and discharge.
- Lacrimal Gland Dysfunction: Conditions such as Sjögren's syndrome can lead to reduced tear production and dry eyes.
- Obstruction of the Nasolacrimal Duct: Can cause tears to accumulate, leading to excessive tearing (epiphora) and potential infection.
- Surgical Interventions: Procedures such as dacryocystorhinostomy (DCR) can be performed to relieve blockages in the nasolacrimal duct.

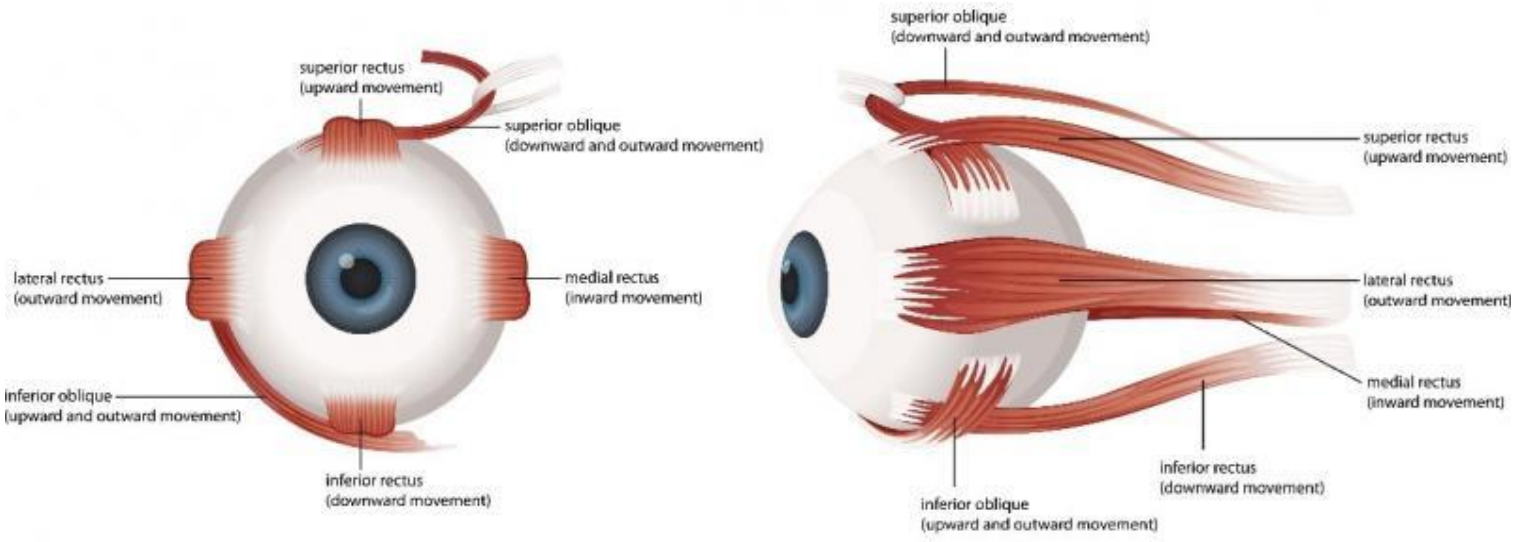

Figure 1: the anatomy of ocular muscles [6]

iv. The Ocular Muscles

The ocular muscles, also known as extraocular muscles, are responsible for controlling the movements of the eye. There are six muscles that allow the eye to move in various directions, contributing to the control of gaze and vision. These muscles are arranged around the eyeball and work in coordinated pairs to enable smooth and precise movements. Each muscle has a unique origin, insertion, function, and innervation.

1. RECTUS MUSCLES:

There are four rectus muscles: superior, inferior, medial, and lateral rectus. These muscles are responsible for the vertical, horizontal, and some rotational movements of the eye.

- **Superior Rectus** :
  - **Location and Origin**: The superior rectus originates from the Annulus of Zinn, a common tendinous ring at the back of the orbit, near the optic foramen.
  - **Insertion**: It inserts onto the superior aspect of the sclera, just behind the cornea.
  - **Function**: The primary action of the superior rectus is to elevate the eye (move it upwards). It also assists in adduction (moving the eye towards the nose) and intorsion (rotating the eye towards the nose).
  - **Innervation**: The superior rectus is innervated by the oculomotor nerve (cranial nerve III).
- **Inferior Rectus**
  - **Location and Origin**: Like the superior rectus, the inferior rectus also originates from the Annulus of Zinn.
  - **Insertion**: It attaches to the inferior part of the sclera.
  - **Function**: The inferior rectus is responsible for depressing the eye (moving it downwards). It also helps in adduction and extorsion (rotating the eye away from the nose).
  - **Innervation**: The oculomotor nerve (cranial nerve III) supplies the inferior rectus.
- **Medial Rectus :**
  - **Location and Origin**: The medial rectus, originating from the Annulus of Zinn, runs along the medial (inner) side of the orbit.
  - **Insertion**: It inserts into the medial part of the sclera.
  - **Function**: The medial rectus is the strongest muscle for adduction, pulling the eye towards the nose.
  - **Innervation**: This muscle is innervated by the oculomotor nerve (cranial nerve III).
- **Lateral Rectus :**
  - **Location and Origin**: The lateral rectus arises from the Annulus of Zinn and runs along the lateral (outer) side of the orbit.
  - **Insertion**: It attaches to the lateral part of the sclera.
  - **Function**: The lateral rectus abducts the eye, moving it away from the midline (towards the ear).

- **Innervation**: The lateral rectus is the only extraocular muscle innervated by the abducens nerve (cranial nerve VI).

2. OBLIQUE MUSCLES:

The oblique muscles, superior and inferior, are primarily responsible for rotational movements of the eye and assist in vertical movement.

- **Superior Oblique :**
  - **Location and Origin**: The superior oblique originates from the sphenoid bone, near the optic canal. It passes through a fibrocartilaginous loop called the trochlea, located in the anterior medial part of the orbit.
  - **Insertion**: It inserts onto the posterior-superior aspect of the sclera, under the superior rectus.
  - **Function**: The primary function of the superior oblique is intorsion (rotating the top of the eye towards the nose). It also contributes to depression and abduction of the eye.
  - **Innervation**: The trochlear nerve (cranial nerve IV) innervates the superior oblique, making it the only muscle supplied by this nerve.
- **Inferior Oblique :**
  - **Location and Origin**: The inferior oblique originates from the maxillary bone in the anterior part of the orbit, specifically on the orbital floor.
  - **Insertion**: It attaches to the inferior-posterior aspect of the sclera, beneath the lateral rectus.
  - **Function**: The inferior oblique extorts the eye (rotating the top of the eye away from the nose). It also aids in elevation and abduction of the eye.
  - **Innervation**: The oculomotor nerve (cranial nerve III) innervates the inferior oblique.

3. FUNCTIONAL GROUPINGS:

The extraocular muscles work in pairs and coordinate to allow precise and smooth eye movements.

- **Vertical Movements**:
  - The **superior rectus** and **inferior oblique** work together to elevate the eye.
  - The **inferior rectus** and **superior oblique** collaborate to depress the eye.
- **Horizontal Movements**:
  - The **medial rectus** is the primary muscle for adduction (moving the eye towards the midline).
  - The **lateral rectus** handles abduction (moving the eye away from the midline).
- **Rotational Movements**:
  - The **superior oblique** intorts the eye, while the **inferior oblique** extorts it.

4. INNERVATION:

The ocular muscles receive their nerve supply primarily from three cranial nerves:

- **Oculomotor nerve (CN III)**: Supplies the superior rectus, inferior rectus, medial rectus, and inferior oblique.
- **Trochlear nerve (CN IV)**: Supplies the superior oblique.
- **Abducens nerve (CN VI)**: Supplies the lateral rectus.

The precise control and coordination of these muscles allow for smooth movements and proper alignment of the eyes, critical for maintaining binocular vision and preventing double vision (diplopia).

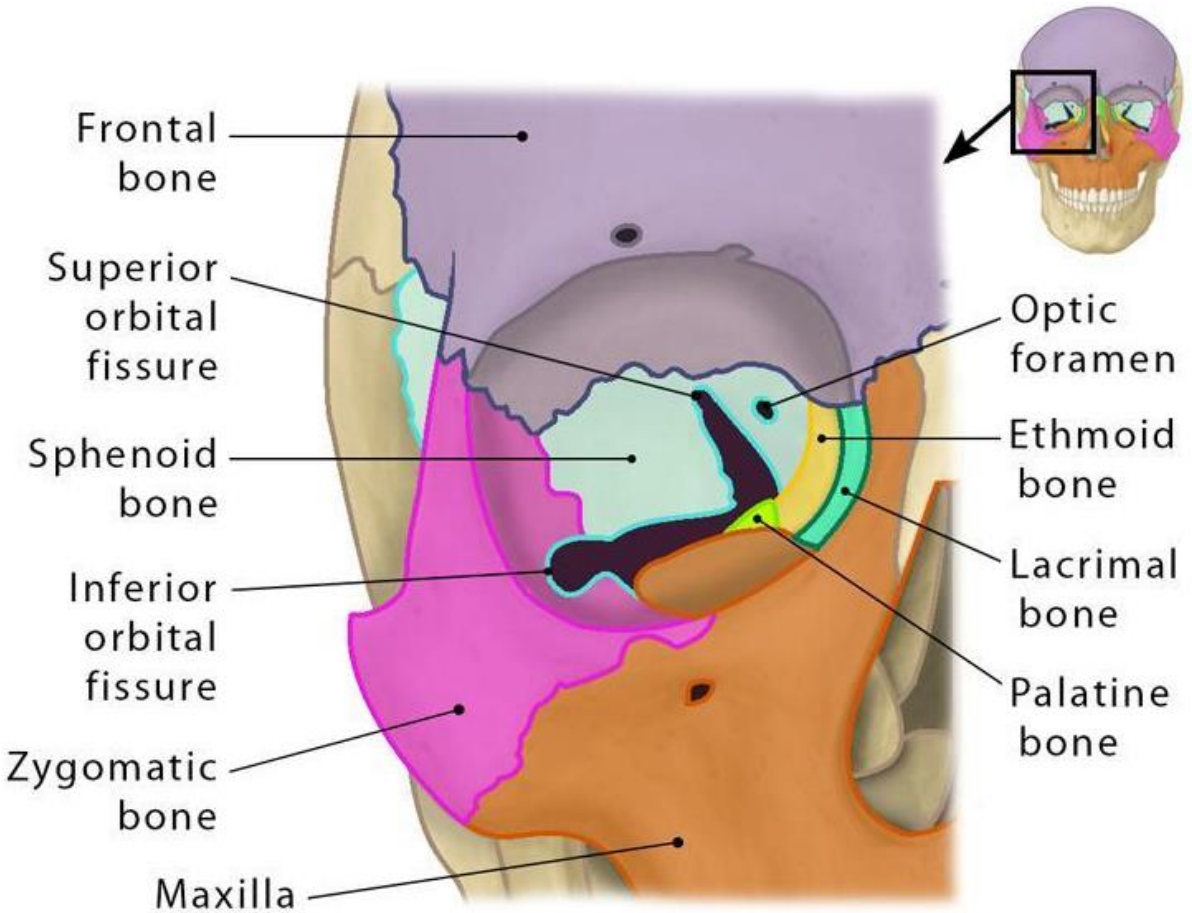

Figure 2: the anatomy of the orbital bone [7]

v. The Orbit Bones

The orbit, or the eye socket, is a complex bony structure that houses and protects the eye and its associated structures, including muscles, nerves, blood vessels, and fat. It is made up of seven bones, forming a pyramidal cavity that supports the eye's functionality and shields it from trauma. The orbital bones are vital in providing structural integrity and serve as attachment points for the extraocular muscles.

1. FRONTAL BONE:

- The frontal bone forms the superior (roof) part of the orbit. It also contributes to the protection of the eye by providing a sturdy upper boundary. The bone houses the supraorbital foramen, which allows the passage of the supraorbital nerve and vessels. This bone supports the frontal sinus above the orbit, which is separated from the orbital cavity by a thin bony wall.

2. ZYGOMATIC BONE:

- The zygomatic bone forms the lateral wall and part of the floor of the orbit. This bone is crucial for protecting the eye from lateral trauma due to its robust structure. It connects to the **frontal bone** at the front and the **maxilla** at the base of the orbit. The zygomatic bone is also part of the **zygomatic arch**, contributing to the shape of the face.

3. MAXILLA:

- The **maxillary bone** forms a significant portion of the orbital floor. This bone also contains the **infraorbital foramen**, through which the infraorbital nerve and vessels pass, supplying sensation to the lower eyelid, cheek, and upper lip. The floor of the orbit is the thinnest part, making it vulnerable to fractures, such as in **blowout fractures**, where the orbital contents herniate into the maxillary sinus.

4. SPHENOID BONE:

- The sphenoid bone contributes to the posterior (back) part of the orbit and forms the optic canal, which allows the optic nerve (cranial nerve II) and ophthalmic artery to pass into the orbit. The greater wing of the sphenoid forms part of the lateral wall, while the **lesser wing** forms part of the orbit's roof. The superior orbital fissure, an important gap between the greater and lesser wings, allows passage for several nerves (oculomotor, trochlear, abduces, and the ophthalmic branch of the trigeminal nerve) and vessels.

5. ETHMOID BONE:

- The ethmoid bone forms most of the medial wall of the orbit. This bone is honeycombed and lightweight, containing numerous air cells, making it delicate and prone to fracture. The lamina papyracea**,** a thin part of the ethmoid bone, separates the orbit from the ethmoid sinus. Fractures of this bone can lead to complications such as orbital cellulitis due to the proximity to the sinus.

6. LACRIMAL BONE:

- The lacrimal bone, located in the anterior portion of the medial wall, is the smallest and most fragile bone in the orbit. It forms part of the lacrimal fossa, which houses the lacrimal sac, an essential component of the tear drainage system. The lacrimal bone's role in tear production and drainage is critical for maintaining eye moisture and preventing infection.

7. PALATINE BONE:

- The palatine bone contributes a small portion to the orbit, forming part of the floor and the posterior wall. Though its contribution is minimal, it plays a role in stabilizing the orbit's structure. The palatine bone forms part of the orbital process, which is crucial for the integrity of the posterior orbital floor.

The Fatty Orbit

The fatty orbit, also known as orbital fat, plays an essential role in supporting and protecting the eye and its surrounding structures. It is a soft cushion of adipose tissue that fills the spaces within the bony orbit, surrounding the eyeball, optic nerve, extraocular muscles, and blood vessels. This fat provides structural stability, absorbs shocks, and allows free movement of the eye by reducing friction between different components of the orbit.

1. COMPARTMENTS OF ORBITAL FAT:

Orbital fat is divided into two primary compartments: intraconal fat and extraconal fat**.** These compartments are based on the location of the fat relative to the extraocular muscles.

- **Intraconal Fat**:
    - **Location**: Intraconal fat is located within the muscle cone, which is formed by the four rectus muscles and the optic nerve. It is found deep in the orbit, surrounding the optic nerve and extraocular muscles.
    - **Function**: This fat supports the muscles and optic nerve, allowing smooth eye movements while minimizing friction. It also cushions the delicate structures within the orbit and helps maintain the position of the globe (eyeball) in its correct anatomical location.
- **Extraconal Fat**:

Location: Extraconal fat is found outside the muscle cone, filling the spaces between the extraocular muscles and the bony walls of the orbit.

Function: This fat provides protection and insulation to the eyeball and muscles, absorbs shocks from external forces, and acts as a buffer between the eye and the surrounding bones. Extraconal fat also helps distribute pressure evenly within the orbit, preventing compression of sensitive structures like the optic nerve.

2. FUNCTIONS OF ORBITAL FAT:

Orbital fat is not only important for cushioning and protecting the eye but also serves additional roles that contribute to the overall functionality of the orbit:

- **Protection and Cushioning**:

The primary role of orbital fat is to act as a shock absorber, protecting the eye from trauma by buffering impacts. The fat prevents the eyeball from making direct contact with the bony orbit during movements or impacts.

- **Support and Positioning**:

  Orbital fat helps maintain the position of the eye within the orbit, ensuring it remains aligned for proper vision. It prevents the globe from sinking back or shifting within the orbit, which is especially important in maintaining the eye's alignment with the visual axis.

- **Facilitation of Movement**:

  The fat allows the extraocular muscles to move freely and smoothly. By reducing friction between the muscles and the orbital bones, the fat enables controlled and precise eye movements without interference from rigid structures.

- **Metabolic Function**:

  Orbital fat contains a rich network of blood vessels, providing nutrients and oxygen to the eye, muscles, and nerves. It also has a metabolic function, storing energy in the form of fat, which can be mobilized during periods of need.

Anatomical Location

- Pre- and Post-Eyeball Fat: Orbital fat is generally categorized into:
- Pre-aponeurotic Fat: Located anteriorly, between the eyelid and the eyeball.
- Retro-orbital Fat: Situated behind the eyeball, providing additional cushioning and support.

3. CLINICAL IMPORTANCE OF ORBITAL FAT:

- **Proptosis and Enophthalmos**:

Alterations in the volume or distribution of orbital fat can lead to conditions like proptosis (forward displacement of the eye) or enophthalmos (posterior displacement of the eye). For example, in thyroid eye disease, inflammation and increased orbital fat volume lead to proptosis, causing the eyes to bulge forward.

- **Orbital Tumors and Infections**:

Tumors or infections can arise within the orbital fat, leading to swelling, discomfort, or vision problems. Orbital fat is prone to inflammation in conditions like orbital cellulitis**,** which can cause significant swelling and pressure on the eye, requiring prompt medical attention.

- **Orbital Fat Loss**:

With age or trauma, the fat may atrophy, leading to enophthalmos, where the eye appears sunken. This condition can also occur after surgeries or in diseases like HIV-associated lipodystrophy**.**

Clinical Significance

1. Aging:

- As individuals age, changes in orbital fat distribution can lead to cosmetic concerns, such as:

- Ptosis: Drooping of the eyelids.

- Eyelid Bags: Puffiness due to fat herniation.

2. Obesity:

- Increased body fat can lead to an accumulation of orbital fat, affecting the aesthetic appearance of the eyes.

3. Pathological Conditions:

- Thyroid Eye Disease (Graves' Disease): Causes inflammation of orbital fat, leading to swelling and protrusion of the eyes (proptosis).
- Orbital Tumors: Can displace or increase the volume of orbital fat, impacting vision and eye function.

Diagnostic Approaches

- Imaging Techniques:

- CT Scans and MRIs: Useful for assessing the quantity and distribution of orbital fat and identifying abnormalities.

- Ophthalmological Examination:

- An eye care professional may evaluate visual acuity, eye movement, and any signs of swelling or displacement.

Treatment Options

1. Surgical Intervention:

- Orbital Decompression Surgery: Often performed in cases of Graves' disease or significant fat accumulation that causes vision problems or cosmetic concerns.
- Blepharoplasty: Surgical procedure to remove excess skin and fat from the eyelids.

2. Medical Management:

- Addressing underlying conditions, such as thyroid dysfunction or obesity, may help reduce orbital fat and associated symptoms.

3. Non-Surgical Approaches:

- Lifestyle changes, including weight management and skincare, can help improve the appearance of the eyes

II.2.Anatomical and Physiological Review of the Human Eye Globe

The human eye is one of the most remarkable sensory systems. Leonardo da Vinci was acutely aware of its prime significance: ‘‘The eye, which is termed the window of the soul, is the chief organ whereby the senso commune can have the most complete and magnificent view of the infinite works of nature’’. Human beings gather most of the information about the external environment through their eyes and thus rely on sight more than on any other sense, with the eye being the most sensitive organ we have. Besides its consideration as a window to the soul, the eye can indeed serve as a window to the identity of an individual. It offers unique features for the application of identification technology. Both the highly detailed texture of the iris and the fundus blood vessel pattern are unique to every person, providing suitable traits for biometric recognition.

a) Anatomy

The adult eyeball, often referred to as a spherical globe, is only approximately spherical in shape, with its largest diameter being 24 mm antero-posteriorly. A schematic drawing of the human eye is shown in Fig. 1. The anterior portion of the eye consists of the cornea, iris, pupil, and crystalline lens. The pupil serves as an aperture which is adjusted by the surrounding iris, acting as a diaphragm that regulates the amount of light entering the eye. Both the iris and the pupil are covered by the convex transparent cornea, the major refractive component of the eye due to the huge difference in refractive index across the air-cornea interface . Together with the crystalline lens, the cornea is responsible for the formation of the optical image on the retina. The crystalline lens is held in place by suspensory ligaments, or zonules, that are attached to the ciliary muscle. Ciliary muscle actions cause the zonular fibers to relax or tighten and thus provide accommodation, the active function of the crystalline lens. This ability to change its curvature, allowing objects at various distances to be brought into sharp focus on the retinal surface, decreases with age, with the eye becoming ‘‘presbyopic.’’ Besides the cornea and crystalline lens, both the vitreous and aqueous humor contribute to the dioptric apparatus of the eye, leading to an overall refractive power of about 60 diopters. The aqueous humor fills the anterior chamber between the cornea and iris, and fills the posterior chamber that is situated between the iris and the zonular fibers and crystalline lens. Together with the vitreous humor, or vitreous, a loose gel filling the cavity between the crystalline lens and retina, the aqueous humor is responsible for maintaining the intraocular pressure and thereby helps the eyeball maintain its shape. Moreover, this clear watery fluid nourishes the cornea and crystalline lens. Taken all together, with its refracting constituents, self-adjusting aperture, and finally, its detecting segment, the eye is very similar to a photographic camera. The film of this optical system is the retina, the multilayered sensory tissue of the posterior eyeball onto which the light entering the eye is focused, forming a reversed and inverted image. External to the retina is the choroid, the layer that lies between retina and sclera. The choroid is primarily composed of a dense capillary plexus, as well as small arteries and veins [5]. As it consists of numerous blood vessels and thus contains many blood

cells, the choroid supplies most of the back of the eye with necessary oxygen and nutrients. The sclera is the external fibrous covering of the eye. The visible portion of the sclera is commonly known as the ‘‘white’’ of the eye. Both iris and retina are described in more detail in the following sections due to their major role in biometric application.

From superficial to deep, the eyelid is made of epidermis, dermis, the orbicularis oculi muscle, the orbital septum, the tarsal plate, and the palpebral conjunctiva [4, 5]

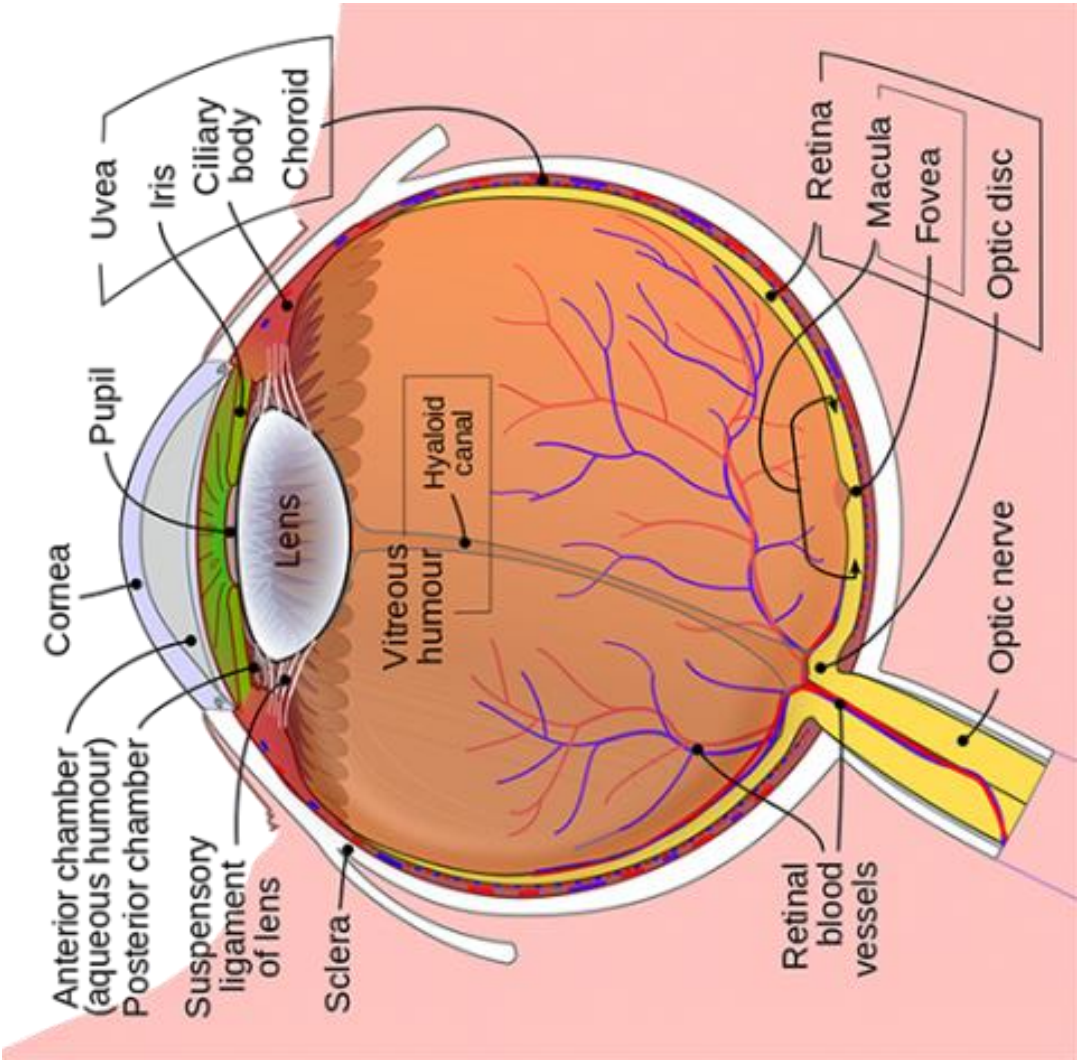

Figure 3: a cross-section of the human eye[6]

According to the American Academy of Ophthalmology the human eye, consist of mainly two recognized segments, which are:

- The Anterior Segment
- The Posterior Segment

I. Anterior Segment

Anatomy:

The anterior segment of the eye is crucial for visual function, focusing light, and regulating the amount of light entering the eye. It comprises several key structures, each with specific anatomical and physiological roles.

Key Anatomical Structures

1. Cornea

- Structure:
  - Composed of five layers:
  - Epithelium: The outermost layer, providing a barrier against environmental damage.
  - Bowman's Layer: A tough layer that supports the epithelium.
  - Stroma: The thickest layer, made up of collagen fibers providing strength and transparency.
  - Descemet's Membrane: A thin layer that separates the stroma from the endothelium.
  - Endothelium: The innermost layer, responsible for maintaining corneal hydration and transparency.

Function:

The cornea refracts light, contributing about two-thirds of the eye's total optical power. Its curvature is vital for focusing images on the retina..

2. Anterior Chamber:

Location: The space between the cornea and the iris.

Contents: Filled with aqueous humor, a clear fluid that nourishes the avascular structures (cornea and lens) and maintains intraocular pressure.

Function:

Provides structural support and protection to the eye. The aqueous humor continuously circulates, helping to remove metabolic waste[7–11].

3. Iris:

Structure: A circular, pigmented structure with two muscle layers.

- Sphincter Pupillae: Constricts the pupil in bright light.
- Dilator Pupillae: Expands the pupil in low light.

Function:

Regulates the size of the pupil, thereby controlling the amount of light entering the eye. This adjustment helps protect the retina from excessive light and aids in optimal vision under varying lighting conditions

4. Pupil:

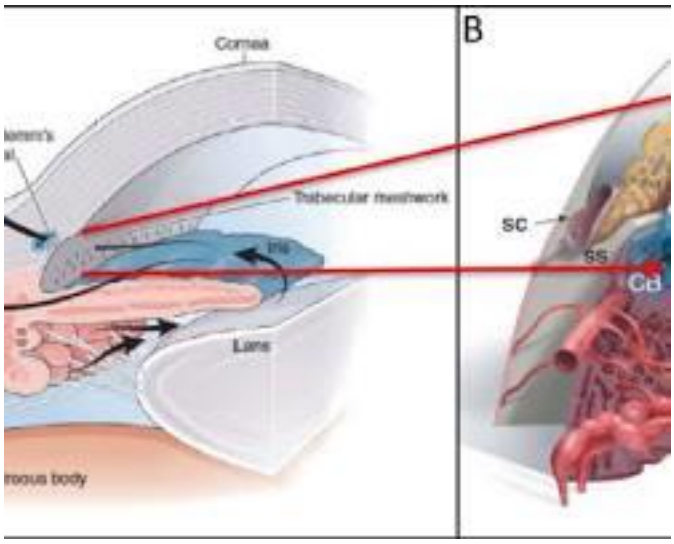

Figure 4: a dynamic duo: pupillary control and eye color [12]

- The opening in the center of the iris that allows light to enter the eye.

Function:

- Acts as an aperture, adjusting in size based on light intensity and focus. A larger pupil allows more light in, while a smaller pupil reduces light intake[9, 11].

5. Ciliary Body:

- A ring-shaped structure behind the iris.

Function:

- Controls the shape of the lens through the ciliary muscles, facilitating accommodation (the ability to focus on near and distant objects).

- Produces aqueous humor, which drains through the trabecular meshwork into the canal of Schlemm, maintaining intraocular pressure

6. Lens:

- A transparent, flexible structure located behind the iris.

Function:

- Works with the cornea to focus light onto the retina. The lens changes shape (becomes thicker or thinner) in response to ciliary muscle contraction or relaxation, allowing for sharp vision at varying distances.

Physiological Functions

Light Refraction: The anterior segment refracts light primarily through the cornea and the lens, directing light to the retina for image formation. [11]

Aqueous Humor Dynamics:

- The production and drainage of aqueous humor regulate intraocular pressure, crucial for maintaining the eye's shape and preventing conditions like glaucoma.

Accommodation:

- The ciliary body's action on the lens allows for focusing adjustments, essential for clear vision at different distances.

Pupil Reflex:

- The iris responds to light changes, adjusting pupil size to optimize light entry and protect the retina.

Clinical Relevance

1. Refractive Errors:

- Conditions like myopia (nearsightedness) and hyperopia (farsightedness) arise from improper focus due to corneal shape or lens flexibility.

2. Cataracts:

- Clouding of the lens can impair vision and is often age-related.

3. Glaucoma:

- Increased intraocular pressure due to improper drainage of aqueous humor can lead to optic nerve damage.

4. Iritis/Uveitis:

- Inflammation of the iris can affect vision and cause pain.

5. Corneal Diseases:

- Conditions such as keratoconus and corneal dystrophies can impact corneal transparency and curvature.

II. Posterior Segment

The posterior segment of the eye plays a critical role in the processing of visual information. It includes several key structures that are essential for vision and ocular health[9].

Key Anatomical Structures

1. Vitreous Body

- Structure: A gel-like substance that fills the space between the lens and the retina. It is composed of water, collagen fibers, and hyaluronic acid. [11, 13].

Function:

- Maintains the shape of the eyeball and provides structural support to the retina.
- Acts as a shock absorber, protecting the retina from impacts and mechanical damage.

2. Retina

- Structure: A thin, multi-layered tissue lining the back of the eye. It consists of several layers:
  - Photoreceptor Layer: Contains rods (for low light) and cones (for color and detail).
  - Bipolar Cells: Transmit signals from photoreceptors to ganglion cells.
  - Ganglion Cells: Form the optic nerve, transmitting visual information to the brain.
  - Macula: The central part of the retina responsible for sharp, detailed vision.
  - Fovea: The center of the macula, where cone density is highest, providing the best visual acuity.

Function:

- Converts light into electrical signals through phototransduction, initiating the visual process.

3. Choroid

- Structure: A layer of blood vessels and pigment located between the retina and sclera.

Function:

- Supplies oxygen and nutrients to the outer layers of the retina and absorbs excess light, preventing scattering within the eye.

4. Sclera

- Structure: The tough, white outer layer of the eye that continues from the cornea.

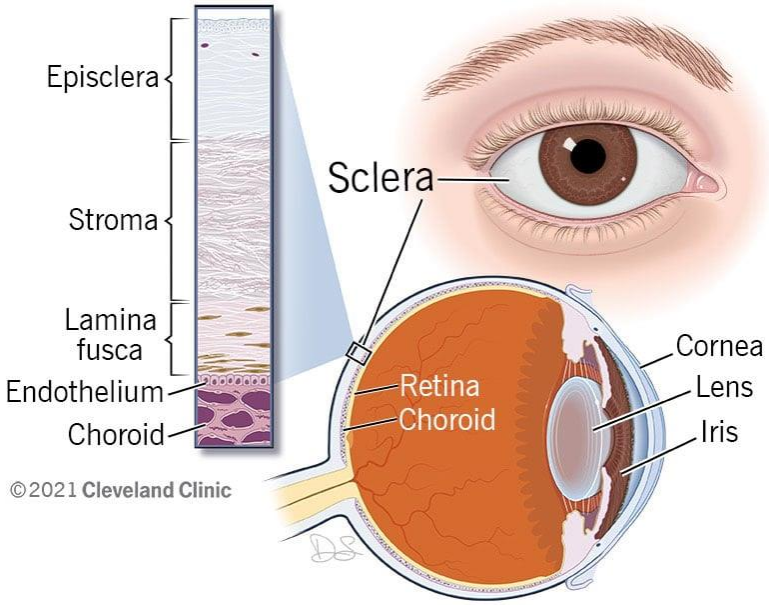

Figure 5: an illustration of the sclera **[13]**

Function:

- Provides structural integrity and protection for the inner components of the eye. It also serves as an attachment point for the extraocular muscles.

5. Optic Nerve

- Structure: Composed of the axons of ganglion cells, it exits the eye at the optic disc.

Function:

- Transmits visual information from the retina to the brain for processing. The optic disc is also known as the blind spot due to the absence of photoreceptors.

Physiological Functions

1. Image Formation:

- Light focused onto the retina is converted into electrical impulses by photoreceptors. Rods are sensitive to low light levels, while cones detect color and fine detail.

2. Signal Processing:

- The retina processes visual information through a series of neural connections (from photoreceptors to bipolar and ganglion cells) before sending it to the brain via the optic nerve.

3. Visual Acuity:

- The macula and fovea are specialized for high-resolution vision. The fovea's high concentration of cones allows for detailed color vision.

4. Nutrient Supply:

- The choroid provides essential nutrients to the retina and helps maintain retinal health.

5. Protective Role:

- The vitreous body acts as a shock absorber, protecting the retina from mechanical impacts.

Clinical Relevance

1. Retinal Disorders:

- Diabetic Retinopathy: Damage to the retinal blood vessels due to diabetes, leading to vision impairment.
- Age-Related Macular Degeneration (AMD): Deterioration of the macula affecting central vision.
- Retinal Detachment: Separation of the retina from the underlying tissue, requiring urgent treatment.

2. Vitreous Disorders:

- Vitreous Hemorrhage: Bleeding into the vitreous cavity, which can obscure vision.
- Posterior Vitreous Detachment: Occurs when the vitreous gel separates from the retina, potentially leading to retinal tears.

3. Glaucoma:

- Increased intraocular pressure can damage the optic nerve, often affecting peripheral vision first.

4. Optic Nerve Disorders:

- Optic Neuritis: Inflammation of the optic nerve, often associated with multiple sclerosis, leading to vision loss.

II.3. Childhood visual impairment

i. International Classification of Diseases (ICD-11)

The International Classification of Diseases (ICD-11) defines visual impairment in terms of visual acuity. This visual function is divided into two modalities, depending on whether distance or near vision is affected. For distance vision, the ICD-11 distinguishes four categories: mild visual impairment, moderate visual impairment, severe visual impairment and blindness. Moderate or severe visual impairment is referred to as low vision. When a person is completely or almost completely blind, the term blindness is used. The term visual impairment covers both low vision and blindness. The term poor vision (or the subjective poor vision) is a more common term for low vision. Similarly, the adjectives blind or non-blind refer to people deprived of the use of their sight.

Table I: Classification of Visual Impairment and Blindness Based on Modified Visual Acuity

Type	**Degree of Visual Impairment**	**Modified Visual acuity**
Visually Impaired	Mild	]5/10-3/10
	Moderate	]3/10-1/10]
	Severe	]1/10-1/20]
Blindness	Deep	]1/20 – 1/10]
	Partial	]1/50 – PL+]
	Total	No perception of Light

ii. Definition of childhood visual impairment

Childhood visual impairment (CVI) is defined as a significant reduction in visual function that affects a child's ability to perform daily activities, participate in educational experiences, and develop normally. This condition may encompass a range of visual deficits, including reduced visual acuity, field loss, and problems with eye coordination or alignment.[1].

iii. Epidemiology of Childhood visual impairment

Childhood visual impairment (VI) is a major global health concern, affecting approximately 19 million children worldwide, with an estimated 1.4 million being blind and 17.5 million having moderate to severe visual impairment. The primary causes of VI in children include uncorrected refractive errors, cataracts, retinopathy of prematurity (ROP), and vitamin A deficiency. While ROP is more common in high-income countries, cataracts and refractive errors are prominent in low-income regions. Advances in healthcare, particularly neonatal care and vaccination programs, have contributed to shifts in the epidemiology of

childhood VI, with screening for ROP and increased access to refractive services helping to reduce the burden of childhood blindness in many parts of the world [1,2].

In Africa, the causes of childhood VI largely mirror those seen in other low-income regions. Preventable conditions such as cataracts, uncorrected refractive errors, corneal scarring due to infections (like measles) or vitamin A deficiency, and harmful traditional practices remain major contributors. It is estimated that around 1.5 to 3 million children in sub-Saharan Africa suffer from some form of visual impairment, with about 50% of these cases being preventable or treatable [3]. Infectious diseases, though declining due to immunization efforts, continue to play a role in rural areas. Limited access to eye care services, coupled with socioeconomic challenges, exacerbates the burden of childhood visual impairment across the continent [4,5].

In Cameroon, the causes of childhood VI align closely with those seen across sub-Saharan Africa. Uncorrected refractive errors and cataracts are the leading causes, as found in a study conducted in Yaoundé [6]. Nationally, childhood blindness is estimated to affect about 0.1% to 0.2% of the population [7]. Additional contributors to childhood visual impairment in Cameroon include congenital conditions, corneal opacities, and glaucoma [8]. Barriers to early diagnosis, the high cost of corrective measures, and a shortage of pediatric ophthalmology services pose challenges to the effective management of childhood VI in the country. Efforts such as school-based vision screening and public health campaigns are being implemented to improve early detection and treatment outcomes [9].

iv. The Etiologies of Childhood visual impairment

Globally, the most common causes of childhood blindness and visual impairment are both preventable and unavoidable. According to the World Health Organization (WHO), about 1.4 million children are blind globally, with millions more experiencing moderate to severe visual impairment. The leading causes of childhood blindness worldwide include cataract, retinopathy of prematurity (ROP), congenital abnormalities such as congenital glaucoma, vitamin A deficiency, and infectious diseases such as measles. These conditions are unevenly distributed, with children in low-income regions disproportionately affected by preventable causes.

In Africa, the etiologies of childhood blindness and visual impairment are distinctively shaped by socio-economic challenges, poor access to healthcare, and the high prevalence of preventable diseases. The five most common causes of childhood visual impairment in Africa are:

1. Vitamin A Deficiency

Vitamin A deficiency remains one of the leading causes of preventable blindness in children, particularly in low-income countries in Africa. The deficiency leads to xerophthalmia, which can progress to corneal ulceration and eventual blindness. Children who are malnourished are more susceptible to this deficiency, especially in regions where food insecurity is prevalent. Vitamin A deficiency-related blindness is largely preventable through adequate nutrition and supplementation programs [14].

- Prevalence: This deficiency is most common in sub-Saharan Africa, particularly in countries such as Ethiopia and Nigeria, where malnutrition rates are high [1].

- Prevention: Vitamin A supplementation, coupled with food fortification programs, has significantly reduced the incidence of blindness in children, but gaps remain due to irregular distribution and insufficient healthcare access [2].

2. Measles-Related Blindness

Measles infection, especially in malnourished children, can cause severe complications such as corneal scarring and blindness. Before the advent of widespread vaccination, measles was one of the leading causes of childhood blindness globally. While vaccination programs have significantly reduced the incidence of measles-related blindness, outbreaks still occur in regions with poor immunization coverage.

- Prevalence: Measles-related blindness remains a challenge in sub-Saharan Africa, particularly in rural areas where vaccine coverage is inadequate [3].

- Prevention: Expanding immunization campaigns and improving access to vaccines are key to preventing measles-related blindness. However, healthcare delivery challenges and vaccine hesitancy hinder these efforts [4].

3. Cataract

Congenital or developmental cataracts are significant causes of childhood blindness worldwide, including in Africa. Cataracts can impair vision at birth or develop during childhood, leading to permanent vision loss if not treated early. Access to pediatric cataract surgery is limited in many parts of Africa, leaving many children visually impaired due to delayed treatment.

- Prevalence: In sub-Saharan Africa, congenital cataracts account for up to 20% of childhood blindness cases. Early diagnosis and timely surgery are crucial but often unattainable due to the scarcity of healthcare professionals and surgical facilities [5].

- Treatment: Pediatric cataract surgeries are highly effective in restoring vision, but the lack of specialized care and resources means that many children do not receive timely intervention [6].

4. Corneal Scarring (Trachoma)

Trachoma, caused by Chlamydia trachomatis, is a leading cause of preventable blindness in children. The disease is endemic in many African countries, particularly in impoverished rural areas where access to clean water and sanitation is limited. Repeated infections in childhood lead to chronic inflammation and scarring of the cornea, ultimately resulting in blindness if untreated. Global initiatives have targeted trachoma for elimination through the SAFE strategy (Surgery, Antibiotics, Facial cleanliness, and Environmental improvement).

- Prevalence: Trachoma remains highly prevalent in countries such as Ethiopia, Niger, and South Sudan, where it contributes significantly to the overall burden of childhood blindness [7].

- Prevention: The SAFE strategy has been successful in reducing trachoma-related blindness, but sustainable improvements in water, sanitation, and hygiene (WASH) are needed to fully eliminate the disease.

5. Retinopathy of Prematurity (ROP)

Retinopathy of Prematurity (ROP) is a leading cause of blindness in premature infants worldwide. With improvements in neonatal care, more premature infants are surviving, but inadequate screening and treatment for ROP have led to an increase in blindness due to this condition. In many African countries, the rapid expansion of neonatal intensive care units has not been accompanied by the necessary ophthalmic services to monitor and treat ROP.

- Prevalence: As neonatal care services improve in Africa, the incidence of ROP-related blindness is increasing due to the lack of proper screening protocols and specialized care [9].

- Prevention: Early detection through screening programs and timely intervention, including laser therapy or anti-VEGF injections, can prevent severe visual impairment from ROP. However, these services are often unavailable in low-resource settings [15].

2.2. STATE OF KNOWLEDGE ON CHILDHOOD VISUAL IMPAIREMENT

Table II: A brief overview of publications on Childhood visual impairment from 2009 to 2024

AUTHOR	STUDY TYPE	TITLE OF THE ARTICLE	RESULTS
Wang et al [16]. 2024 Global	Spatiotemporal analysis	Global, regional and national burden of retinopathy of prematurity among childhood and adolescent: a spatiotemporal analysis based on the Global Burden of Disease Study 2019	In 2019, the global age-standardised rates (ASRs) of prevalence per 100 000 population was 86.4 for vision loss, specifically, 35 for moderate vision loss, 19.9 for severe vision loss, 31.6 for blindness due to ROP among people younger than 20 years. Moreover, the ASR of years lived with disability per 100 000 was 10.6 for vision loss, specifically, 1.1 for moderate vision loss, 3.6 for severe vision loss, 5.9 for blindness, respectively. From 1990 to 2019, the ASR of prevalence of blindness and vision loss due to ROP significantly increased, while its burden slightly decreased. Males showed higher ASR of prevalence than females in 2019, whereas females have larger increasing trend than males from 1990 to 2019. The global highest ASR of disease burden was observed in South Asia and Southern sub-Saharan Africa, as well as low sociodemographic index (SDI) regions in 2019.
Malek et al [17] . Tunisia 2020	Retrospective study	Epidemiology and prognostic factors of open globe injuries in a Tunisian pediatric population	-OGI most frequent in school-age boys. -Prognosis influenced by: initial visual acuity, trauma score, wound severity and location.

Chong et al [18]. New Zealand 2019	Retrospective data analysis.	Causes of childhood low vision and blindness in New Zealand	Childhood visual impairment and low vision affected 0.11% globally, with over 60% preventable due to causes like birth complications and accidents. Cortical visual impairment was the leading cause of blindness overall.
Lim et al [19]. 2023 United States	Cross-sectional study	Causes of Childhood visual impairment in the United States Using the IRIS® Registry (Intelligent Research in Sight)	Investigate causes of Childhood visual impairment in the US using the IRIS® Registry
Osswald et al [20]. 2018 France	Retrospective chart review	Profil clinique et épidémiologique des uvéites pédiatriques, évolution des uvéites inflammatoires sous anti-TNF alpha	90 cases of pediatric uveitis; 16.7% infectious, 38.9% inflammatory, 44.4% idiopathic; 45% idiopathic cases with incomplete etiologic assessment; anti-TNF alpha used in 15.5% patients, with etanercept requiring escalation in 33% and infliximab/adalimumab successful in 28.6% each
Moreira et al [21]. Portugal 2017	Retrospective study	Understand pediatric cataracts epidemiology for prevention and early diagnosis in Portugal	A study of 42 children with cataracts found most diagnosed at age 6, with decreased vision and white pupils common. Nearly 60% had unknown cause, and surgery was performed in almost half. Postoperative complications occurred in 35%, with clouding behind the lens most frequent.
Mayouego et al [22]. France 2015	Descriptive, prospective, longitudinal	Analyze epidemiological, clinical, and therapeutic features of pediatric ocular trauma.	45.22% of children visited eye emergency department had ocular trauma (n=265). Male: female ratio = 1.6:1. Main injury locations: home (64.15%), school (18.11%). Most frequent injury: fingernail scratch (12.45%).

Chong et al [18]. New Zealand 2022	Retrospective data analysis.	A Cross-sectional Study of Prevalence and Etiology of Childhood visual impairment in Auckland, New Zealand.	Childhood visual impairment and low vision affected 0.11% globally, with over 60% preventable due to causes like birth complications and accidents. Cortical visual impairment was the leading cause of blindness overall.
Yahalom et al [23]. Israel 2019	Retrospective case series	Childhood visual impairment and blindness: 5-year data from a tertiary low vision center in Israel	Inherited eye diseases (IED) were the leading cause (51%), including albinism and retinal dystrophies. Non-IED causes included cerebral visual impairment and retinopathy of prematurity.
Hussain et al [24]. Bangladesh 2021	Cross-sectional quantitative	Epidemiology of Childhood visual impairment: A community-based study in Bangladesh	6.3 per 10,000 children with blindness, 4.8 per 10,000 with uniocular blindness. Congenital causes dominant in both.
Malek et al [17] . Tunisia 2020	Retrospective study	Epidemiology and prognostic factors of open globe injuries in a Tunisian pediatric population	- OGI most frequent in school-age boys. - Prognosis influenced by: initial visual acuity, trauma score, wound severity and location.
Lim et al [19]. 2023 United States	Cross-sectional study	Causes of Childhood visual impairment in the United States Using the IRIS® Registry	Investigate causes of Childhood visual impairment in the US using the IRIS® Registry
Uprety et al [25]. Nepal	Retrospective study	Profile of paediatric low vision population: a retrospective study from Nepal	8 children with visual impairment, 63.7% male. ge group: 11-16 years (56.5%). sual impairment severity: moderate (52.9%). tiology: childhood (36.2%), genetic (35.5%), prenatal (22.2%), perinatal (6.1%). mmon causes: refractive error/amblyopia (20.1%), retinitis pigmentosa (14.9%), macular dystrophy (13.4%). ge-specific: nystagmus (1-5 yrs), refractive

			error/amblyopia (6-10 & 11-16 yrs). Low-vision aids prescribed for 86.0%, improving visual acuity in 72.0%.
Wadhwani et al [26]. India 2023	Population-based study	Determine prevalence and causes of visual impairment in children <16 years	1. Prevalence of VI: 5.92 per thousand (95% CI: 4.96-7.05). 2. Moderate/severe VI highest in 11-15-year age group. 3. Main cause of avoidable VI: refractive error (75.7%). 4. Prevalence of blindness: 0.42 per thousand. 5. Optic nerve abnormalities leading cause of blindness. 6. Refractive error leading cause of VI
Israeli et al [27]. 2017	Retrospective population-based trend study	Childhood visual impairment incidence and aetiologies trends in Israel 2014–2020: what should we focus on?	CHB certificate rate remained stable with slight increase (4.19/100,000). Leading causes: optic nerve anomalies, retinal dystrophies, other retinal disorders, & cerebral visual impairment. Retinal dystrophies & other retinal disorders increased compared to previous decade. Preventable causes like ROP remained low.
Gyawali et al[28]. 2015 Eritrea	Retrospective Data Review	Retrospective data on causes of childhood vision impairment in Eritrea	1.1% of children (249/22,509) visually impaired.Leading causes: cataract (19.7%), corneal scars (15.7%), refractive errors/amblyopia (12.1%). 34.5% due to childhood factors (mostly trauma), 69.9% potentially avoidable.
Baarah et al [29]. Jordan 2018	Retrospective study	To report the causes of permanent severe visual impairment and blindness among Jordanian blind people.	Retinitis pigmentosa (29.7%), diabetic retinopathy (19.9%), glaucoma (15.8%)

Huh et al [30] . Ghana 2018	Retrospective study	Causes of Childhood visual impairment in Ghana: results from a blind school survey in Upper West Region, Ghana, and review of the literature	Of 190 students screened, the major anatomical causes of blindness/SVI were corneal scar/phthisis bulbi (CS/PB) (n=28, 15%) and optic atrophy (n=23, 12%). The major etiological causes of blindness/SVI were unknown (n=114, 60%). Eighty-three (44%) students became blind before age one year. Of four published blind school surveys conducted in Ghana, CS/PB was the most common anatomical cause of Childhood visual impairment. Over time, the prevalence of CS/PB within blind schools decreased in the north and increased in the south. Measles-associated visual loss decreased from 52% in 1987 to 10% in 2014 at Wa Methodist School.
Kilangalanga et al [31]. 2020 Democratic Republic Of Congo Kinshasa	Survey	Epidemiology of Childhood visual impairment and Low Vision in Kinshasa–democratic Republic of the Congo	Thirty-six children with bilateral visual impairment were identified, including 10 cases of blindness and 26 cases of low vision. The prevalence of blindness and low vision was, respectively, 0.08% [95% CI 0.04-0.14] and 0.19% [95% CI 0.13-0.28].
Santos-Bueso et al [32].2015 Morocco, Ethiopia	Retrospective study	Causes of Childhood visual impairment in a developing country and an underdeveloped country	The main causes of blindness in Morocco were hereditary pathologies (25.92%) and refractive errors (14.82%), while in Ethiopia, corneal disease (27.05%) and trauma (20%) were the main causes.
Herrod et al [33]. Nigeria2022	Questionnaire	Blindness Secondary to Retinopathy of Prematurity in Sub-Saharan Africa	ROP is becoming a more important and widespread cause of Childhood visual impairment in sub-Saharan Africa.

Bella et al [34]. 2013 Cameroon	Retrospective	Determine prevalence and causes of corneal blindness in children (0-15 years)	Prevalence: 2.1% Main causes: Trauma (48.2%), Infection (28.0%) Visual impairment/blindness in 50% of followed cases

CHAPTER III : METHODOLOGY

3.1 TYPE OF STUDY

We carried out a descriptive cross-sectional studies with retrospective data collection.

3.2 SITE OF STUDY

This study was conducted at the Second Region Military Hospital in Douala, which is a military hospital institution located in the district of Douala 1, at Bonanjo. It is an integral part of the institutions with which the Cameroonian armed corps is endowed in health matters and ranks as a military reference hospital in the region and with a capacity of approximately 150 beds. It brings together a large number specialties with several units which includes: Ophthalmology unit, internal medicine, gynecology and obstetrics unit, pediatrics unit, traumatology unit, orthopedic traumatology unit, odontology, anesthesia and resuscitation unit, medical imaging unit, laboratory unit, pharmacy unit, nephrology unit, emergency unit and a service for the management of HIV positive patients, rheumatology and dermatology unit.

The ophthalmology unit is bordered by that of the physiotherapy unit and internal medicine unit and is presented as follows:

-Awaiting room,

- Reception room,

-Visual acuity (VA) room, where refractometry, tonometry and pachymetry are also carried out (autorefractometer Nidek ARK700 A) ;

-A box for the realization of the different dressings ;

- Two consultation boxes (each equipped with a slit lamp),

-A functional exploration room with a branded visual field device OCTOPUS 300, an angiograph and an OCT Carl Zeiss 5000,

-The Head of office department,

-A technical room,

-An operational ophthalmology operating room.

The staff consist of:

-The head of department Colonel BIANGOUP NYAMSI Prisca (Ophthalmologist), -Two medical doctors : Professor KOKI Godefroy (MCA), Dr. Ekoumelon Annita (Ophthalmologist),

-An intern ophthalmologist

-The major,

-Five nurses including two specialized (one military and one civilian) in ophthalmology and 03 nursing assistants (one military and two civilians)

-And alternating ophthalmology residents.

- The welcome population is mainly made up of adults, third -year people and children and receives an average of about 50 patients per day.

3.3. PERIOD AND DURATION OF STUDY

This study was carried out over a period of 3 years from 1st January 2021 to 31st December 2023.with a study duration 8 months from November 2023 to June 2024.

3.4. POPULATION OF STUDY

SOURCE POPULATION

Our study population consisted of the medical records of children who consulted in the ophthalmological units at the Second Region Military Hospital Douala from the 1st January 2021 to 31st December 2023.

TARGET POPULATION

Records of children who fulfilled all the inclusion criteria cited in our studies. Children aged between 0 to 18 years old with visual impairment.

3.4.1. Inclusion Criteria

- All children who consulted at the ophthalmology unit at the Second Region Military Hospital in with age 0 to 18 years within the study period 1st January 2021 to 31st December 2023.
- All children with complete files

3.4.2. Exclusion Criteria

- All children with incomplete files

3.4.4 Sampling Method

Children were consecutively recruited during our study period and were evaluated.

3.4.5. SAMPLING SIZE ESTIMATION

Based on our study we calculated our minimum sample size using Cochran's formula as shown below:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Where

- n is the sample size
- Z is the Z value (e.g., 1.96 for a 95% confidence level).
- p Studies carried out by the Helen Keller Intl in Cameroon reported a prevalence of visual impairment to be 3%[35]
- e is the acceptable margin of error 1.67%

Our estimated sample size was **400**

3.5. PROCEDURE

3.5.1. DATA COLLECTION PROCEDURES

Step1: Administrative authorization and Ethics.

A research proposal was written and approved by the thesis supervisor and co-supervisor.

Ethical Clearance was requested and obtained from the ethical committee of the Faculty of Medicine and Biomedical Sciences to carry out the study and we obtained researched authorization from the director of the concerned Hospital SRMH Douala. Confidentiality was assured by assigning codes for every participant and the codes were used to label all documentations and not the names of the children, the data collected were used for the research purpose only.

Step 2: Review of medical records

After obtaining administrative approval we were introduced to the staff and were briefed on the flow of patients in the hospital, then granted access to medical records of children we accessed all records of children aged 0 to 18 who visited the ophthalmology unit from January 2021 to December 2023.

Step 3: Recruitment of Children

On examining the medical records, we included all medical records of children who consulted within our selected period of study. We excluded all children with incomplete files, files of children with no final diagnosis of visual impairment. The eligible files where then classified using the international classification of disease ICD 11, then relevant information from these files where filed into on established questionnaire. These questionnaire were internally validated and later adjusted and adapted for our study.

3.5.2. Variables of study:

We reviewed the medical records and obtained the sociodemographic profiles of patients with etiologies and visual impairments. These included:

- Age
- Sex
- Region of residence
- Level of education includes

For the clinical and paraclinical variables, we collected information on the following:

- Visual Assessments
- Visual impairment
- Visual acuity
- Ocular motility
- Intraocular pressure measurements (IOP), both right and left eye
- Final diagnosis retained

3.5.3. Materials for Data collection

In this study, we used well-structured questionnaires, medical records, pens, admission registers, mobile phone, rim of A4 papers, laptop.

3.5.4. Statistical Analysis

The database was constructed and coded using Cspro version 8.0 (Census Survey Processing) software and analysed with IBM SPSS (Statistical Package for Social Sciences) version 27.0 software for statistical analysis. Charts will be generated using Microsoft® Office Excel 2016 and S.P.S.S. version 27.0 Quantitative variables were summarized with the mean and standard deviation or medians and interquartile ranges. According to the distribution. While qualitative variables were expressed in frequencies and percentages.

3.5.5. Material for data management

- A laptop
- A smart phone
- A USB flash drive

3.5.6 Human Resources

- Myself (investigator in chief)
- The Supervisor and Co-supervisor
- The Statistician

3.5.7. ETHICAL CONSIDERATIONS

We obtained Ethical clearance from the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I. We also obtained authorization from the administrative board of the Second Region Military Hospital, Douala.

Confidentiality was assured by assigning codes for every medical record and the codes were used to label all documentations.The data collected was used for the research purpose only.

3.5.8. DEFINITION OF OPERATIONAL TERMS

- **Childhood:** Refers to the period of life from infancy through adolescence, during which significant physical, cognitive and emotional development occurs.(WHO) [36]
- **Visual acuity:** Ability of the eye to distinguish details and perceive the sharpness of objects at different distances[36].
- **Intraocular pressure:** measures the pressure inside the eye, measured in millimeters of mercury and normal between 10 and 20 mmHg (WHO)[37].
- **Clinical visual field:** extent of the visual space that an individual can perceive by looking straight ahead [38].
- **Refraction:** process of measuring eye refraction errors and prescribing corrective lenses to improve vision.

- **Dilatation:** enlargement of the pupils of the eye, caused by the administration of dilator drops (Mydriaticum 0.5%) to reach between 5 and 9 mm in diameter[37].
- **Visual impairment:** Visual acuity at a distance in the better eye is less than 5/10 after optical correction [39].
- **Low vision:** Corrected visual acuity at a distance is between 3/10 and 1/20 (counts fingers at 3 meters) [37].
- **Blindness :** Corrected visual acuity at a distance is less than 1/20[37].

Examination of the normal fundus: observation of structures inside the eye, including the retina and optic nerve, without the presence of pathology or anomalies.

CHAPTER IV : RESULTS

V. EPIDERMIOLOGICAL CHARCTERISTICS

VI.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

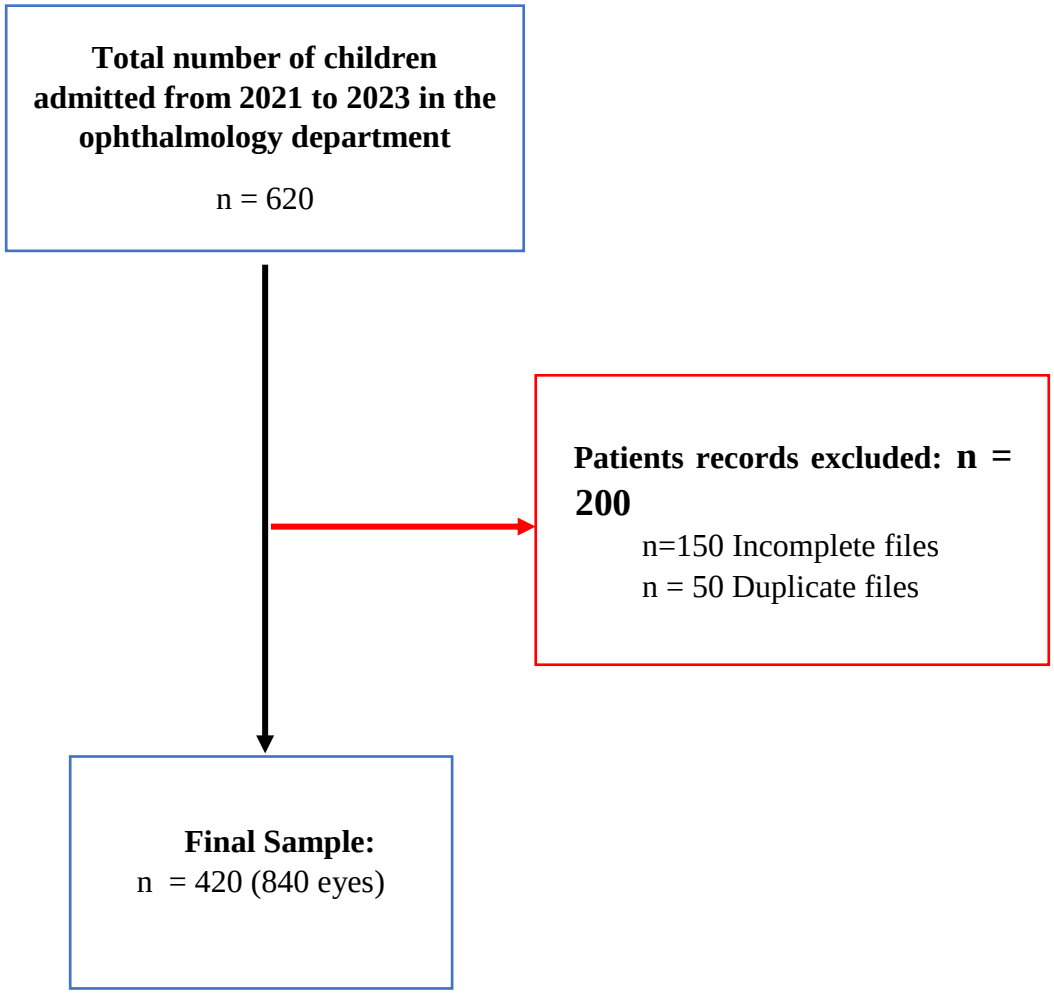

Figure 6: recruitment flow chart n =420 (840 eyes)

In total we successfully recruited **420**

The study population (n=420) was made mostly of children aged 10 to 15 years (36.65) and were mostly female (55.6%). Most of them lived in rural areas (60.3%) and 53.1% of them attained a secondary school level of education.

Table III: descriptive statistics for socio-demographic variables

Variables		**Frequency**	**Percentage %**
Age Group (n= 420)	]0 - 5]	053	12.6
	]5 - 10]	104	24.8
	]10 - 15]	**154**	**36.6**
	]15 – 18]	109	26.0
Sex (n= 420)	**Female**	**233**	**55.6**
	Male	187	44.4
Region of residence (n= 420)	**Rural**	**252**	**60.3**
	Urban	168	39.7
Level of Education (n= 420)	Primary School	125	29.8
	Secondary School	**222**	**53.1**
	University	032	7.6
	None	041	9.5

VI.2. CLINICAL CHARACTERISTICS

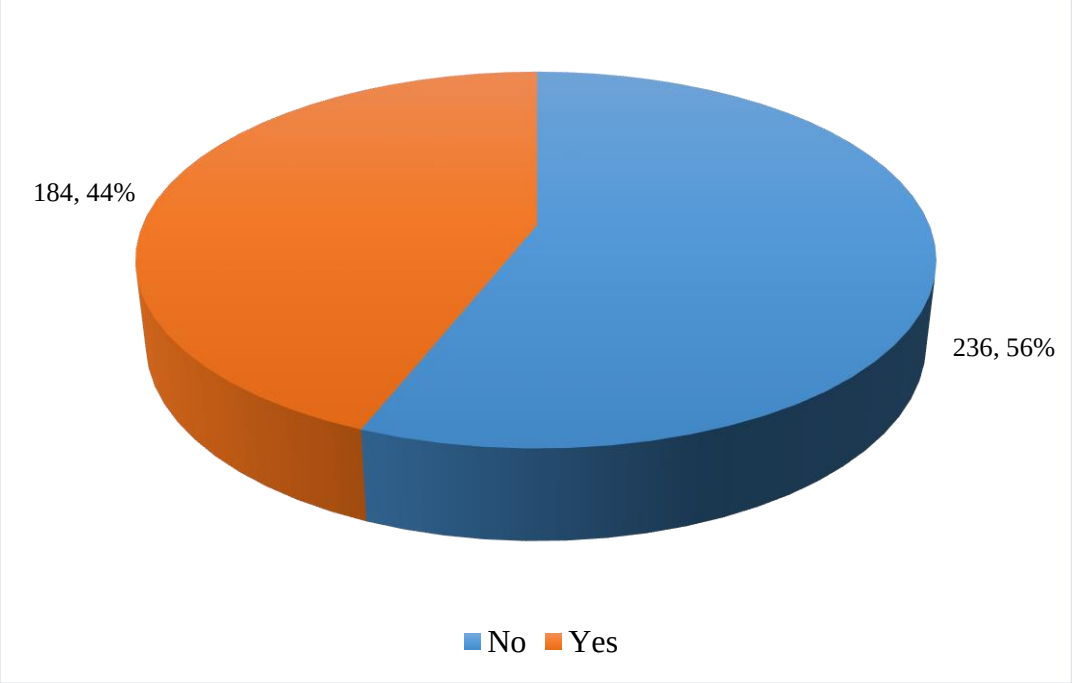

Figure 7:past history of use of corrective lenses

Most of our study participants n = 236, 56% had used corrective lenses while n = 184, 44% had never used corrective lenses before

The table below shows that visual impairment typically begins around age 9.85, with a range from birth to 17 years. Most individuals have used lenses for an average of 2.62 years, with durations ranging from 1 to 13 years, and the majority using them for about 3 years.

Table IV**: Past history and onset of visual impairment**

Variables	**Mean ± SD**	**Median**	**Mode**	**Maximum**	**Minimum**
Age of Onset of Visual Loss (in years)	9.85 ± 4.39	10	15	17	0
How long have you used your lenses (in years)	2.62 ± 1.93	3	3	13	1

Table V: distribution of visual acuity in right and left eyes among children with correction

Visual Acuity	**Right Eye**		**Left Eye**	
	Frequency (n =414)	**Percentage (%)**	**Frequency (n = 415)**	**Percentage (%)**
Blind] PL+ –COF (1/20)]	6	1.5	5	1.3
Low Vision]1/10-1/20]	4	1.0	3	0.7
Mild Vision]5/10-3/10]	32	7.7	24	5.5
Normal Vision]10/10-5/10]	378	89.8	388	92.5
Total	420	100	420	100

Note: "COF" stands for Counting Of Fingers at 3m to 1m, and "PL (+)" represents Perception of Light Positive.

Table VI: distribution of visual impairment severity with correction

Visual Acuity	Frequency	Percentage %
≥ 5/10]	383	92.3
]5/10 - 3/10]	22	5.3
]3/10 -1/10]	4	1.0
]1/10 - 1/20]	3	0.7
] ≤ 1/20]	3	0.7

Note: *383 (92.3%) where had no visual impairment*

In our studies 7.7% had visual acuity less than or equal to 5 /10e with 5.3% having visual acuity scores between 5/10e to 3/10e and 0.7% having visual acuity scores between 1/10 to 1/120 and ≤ 1/20

Table VII: ophthalmological examination

Variables	Signs and symptoms	Frequency	Percentage %
Ocular Motility	Abnormal	21	5.0
	Normal	**399**	**95.0**
External Eye Examination			
	Abnormal	6	1.4
	Normal	**414**	**98.6**
Slit Lamp Examination			
	Abnormal	20	4.7
	Normal	**400**	**95.3**
Funduscopic examination			
	Abnormal	19	4.5
	Normal	**401**	**95.5**

Not all participant took part in this evaluation due to trauma sustained from injury

Table VIII: descriptive statistic on intraocular pressure for left and right eye

	Range	Minimum	Maximum	**Mean ± SD**
Intraocular Pressure Measurement Right Eye (mmHg)	123.0	10.0	133.0	12.79 ± 6.33
Intraocular Pressure Measurement Left Eye (mmHg)	150.1	1.9	152.0	15.06 ± 17.42

In our studies 8.85% of children aged between 9 and 12 years old had visual acuity scores between 5/10e and 3/10e, and 1.3% of children had Visual acuity scores ≤ 1/20. Meanwhile 1.4% of children had visual acuity scores ≤ 1/20.

Table IX: prevalence of visual impairment by age group

	Age Group					
	]5	**]6 - 8[**	**]9 - 12[**	**]13 - 15[**	**16[**	**Total**
Visual Acuity	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**
≥ 5/10e	46(92)	41(91.1)	73(90)	84(92.3)	139(93.9)	383(92.3)
]5/10 - 3/10]	2(4)	3(6.7)	7(8.8)	6(5.5)	6(3.4)	24(5.3)
]3/10 -1/10]	1(2)	0	0	3(2.2)	1(0.7)	5(1.0)
]1/10 - 1/20]	1(2)	2(2.2)	0	0	1(0.7)	4(0.7)
] ≤ 1/20]	0	0	1(1.3)	0	3(1.4)	4(0.7)

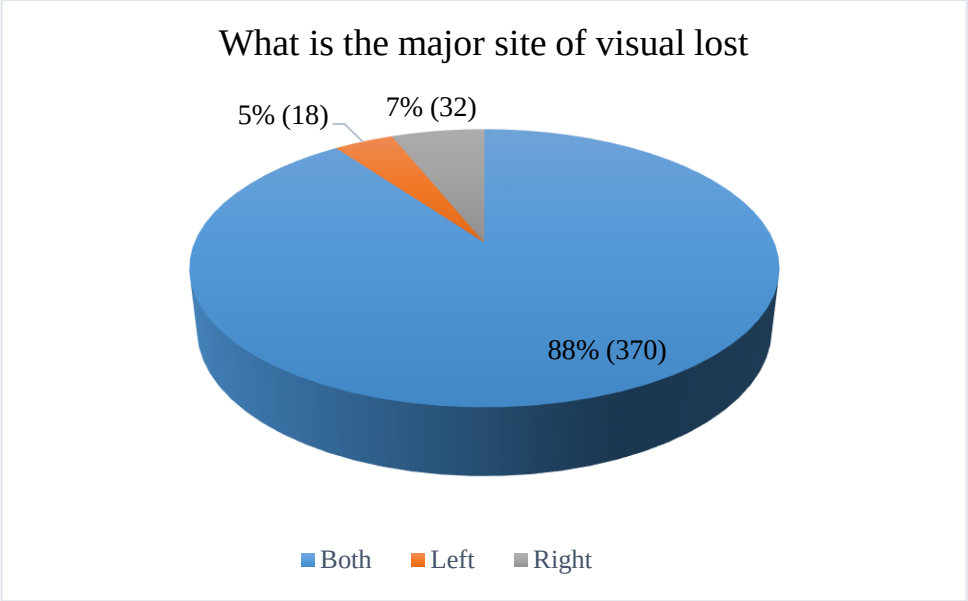

Figure 8: the distribution of major site of visual loss

In our studies 88% (n =370) participant experience vison loss on both eyes and 7% (n = 32) participant experience vison loss on the right eye than on the left

VI.3. ETIOLOGIES OF VISUAL IMPAIRMENT

Table X: distribution of the etiologies of chilfhood vsiual impairment and blindness

Cause	Frequency (n)	Percentage (%)
Avoidable Causes		
Ametropia	242	57.3
Trauma (corneal wound)	26	6.2
Keratitis	15	3.6
Cataract	9	2.1
Uveitis	3	0.7
Subtotal	**295**	**69.9**
Non-Avoidable Causes		
Glaucoma	12	2.8
Strabismus	8	1.9
Albinism	6	1.4
Amblyopia	2	0.5
Subtotal	**28**	**6.6**
Others	73	17.5
None	24	6.0
Total	**420**	**100**

Others (Conjunctivitis 30, (7.6%), Nasolacrimal duct obstruction (NLDO) 20 (7.1%), Chalazion 11 (2.6%))

CHAPTER V : DISCUSSION

V. 1 LIMITS OF THE STUDY

1. A potential limitation to this study was the fact that the study was conducted in one hospital in Douala, so the results can't be generalized to the entire population due to our reduce sample size

V. 2 EPIDERMIOLOGICAL CHARACTERISTICS OF STUDY POPULATION

FREQUENCY OF VISUAL IMPAIRMENT

Visual impairment among children was assessed in both the right and left eyes, with visual acuity (840 eyes) measurements taken into account. The total number of children assessed for the right eye was 419, while 421 (840 eyes) were assessed for the left eye. Out of this population, various categories of visual impairment were identified, ranging from blindness to mild and low vision, as well as those with normal vision.

Global visual impairment

According to our results, visual impairment affects a minority of children. In our study, the overall frequency of global visual impairment in the right eye is 9.5%, while in the left eye, it is slightly lower at 7.5%. However our results are similar to that of Ferede et al. (2020) in Ethiopia in the town of gondar where overall prevalence of visual impairment was reported to be 1.8% [40]. This similarity could be attributed to differences in the population, geographic location, or potentially the criteria used for diagnosing visual impairment

Mild visual impairment

According to our results, mild visual impairment was the most common form of impairment in our study. In the right eye, 32 children (7.7%) exhibited mild visual impairment, while in the left eye, 24 children (5.5%) were affected. However our results is different from that of Ferede et al. (2020) in Ethiopia where majority (98.2%) of children have normal-to-mild vision impairment (6/6–6/18), followed by moderate visual impairment in 1.6% (<6/18–6/60) [40].This difference could be due to the difference in the classification of mild and moderate impairments.

Low visual impairment

In our study, we observed a relatively low prevalence of low vision in both eyes among the children. Specifically, in the right eye, only 4 children (1%) were affected, while in the left eye, the number was slightly lower, with 3 children (0.7%).

Blindness

According to our results, blindness was present in a small fraction of the children we studied. In the right eye, 6 children (1.5%) were classified as blind, while in the left eye, the number was slightly lower, with 5 children (1.3%) affected. Our results are similar to that of Ferede et al. (2020) in Ethiopia who had a low prevalence of child blindness where 3 (0.2%) children were found to be bilaterally blind [40]. Our results are also similar to that of Wadhwani et al. (2021) conducted in North India in which the prevalence of severe visual impairment (SVI) was 0.24 per thousand[41]. Although these numbers are relatively low, they underscore the importance of providing specialized support and interventions to ensure these children can maximize their quality of life and potential.

According to the results from our studies mild visual impairment is more prevalent than other forms of visual issues among the children we studied, highlighting the need for corrective measures or continued treatment to further improve their vision.

SOCIO DEMOGRAPHIC CHARACTERISTICS

Age

From our study, we found that the mean age was 11.88 ± 4.53 years, with most children aged between 1 and 16 years and the largest age represented was 16years. This result differs from that reported by Penda et al, 2020 in Cameroon and Lim et al, 2023 in the United States have noted a younger mean age (9.58 ± 3.6 years and 8.49 ± 6.35 years respectively). [42, 43]. This result differs due to the methodology employed on selection of children and the difference in study setting where these research was carried out.

Sex

We found out that girls predominated with 55.2% compared to 44.8% that were boys, with a sex ratio of 0.8. Our results differ that reported by Bhattacharjee et al. 2022 in India, were boys represented 56.8% [44]. And that reported by Ahnoux-Zabsonré et al. 2020 in Burkina Faso who reported 62% of boys [45]. These differences in results may be attributed to variations in study design and setting.

Level of Education

We found out that most of the children were in secondary school 53.0%. Fewer had completed primary school (29.8%) , while a smaller number (9.3%) were neither students nor pupils. Our results are different from that of Penda et al, 2020 in Cameroon where majority of participant where Pupils in Primary School n = 32 (37.2%) and n = 28 (32.6%) of children where Students in Secondary school. This could be due to difference in study setting and study design since our studies considered children of older aged groups [42].

Residence

Our study found that 60.3% of children with visual impairments lived in rural areas, compared to 39.7% in urban areas, contrasting with findings by Lim et al. (2023) in the United States, where 64.8% of visually impaired participants resided in urban settings and only 5.1% in rural ones[43]. This difference could be attributed to the distinct study contexts, as access to healthcare may vary significantly depending on the area of residency . Rural areas often have limited eye care resources, which could delay diagnosis and treatment for visual impairments, potentially contributing to higher rates in these settings. Meanwhile, in the U.S., urban areas typically have more healthcare facilities, making eye care more accessible, which may influence the higher urban concentration in Lim et al.'s study. This disparity highlights the role of geography and healthcare infrastructure in influencing the distribution of visual impairment across rural and urban populations.

V. 3 CLINICAL CHARACTERISTICS

1. Visual acuity without correction

Out of all children, 55.6% (236) reported never using corrective lenses, while 44% (184) had used corrective lenses, with an average age of onset of 9.85 years (SD ± 4.39 years). The mean age of onset was 10 years, with a mode of 16 years, and age ranges from 1 year to 18 years. The average duration of lens use was 2.62 ± 1.93 years, with a mean of 3 years and a range from 1 to 13 years.

Regarding visual acuity, a small proportion of children (56, 13.2 %,) had mild vision impairment (3/10 to 5/10) , affecting 7.3% in the right eye and 5.3% in the left eye. Severe visual impairment was observed in 6 children (1.5%) in the right eye and 5 children (1.3%) in the left eye, classified as blind. Additionally, 4 children (1.0%) in the right eye and 3 children (0.7%) in the left eye exhibited severe visual impairment. Mild visual impairment was found in 32 children (7.7%) for the right eye and 24 children (5.5%) for the left eye.

These findings align with the study by Wadhwani et al. (2021) conducted in North India, where blindness was reported in 0.42 per 1,000 children (0.042%)[41] . While both studies show a low prevalence of blindness, the rate in our study is comparatively higher. In contrast, Adhikari et al. (2023) found that 60% of children with moderate to severe visual impairment and 62% of children with blindness were male. Their study reported that out of 200 children, 45% had moderate visual impairment, 5% had severe visual impairment, and 44.5% were classified as blind, including perception of light. The differences in results may be attributed to sample characteristics or healthcare access between studies[46].

2. Examination and pressure

In our study, 21 children (5.0%) exhibited abnormal ocular motility, indicating conditions such as strabismus. Slit-lamp examinations revealed abnormalities in 20 children (4.7%), detecting issues such as cataracts or conjunctival pathologies. Funduscopic examinations of 19 children (4.5%) provided crucial insights into retinal and optic nerve health, with findings suggesting potential conditions such as glaucoma.

Intraocular pressure (IOP) measurements for the right eye ranged from 10.0 to 133.0 mmHg, with an average of 12.79 ± 6.33 mmHg. The left eye showed a mean IOP of 15.06 ± 17.42 mmHg. Most children had IOP levels within the normal range in both eyes, though some extreme values were recorded, including an unusually high IOP of 133.0 mmHg in the right eye and 150.1 mmHg in the left. These high deviations contrast with findings from previous studies, such as Nanfack et al. (2022) in Cameroon, where mean IOPs were 10.24 ± 3.7 mmHg for the right eye and 10.43 ± 3.9 mmHg for the left, and Alshigari et al. (2021), where the mean IOP was 28.75 ± 9.10 mmHg.[47, 48]. The small subset with severe visual impairments emphasizes the need for early identification and intervention, particularly for those at the lower end of the visual acuity spectrum, to prevent further vision loss and improve overall ocular health outcomes.

V. 4 CAUSES OF VISUAL IMPAIRMENT

I. Avoidable causes

Our study indicates that avoidable causes, particularly ametropia, are the leading contributors to childhood visual impairment, accounting for 57.3% of cases. This is consistent with the findings of Wadhwani et al. (2021) in North India, where avoidable causes accounted for 75.7% of visual impairment cases . Ametropia, a correctable refractive error, highlights the critical need for accessible vision screenings and corrective services. Early detection and intervention can substantially reduce the incidence of visual impairment in children[26].

Other notable avoidable causes in our study included trauma-related corneal wounds (6.2%), keratitis (3.6%), and cataracts (2.1%). These conditions could be managed effectively with timely interventions, such as eye protection, infection control, and cataract surgery. Together, avoidable causes accounted for 69.9% of the total cases, underscoring their preventability through enhanced public health measures and improved healthcare access.

II. Non-avoidable causes

Non-avoidable causes of childhood visual impairment, were less common, still warrant significant attention. Glaucoma was identified in 2.8% of cases. This aligns with the findings of Penda et al. (2020), where glaucoma was responsible for 18.6% of childhood visual impairment in a study of 86 children. Other non-avoidable causes in our study included strabismus (1.9%), albinism (1.4%), and amblyopia (0.5%).

A similar study by Ahnoux-Zabsonré et al. (2020) in Ouagadougou reported that cataracts (30.5%) and glaucoma (3.52%) were key contributors to childhood visual impairment. Despite being non-preventable, early detection and proper management are crucial for minimizing the progression of these conditions[45].

Hereditary causes, such as albinism, were identified in 1.4% of cases in our study. Although not prevalent in our findings, hereditary factors have been reported as significant causes of low vision in other studies. For example, Chee et al. (2014) in New Zealand found that hereditary factors accounted for 17.9% of cases of childhood low vision . Adhikari et al. (2023) also identified hereditary factors as the primary cause of 75% of childhood visual impairment cases[18, 46]. .

CONCULSION AND RECOMENDATIONS

CONCLUSION

Our study at the Second Region Military Hospital identified a global prevalence of visual impairment in 9.5% of right eyes and 7.5% of left eyes among children. Mild visual impairment was the most frequent, affecting 7.7% of children in the right eye and 5.5% in the left. Females comprised 55.2% of the study population, with 60.3% of the children residing in rural areas. The mean age was 11.88 ± 4.53 years, and 53.0% were secondary school students.

Avoidable causes were responsible for 69.9% of cases, with ametropia being the predominant factor (57.3%). Other significant avoidable causes included corneal trauma (6.2%), keratitis (3.6%), and cataracts (2.1%). These conditions emphasize the potential for substantial prevention through early intervention and public health strategies. Non-avoidable causes included glaucoma (2.8%), strabismus (1.9%), and hereditary conditions such as albinism (1.4%).

Mild visual impairment was most common, while severe visual impairment and blindness were observed in 1.5% of right eyes and 1.3% of left eyes. These findings underscore the importance of both preventive measures for avoidable causes and the need for specialized care for non-avoidable conditions to improve paediatric visual health outcomes.

RECOMMENDATIONS

From our results ,we humbly make the following recommendation;

1. To the Ministry of Public Health

- To develop and implement comprehensive national strategies focused on Childhood visual impairment prevention and management.
- To create a national database to monitor the prevalence and causes of Childhood visual impairment, facilitating evidence-based policy-making.

2. To the Faculty of Medicine and Biomedical Sciences

- To embed comprehensive training on pediatric ophthalmology and visual impairment into the medical curriculum to prepare future healthcare providers.
- To encourage faculty and students to engage in research related to Childhood visual impairments, focusing on local etiologies and effective interventions
- To foster partnerships between the faculty and hospitals to provide hands-on training and practical experience for medical students.

3.To Health Professionals and Specialists

- To strengthen pathways for referring children with visual impairments to specialized care, ensuring timely and effective treatment.
- To encourage health professionals to participate in community education programs, raising awareness about eye health and preventive measures.

4. To Students

- To take interest to research projects on Childhood visual impairments, it's detection and prevention
- To develop clinical skill in the diagnosis and treatment of pathologies of the eye

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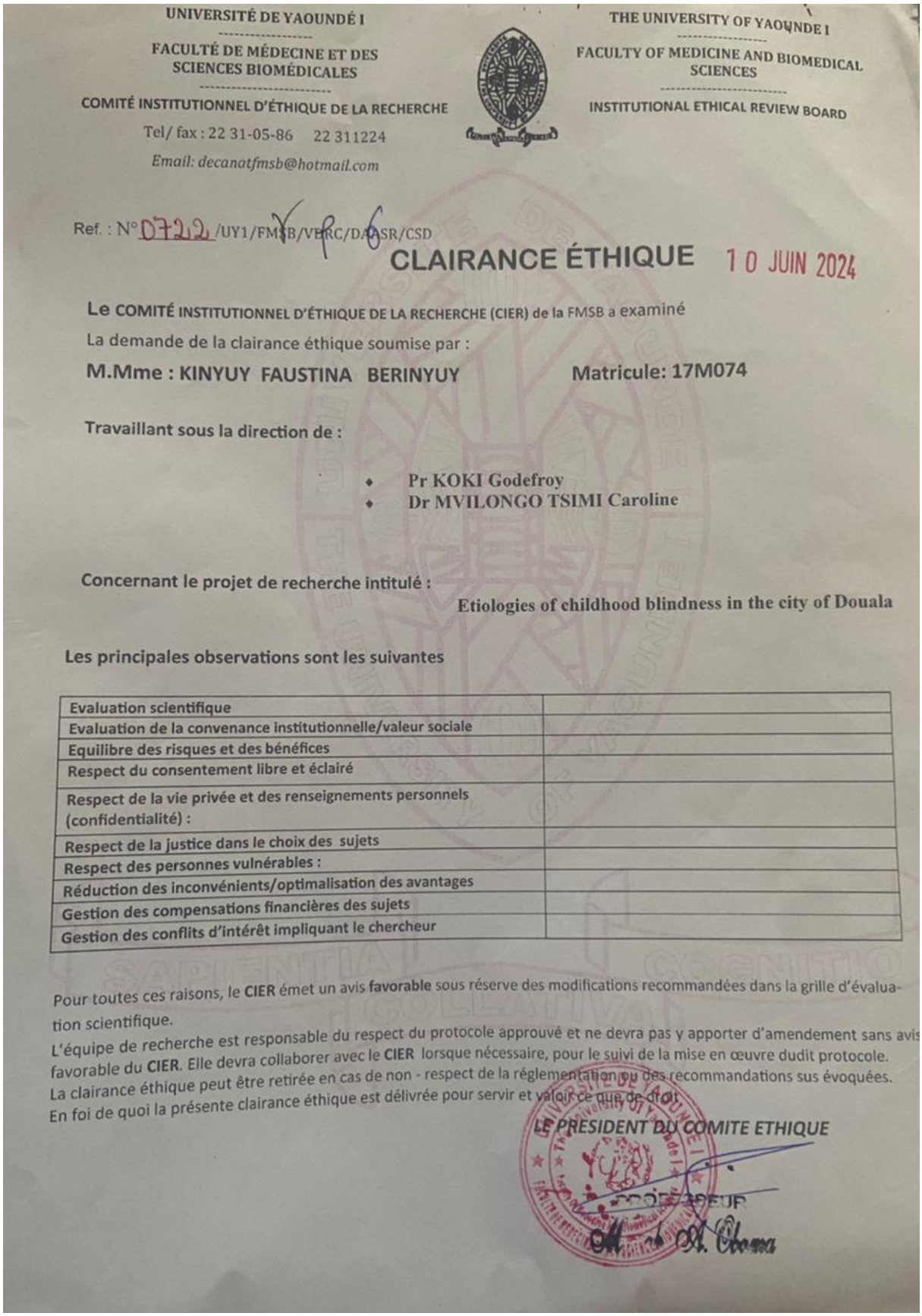
APPENDCIES

APPENDIX 1: AUTHORIZATION FOR ETHICAL CLEARANCE



UNIVERSITÉ DE YAOUNDÉ I
FACULTÉ DE MÉDECINE ET DES SCIENCES BIOMÉDICALES
COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE
Tel/ fax : 22 31-05-86 22 311224
Email: decanatfmsb@hotmail.com

THE UNIVERSITY OF YAOUNDE I
FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES
INSTITUTIONAL ETHICAL REVIEW BOARD

Ref. : N°07222/UY1/FMSB/VRRC/DAASR/CSD

CLAIRANCE ÉTHIQUE 10 JUIN 2024

Le COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE (CIER) de la FMSB a examiné

La demande de la clairance éthique soumise par :

M.Mme : KINYUY FAUSTINA BERINYUY Matricule: 17M074

Travaillant sous la direction de :

- Pr KOKI Godefroy
- Dr MVILONGO TSIMI Caroline

Concernant le projet de recherche intitulé :

Etiologies of childhood blindness in the city of Douala

Les principales observations sont les suivantes

Evaluation scientifique	
Evaluation de la convenance institutionnelle/valeur sociale	
Equilibre des risques et des bénéfices	
Respect du consentement libre et éclairé	
Respect de la vie privée et des renseignements personnels (confidentialité) :	
Respect de la justice dans le choix des sujets	
Respect des personnes vulnérables :	
Réduction des inconvénients/optimalisation des avantages	
Gestion des compensations financières des sujets	
Gestion des conflits d'intérêt impliquant le chercheur	

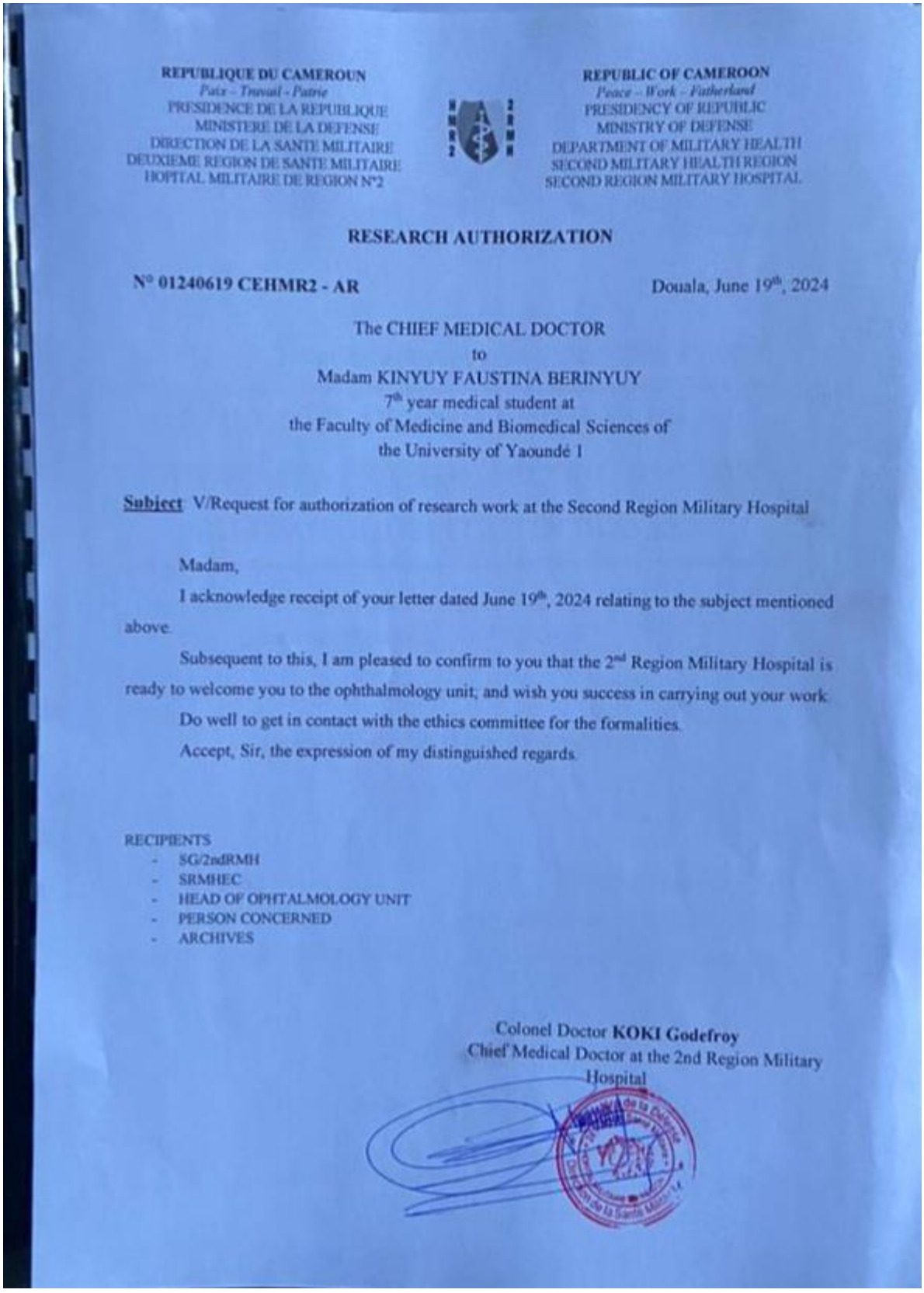
Pour toutes ces raisons, le CIER émet un avis favorable sous réserve des modifications recommandées dans la grille d'évaluation scientifique.
L'équipe de recherche est responsable du respect du protocole approuvé et ne devra pas y apporter d'amendement sans avis favorable du CIER. Elle devra collaborer avec le CIER lorsque nécessaire, pour le suivi de la mise en œuvre dudit protocole.
La clairance éthique peut être retirée en cas de non - respect de la réglementation ou des recommandations sus évoquées.
En foi de quoi la présente clairance éthique est délivrée pour servir et valoir ce que de droit

LE PRESIDENT DU COMITE ETHIQUE

PROFESSEUR

Figure 9: ethical clearance for the Ethical Review Board

APPEDIX 2: AN AUTHORIZATION TO CARRY OUT RESEARCH



REPUBLIQUE DU CAMEROUN
Paix – Travail - Patrie
PRESIDENCE DE LA REPUBLIQUE
MINISTERE DE LA DEFENSE
DIRECTION DE LA SANTE MILITAIRE
DEUXIEME REGION DE SANTE MILITAIRE
HOPITAL MILITAIRE DE REGION N°2

REPUBLIC OF CAMEROON
Peace – Work – Fatherland
PRESIDENCY OF REPUBLIC
MINISTRY OF DEFENSE
DEPARTMENT OF MILITARY HEALTH
SECOND MILITARY HEALTH REGION
SECOND REGION MILITARY HOSPITAL

RESEARCH AUTHORIZATION

N° 01240619 CEHMR2 - AR Douala, June 19th, 2024

The CHIEF MEDICAL DOCTOR
to
Madam KINYUY FAUSTINA BERINYUY
7th year medical student at
the Faculty of Medicine and Biomedical Sciences of
the University of Yaoundé 1

Subject V/Request for authorization of research work at the Second Region Military Hospital

Madam,

I acknowledge receipt of your letter dated June 19th, 2024 relating to the subject mentioned above.

Subsequent to this, I am pleased to confirm to you that the 2nd Region Military Hospital is ready to welcome you to the ophthalmology unit; and wish you success in carrying out your work.

Do well to get in contact with the ethics committee for the formalities.

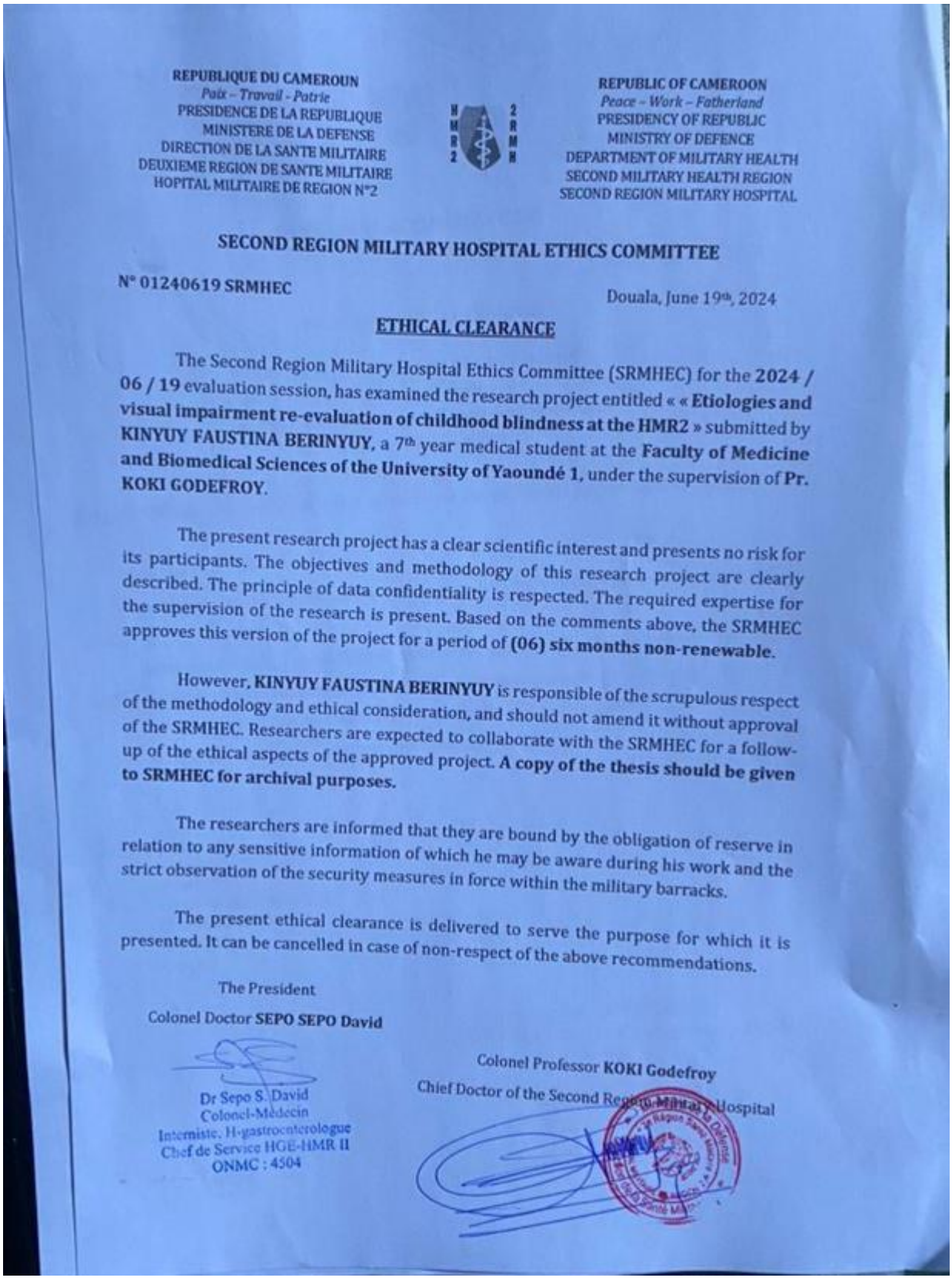
Accept, Sir, the expression of my distinguished regards.

RECIPIENTS
- 5G/2ndRMH
- SRMHEC
- HEAD OF OPHTALMOLOGY UNIT
- PERSON CONCERNED
- ARCHIVES

Colonel Doctor **KOKI Godefroy**
Chief Medical Doctor at the 2nd Region Military Hospital

Figure 10: research Authorization

APPEDIX 3: AUTHORIZATION FOR ETHICAL CLEARANCE BY THE HOSPITAL



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SECOND MILITARY HEALTH REGION
SECOND REGION MILITARY HOSPITAL

SECOND REGION MILITARY HOSPITAL ETHICS COMMITTEE

N° 01240619 SRMHEC

Douala, June 19th, 2024

ETHICAL CLEARANCE

The Second Region Military Hospital Ethics Committee (SRMHEC) for the **2024 / 06 / 19** evaluation session, has examined the research project entitled « **« Etiologies and visual impairment re-evaluation of childhood blindness at the HMR2 »** submitted by **KINYUY FAUSTINA BERINYUY**, a 7th year medical student at the **Faculty of Medicine and Biomedical Sciences of the University of Yaoundé 1**, under the supervision of **Pr. KOKI GODEFROY**.

The present research project has a clear scientific interest and presents no risk for its participants. The objectives and methodology of this research project are clearly described. The principle of data confidentiality is respected. The required expertise for the supervision of the research is present. Based on the comments above, the SRMHEC approves this version of the project for a period of **(06) six months non-renewable**.

However, **KINYUY FAUSTINA BERINYUY** is responsible of the scrupulous respect of the methodology and ethical consideration, and should not amend it without approval of the SRMHEC. Researchers are expected to collaborate with the SRMHEC for a follow-up of the ethical aspects of the approved project. **A copy of the thesis should be given to SRMHEC for archival purposes.**

The researchers are informed that they are bound by the obligation of reserve in relation to any sensitive information of which he may be aware during his work and the strict observation of the security measures in force within the military barracks.

The present ethical clearance is delivered to serve the purpose for which it is presented. It can be cancelled in case of non-respect of the above recommendations.

The President
Colonel Doctor **SEPO SEPO David**

Dr Sepo S. David
Colonel-Médecin
Interniste, H-gastroentérologue
Chef de Service HGE-HMR II
ONMC : 4504

Colonel Professor **KOKI Godefroy**
Chief Doctor of the Second Region Military Hospital

Figure 11: authorization for ethical clearance granted by the hospital

APPENDIX 4: ANTIPLAGIARISM REPORT

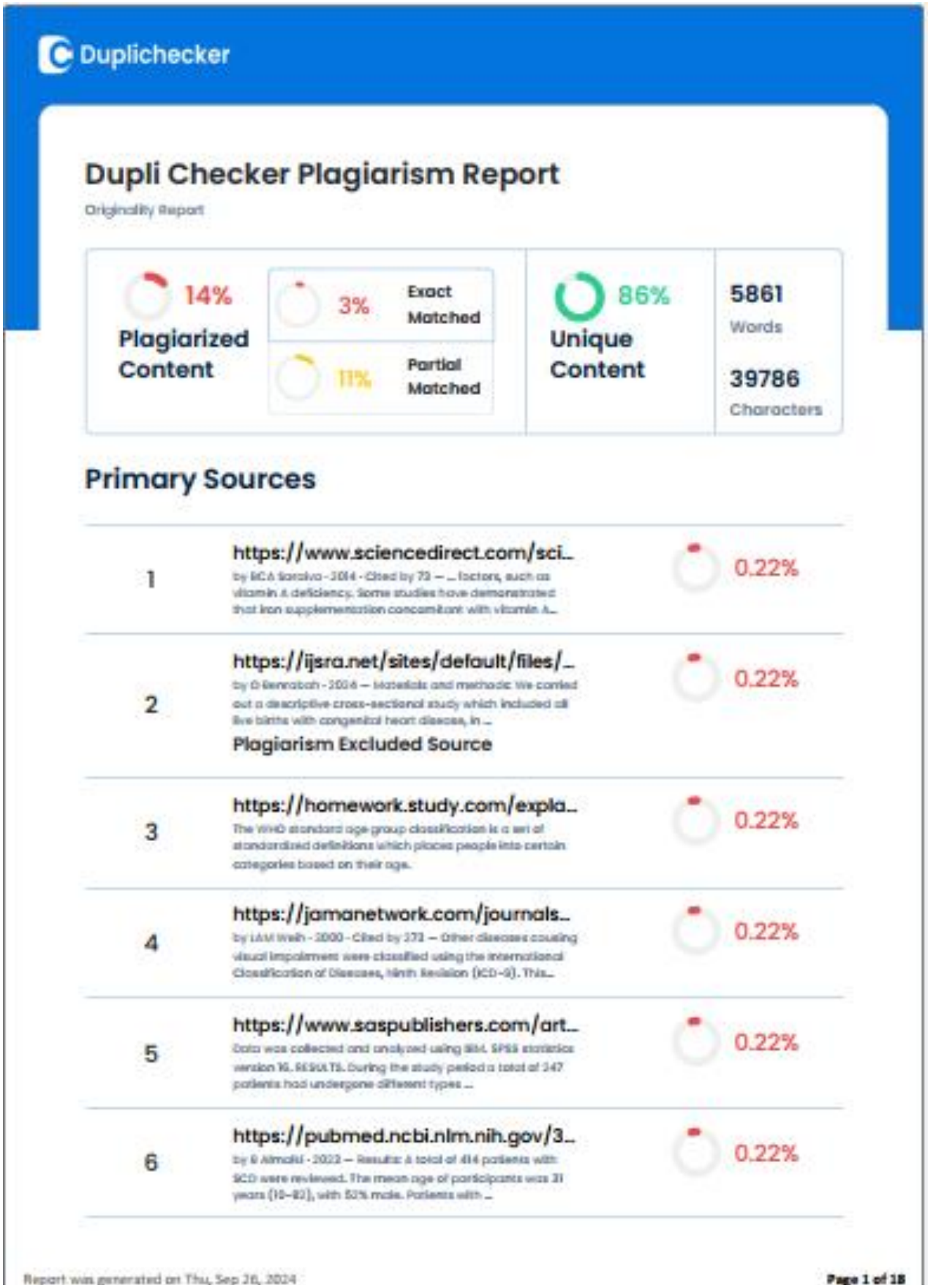

Figure 12:antiplagarism report

APPENDIX 4: INFORMED CONSENT FORM

Title: ETIOLOGIES AND VISUAL IMPAIRMENT RE-EVALUATION OF CHILDHOOD VISUAL IMPAIRMENT AT THE 2ND REGIONAL MILITARY HOSPITAL REGION N°2(2ND JMRH2).

Investigator: KINYUY FAUSTINA BERINYUY, final year General Medicine student in the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I.

Supervisor: Professor. KOKI GODEFROY Associate Professor of Ophthalmology at the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I

Co supervisors: Dr MVILONGO TSIMI CAROLINE Senior Lecturer of Ophthalmology

I,the undersigned Mr/Mrs,Madam/Sir……..

Declares to have been invited to participate in the study entitled "Etiologies and visual impairment re-evaluation of Childhood visual impairment at the Secondary Regional Military Hospital N°2" whose principal investigator is the seventh-year student KINYUY FAUSTINA BERINYUY of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I; under the supervision of Pr. KOKI Godefroy, Ophthalmologist.

I was informed about the nature of the study, its purpose, its duration, the possible benefits and risk of what is expected of me.

I had the opportunity to ask all the questions that came to my mind and I got a satisfactory answer to my questions.

I understood that my participation in this study is voluntary and that I am free to end my participation in this study without it changing my relationship with the therapeutic team in charge of my health.

I understood that data concerning me and my child will be collected during my participation in this study that the investigator of the study guarantees the confidentiality of this data.

I freely agree to involve my child in this study, which implies answering the questionnaire and taking the exams.

I, the principal investigator of the study, take responsibility for giving the participant all the required information about the study.

Done in Douala on...../.....

Signature of the investigator Signature of the participant

APPENDIX 5: INFORMATION SHEET

TOPIC: ETIOLOGIES OF CHILDHOOD VISUAL IMPAIRMENT AT THE 2ND RMH DOUALA

Investigator: KINYUY FAUSTINA BERINYUY, Final year medical student from the FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES; University of YAOUNDE 1.

Tel: 652929457

Email: beryfaustina@gmail.com

Supervisor: Professor KOKI Godefroy, Associate-Professor of Ophthalmology. Director of the Military Hospital of Region Nº2. A Professor in the Department of Ophthalmology-ORL Stomatology at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I.

Co-Supervisor: Dr MVILONGO TSIMI Caroline, Assistant-teacher of Ophthalmology at the Yaoundé central hospital/lecturer in the Department of Ophthalmology-ORL-Stomatology at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé 1.

Study sites: HMR2.

Duration of Study: January to May 2024

Subject: An invitation to participate in this Study

Dear sir/ madam,

We come before you to present this research work and in doing that; invite you to take part in the research visual impairment and blindness in children seen at the HMR2 Douala.

Purpose of this Research

The research has as the purpose to analyze and identify the underlying cause of Childhood visual impairment and visual impairment in children seen at the time of study. During the Study, a questionnaire is going to be administered and data obtained. The results shall be presented publicly to the Faculty of Medicine and Biomedical Science. Copies will be addressed to the respective children.

Reason for the invitation to Participate

We are inviting all children with eye condition. This will provide information that law makers and clinicians can use to reduce the causes of Childhood visual impairment and to identify the most common cause among these children.

Expectations from the Children

We will fill questionnaires from studying patient's files and re-evaluating them. The questionnaires will be coded for confidentiality.

Payment: Children shall not receive any payment for accepting to be part of this research

APPENDIX 6: QUESTIONNAIRE.

PROJECT TITLE: ETIOLOGIES OF CHILDHOOD VISUAL IMPAIRMENT AT THE 2ND RMH DOUALA

Patient Code: _____ **Study Site :** _____ **Date :** ____ /____ / phone number____

SECTION : 1 SOCIO DEMOGRAPHIC			
	Sex	(1) Male (2) Female	
	Age (YEAR)	----	
	Region of residence:	(1) Urban (2) Rural	
	Level of education	(0) None (1) Primary School (2) Secondary School (3) Higher Education (4) University	
	Profession	(0) None (1) Pupil (2) Student	

SECTION : 2 VISUAL ASSESMENT		
	When did you first notice problems with your vision? ----------	I never had good vision _____ (Year)
	Have you ever used any corrective lenses (glasses or contacts)? (Please check all that apply)	(0) Yes (1) No Volume Corrected Right eye Left eye
	If yes, how long have you used them?	_____ years
	Visual fields test 1) Kinetic perimetry (light or object) 2) Confrontation visual (moves fingers or toys) 3) Preferential looking test 4) Charts with drawings with toys	Test each eye separately, then together. Right Left Full filed Hemianopia Constriction to less than 10 Others field loss Cannot test Not tested

	What is the major site of visual lost	(1) Right (3)Both (2) Left

SECTION : 3 CAUSES OF BLINDNESS / VISUAL IMPAIRMENT			
	What is the diagnosed cause of child's blindness/visual impairment		
	(1) Congenital (present at birth) (2) Infectious disease (3) Nutritional deficiency (4) Ocular trauma (injury to the eye) (5) Cataract (6) Glaucoma (7) Refractive error (myopia, hyperopia, astigmatism) (8) Cortical visual impairment (9) Other		
	Age of Onset of visual loss (years):		
	Have you ever experienced any eye injuries?	1) Yes 2) No	
	If yes, please describe the cause of injury		
	If yes, please specify the age of injury		
	Is there any family history of this same condition?	(0) Yes (1) No	
	If yes who is similarly affected	(1) Grand Parent (4)None (2) Parents (3) Uncle/Aunt	
	Have you previously been treated for this causes?	(0) Yes (1) No	
	What was the treatment done	(0) None (1) Refraction later (2) Spectacles (3) Low vision Aid (4) Medication (5) Surgery (6) Others please Specify_ _ _ _ _ _ _ _ _	
	What was the surgery done	(0) None (1) Glaucoma (2) Cataract (3) Corneal Graft	

		(4) Optical Iridectomy (5) Unknown Surgery type	
	Was there an improvement after this surgeries	(0) Yes (1) No	
	If Yes Which Eye did you Noticed a significant improvement	(0) Right eye (1) Left eye (2) Both eyes	

SECTION : 4 GENERAL ASSESMENT			
	Do you have any Additional Disabilities?	(0) None (1) Hearing loss (2) Mental retardation (3) Physical handicap (4) Epilepsy (5) Other	
	Do you have any history of	(0) Heart Disease (1) High Blood Pressure (2) Diabetes (3) Skin disorder (4) None	
	Is there any family history of this same condition?	(0) Yes (1) No	
	If yes who is similarly affected	(0) Grand Parent (1) Parents (2) Uncle/Aunt (3)None	
	Does this Condition affects your daily life?	(0) Yes (1) No	
	Please Specify How has your visual impairment impacted your daily life using LIKERT'S SCALE	(1)Very unlikely (2)Unlikely (3)Neutral (4)Likely (5)Very likely	

SECTION : 5 OPTHALMOLOGY ASSESMENT		
	What is the reason for consultation:_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	

	What Where the test carried out	
	Visual Acuity (Snellen chart notation) 1/10e :☐ 2/10e : ☐3/10e :☐ 4/10e :☐ 5/10e :☐ 6/10e :☐ 7/10e : ☐8/10e :☐ 9/10e :☐ 10/10e :☐ ≤10e ☐ : PL(+) ☐ :NPL ☐:CCD :VBM Distance Vision (Unaided) Distance Vision (Corrected) VA BEFORE: Right Eye: _____ Right Eye: _____ Left Eye: _____ Left Eye: _____ Distance Vision (Unaided) Distance Vision (Corrected) VA AFTER: Right Eye: _____ Right Eye: _____ Left Eye: _____ Left Eye: _____ Time difference: (1) One year (2) Two years (3) Three years	Normal Vision:VA of greater than or equal to 5/10 Mild Vision Impairment:VA 5/10 to 3/10 Moderate Vision Impairment:VA 3/10 to 1/10 Severe Vision Impairment:VA 1/10 to 1/20 Blind Vision:VA ≤ 1/20 According to the International Classification of Disease (ICD-11)
	Ocular Motility:	(1) Normal (2) Abnormal
	External Eye Examination:	(1) Normal (2) Abnormal
	Slit-Lamp Examination:	(1) Normal (2) Abnormal
	Funduscopic Examination:	(1) Normal (2) Abnormal
	Intraocular Pressure Measurement (IOP) (mmHg) : Right Eye: _____ mmHg Left Eye: _____ mmHg	
	Final Diagnosis retained for the patient: …… Complication/Evolution……	
	Actual treatment: …….	

APPENDIX 7: IMAGES.

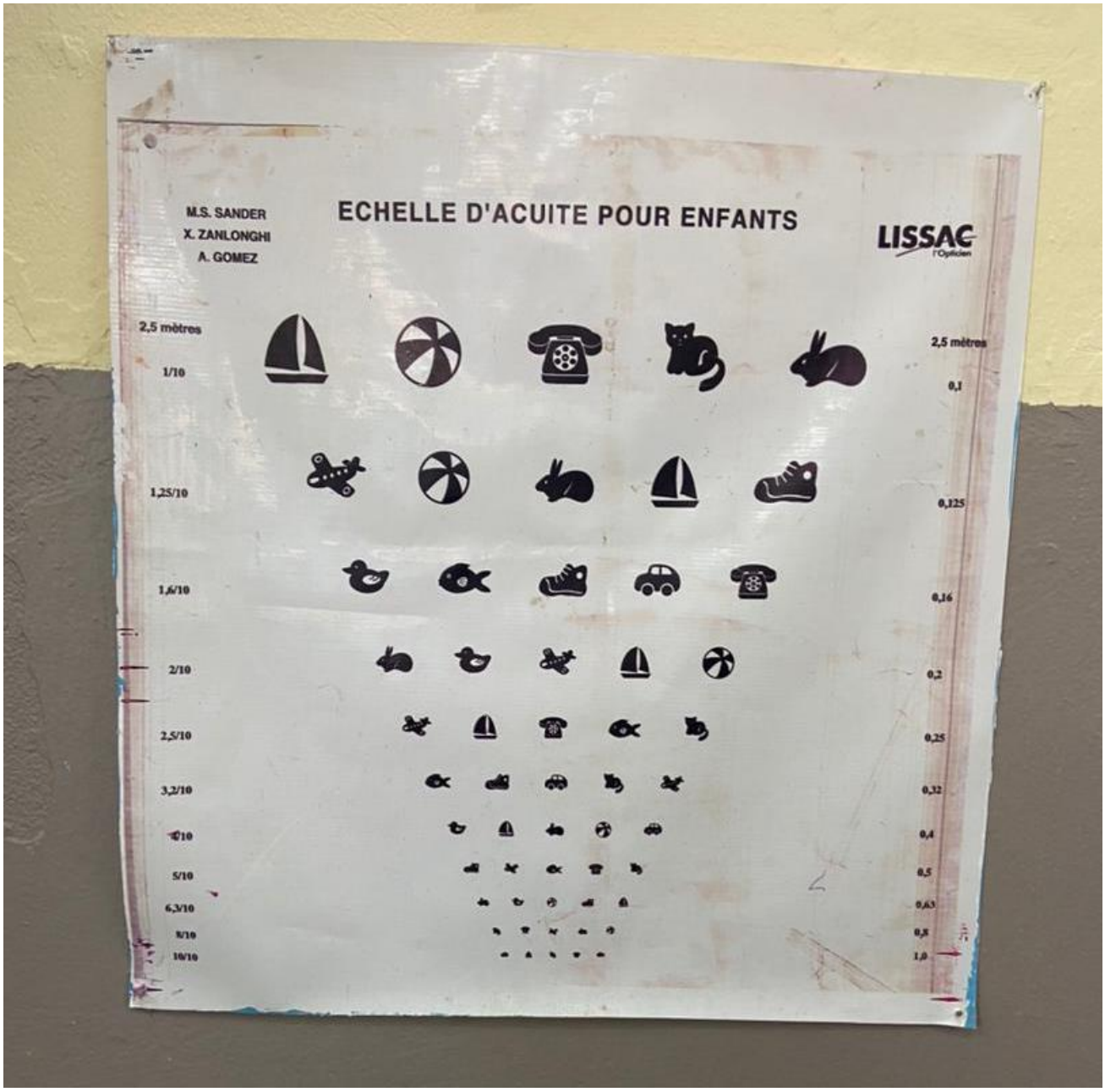

Figure 13:visual acuity scale for children

Figure 14:visual acuity scale 2a

Figure 15: visual acuity scale 2b

Figure 16: autorefractometry nidek ARK 700A Source (Kinyny Fustina Berinyuy, 2RMH,2024)