



Invention: Journal Research and Education Studies
Volume 6 Nomor 1 Maret 2025

The Invention: Journal Research and Education Studies is published
 three (3) times a year

(March, July and November)

Focus : Education Management, Education Policy, Education
 Technology, Education Psychology, Curriculum Development,
 Learning Strategies, Islamic Education, Elementary Education

LINK : <https://pusdikra-publishing.com/index.php/jres>

The Spectrum of Sensory Disorders in Humans: A Review of the Literature

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ABSTRACT

This literature review aims to explore the spectrum of visual sensory disorders in humans, focusing on major disorders such as cataracts, glaucoma, and anisometropia. This condition is one of the leading causes of vision impairment and blindness globally, especially in developing countries. The study synthesizes findings from recent national and international scientific publications to identify the causes of preventable and unpreventable visual dysfunction. Cataracts, often associated with aging and systemic diseases, remain the most common cause of blindness but can be treated through surgical interventions such as phacoemulsification. Glaucoma, known for its asymptomatic progression, causes irreversible damage to the optic nerve and requires early detection and ongoing treatment. Anisometropia, a refractive disorder that results in different visual inputs between the eyes, poses a risk of amblyopia if not treated early. In addition, the study highlights the increasing incidence of visual impairment due to excessive use of digital devices, especially among children, emphasizing the importance of precautions such as regulated screen time and regular eye check-ups. These findings emphasize the important role of early intervention, public awareness, and access to quality eye care in reducing the burden of visual impairment. The review also underscores the need for policy and research support to improve treatment strategies and maintain visual health in the digital age.

*Anisometropia, Cataracts, Digital Eye Strain, Glaucoma, Ensory Disorders
 Visual Disturbances.*

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INTRODUCTION

The sensory system is a collection of organs that work together to carry out activities in the human body so that it works properly as it should, in carrying out its task the sensory system coordinates with each other to be able to receive every stimulus that comes from outside (external) and from within the body (internal) where this response will be received by implus which will send a signal to each of our senses system. The sensory system consists of five

main components according to the name panca which means five, in this case the sensory system will be discussed in the vision part, which is the eye that functions to help the individual see clearly the object in front of his eyes. However, in carrying out their duties, there are often some individuals who experience visual impairments that originate from birth and with age with decreased vision factors.

Vision disorders consist of a decrease in the presence of the working system on the optic nerve / Diseases that come to human vision but in some cases there are some people who experience not being able to see at all / Blindness. There are several causes of conditions in humans that cause blindness and disorders that occur in the eyes that are avoidable and unavoidable. The causes of vision impairment and blindness that can be avoided are divided into two, namely preventable and treatable. Some of the causes of vision impairment and blindness in children that occur in developing countries can be avoided through prevention or treatment. Preventable causes of vision loss and blindness include vitamin A deficiency, trauma, infections, and harmful traditional medicines. According to Mulyani et al (2024) in their research, it was revealed that the causes of visual impairment and blindness that can be treated include refractive disorders, cataracts, afachi/pseudoaphasia, glaucoma, premature retinopathy, uvey, and amblyopia. Causes of vision disorders and blindness that cannot be avoided include eye abnormalities, retinal dystrophy, optic nerve disorders, and cortical vision disorders.

Visual impairment certainly makes every sufferer experience difficulties and discomfort in carrying out daily activities. Reporting from FK KMK UGM Indonesia is a country with the second highest prevalence of blindness and visual impairment in the world after Ethiopia. Quoted from data from the Ministry of Health of the Republic of Indonesia in 2017, the results of the 2014-2016 Rapid Assessment of Avoidable Blindness (RAAB) survey reported that the prevalence of blindness in 15 provinces in Indonesia was 3%. In the era of the development of information systems with increasingly sophisticated and interesting technology to follow, everyone today, especially adults, even children, already has gadgets that make a sense of excessive dependence on users, so many people experience damage or disturbances to the visual system, namely the eyes experience a decrease in vision, this is caused by the high radiation of mobile phones used every day with a very close distance between the eyes and gadgets, The use of gadgets with very minimal light is also some of the concerns that prompted researchers to conduct this study. Therefore, it is not surprising that there are many conditions that can be seen from every person we meet experiencing this condition, because some of the factors above

are interesting to discuss in more depth about what disorders can occur in the eyes and the factors that cause them in this study.

RESEARCH METHODS

This study uses a literature review method by examining relevant sources, including academic journals, books, and articles published in the last five years. Literature is collected from national and international sources through academic databases such as ResearchGate, Google Scholar, and ScienceDirect and articles published in the last five years. The selected literature is evaluated based on its relevance, credibility, and contribution to the research topic. The material collected is then analyzed to identify key findings and insights related to the objectives of this research.

RESULTS AND DISCUSSION

Visual impairment is a condition that is widely discussed in various scientific studies, both domestic and foreign, considering its significant impact on the quality of life of individuals. Various sources of literature, both from international journals and local research, provide a deeper understanding of the types of vision disorders, their causes and treatment. Based on the literature review, a number of findings related to the prevalence of visual impairment in different populations show interesting variations, which will be discussed further in the following subtopics:

Cataracts

Vision impairment, especially caused by cataracts, is a significant global health problem. Cataracts are the leading cause of blindness in the world, and their treatment through phacoemulsification surgery has become the gold standard in modern ophthalmological practice. Cataracts are characterized by cloudiness of the lens of the eye that leads to decreased visual acuity, glare, and impaired color perception. The condition is multifactorial, with major causes such as the aging process causing the accumulation of oxidative stress in lens proteins, systemic diseases such as diabetes mellitus that accelerate lens degeneration, environmental factors, including exposure to UV rays and long-term use of corticosteroid drugs (Harianja et al, 2020). Cataracts not only interfere with daily activities but also increase the risk of complications such as secondary glaucoma due to changes in the structure of the frontal eyespace. Therefore, surgical interventions such as phacoemulsification are the main solution to restore vision function while preventing further complications.

A study at SMEC Samarinda Eye Clinic showed that phacoemulsification surgery significantly lowered TIO in most patients (62.2%). The mechanisms behind this phenomenon include:

- Anatomical changes of the front eye space: The thickened lens lift widens the angle of the eye space, facilitating the flow of juicy humor.
- Biochemical effects of ultrasound: Ultrasound energy during surgery stimulates the production of IL-1 in the trabecular webbing, which improves the drainage of eye fluid.
- Restoration of physiological position of the eye structure: Implantation of the posterior intraocular lens (IOL) promotes relaxation of the ciliatric muscles and opens the trabecular webbing. However, in some patients (22.7%), TIO actually increased postoperatively, mainly due to corneal edema or inflammatory responses. This shows the importance of regular TIO monitoring to detect complications early. The reduction of post-phacoemulsification TIO has positive implications for patients at risk of glaucoma, as this procedure can help stabilize intraocular pressure in the long term. However, some recommendations are worth noting:
- Postoperative monitoring: Periodic evaluation of TIO and visual acuity to detect complications such as corneal edema or increased TIO.
- Comorbidity management: Control of systemic diseases such as diabetes to prevent secondary cataracts or postoperative healing disorders.
- Optimal surgical techniques: Minimizes trauma to eye tissue to reduce the risk of inflammation and edema.

Ophacoemulsification surgery is not only effective in restoring cataract patients' vision, but also plays a role in stabilizing intraocular pressure through anatomical and biochemical mechanisms. An in-depth understanding of the impact of these procedures on TIO is important to optimize therapy outcomes and prevent complications. Further research is needed to explore the factors that influence postoperative TIO response variations, so that more personalized treatment protocols can be developed

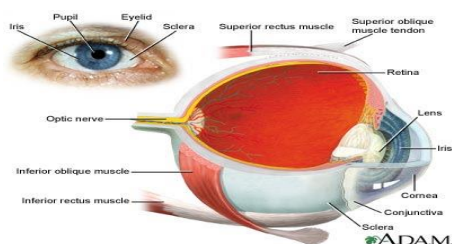


Figure 1. Normal Eyes

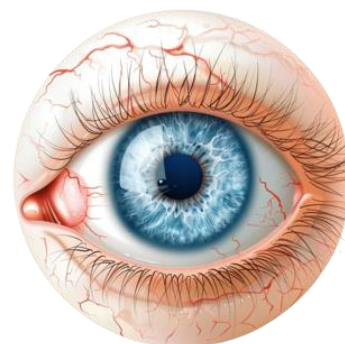


Figure 2. Cataract eye

Based on the results of a study conducted at Cicendo Eye Hospital Bandung, it was found that cataract surgery with phacoemulsification technique had a significant impact on reducing intraocular pressure (TIO), especially in the group of patients with closed front eye compartment angles (BMD). The decrease in TIO of 19.6% in the closed angle group was statistically greater than in the open angle group which only experienced a decrease of 11.3%. These findings are consistent with several previous studies that suggest cataract lens extraction may be one of the therapeutic modalities in treating cases of secondary glaucoma due to the pupil blocking mechanism (Hapsari et al, 2013). The mechanism of decreasing postoperative phacoemulsification TIO can be explained through several theories. First, the theory of anatomical changes in which the removal of the thickened crystalline lens will increase the depth of the frontal eyespace. This increase in depth has an impact on the widening of the angle of the anterior eye space so that it can increase the flow of aqueous humor into the trabecular webbing. Second, biochemical theories state that ultrasound energy during the phacoemulsification procedure is able to stimulate trabecular webbing cells to produce endogenous interleukin-1, a cytokine that plays a role in increasing the permeability of trabecular webbing. The difference in the percentage of TIO decrease between closed and open angle groups can be explained through the concept of aqueous flow resistance. In the closed-angle group, there was greater resistance to the flow of watery humor due to the more significant narrowing of the BMD angle. With phacoemulsification, there is a dramatic change in the angular anatomy of the front eye compartment so that the resulting decrease in TIO is greater than that of the open-angle group that already had a wider angle before surgery.

Several factors need to be considered in the interpretation of the results of this study. First, the gonioscopy examination technique used as the BMD angle assessment standard has limitations in terms of examiner subjectivity. Second, diurnal variations of TIO can affect measurement results despite attempts to minimize them with measurements at relatively contemporaneous times. Third, a relatively short follow-up period (3 weeks postoperatively) may not describe the long-term effects of surgery on TIO. The clinical implications of this study are quite significant. In cataract patients with closed BMD angles, phacoemulsification surgery not only aims to improve vision but can also act as a TIO-lowering therapy. This is especially relevant for cases of cataracts accompanied by chronic closed-angle glaucoma. However, keep in mind that this decreasing effect of TIO may not be permanent and periodic monitoring is still necessary.

Glaucoma

Glaucoma develops when the optic nerve becomes damaged. As these nerves gradually deteriorate, blind spots develop on your vision. For reasons that are not fully understood by ophthalmologists, this nerve damage is usually associated with increased pressure in the eye. Increased eye pressure occurs as a result of fluid buildup that flows throughout the inside of the eye. This fluid, called aqueous humor, usually flows through tissues located in the corner where the iris and cornea meet. This tissue is called a trabecular net. The cornea is important for vision because it allows light to enter the eye. When the eye produces too much fluid or the drainage system is not functioning properly, eye pressure can increase. In addition, glaucoma can be categorized into several types based on its cause, namely:

- Open-angle glaucoma: This is a type of glaucoma that occurs when the trabecular mesh (the duct that drains the watery humor) is partially blocked.
- Closed-angle glaucoma: a type of glaucoma that occurs when the trabecular mesh is closed or completely blocked. This type of glaucoma is often found in Asians.
- Congenital glaucoma: caused by abnormalities that occur in newborns or congenital conditions. For this reason, congenital glaucoma often occurs in children.
- Normal-pressure glaucoma: damage to the optic nerve that occurs even when the pressure of the eyeball is within normal limits. Usually, this type of glaucoma is affected by hypersensitivity or poor blood flow.
- Secondary glaucoma: caused by complications of other diseases, such as diabetes or hypertension. Alternatively, secondary glaucoma can also be caused by taking certain medications.

Glaucoma is a condition whose symptoms often only appear years after the sufferer develops it. For this reason, many sufferers do not realize that they have glaucoma. People with glaucoma tend to only be aware of their condition when they experience vision problems, such as narrow vision, blurred vision, and so on. Therefore, it is important to know the symptoms of glaucoma so that you can detect the disease as early as possible. Some common symptoms of glaucoma are as follows because the eyes look foggy. These symptoms of glaucoma are usually experienced by babies, headaches, pain in the eye area, nausea and vomiting, redness of the eyes, blurred vision, narrowed vision, such as tunnel vision, the appearance of blackish dots that seem to float with eye movements.

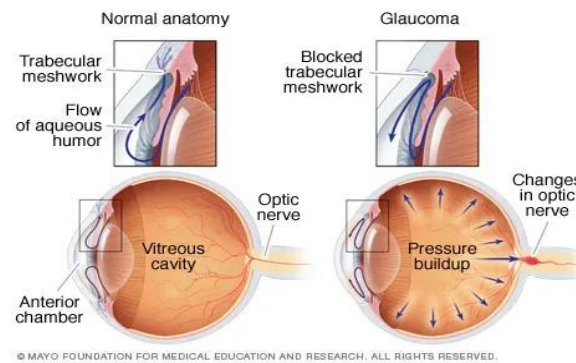


Figure 3. Normal eye and Glaucoma

The damage caused by glaucoma is irreversible. But regular treatment and checkups can help slow or prevent vision loss, especially if the disease is discovered in the early stages. Glaucoma treatment aims to lower intraocular pressure. Treatment options include prescription eye drops, oral medications, laser treatments, surgery or a combination of approaches.

Eye drops

Treatment of glaucoma often begins with prescription eye drops. Some may lower eye pressure by increasing the way fluid flows from the eye. Others reduce the amount of fluid the eyes produce. Depending on how low eye pressure is required, more than one eye drop may be prescribed. Prescription eye drops include:

- Prostaglandins. It increases the outflow of fluid in the eye, helping to reduce eye pressure. Drugs in this category include latanoprost (Xalatan), travoprost (Travatan Z), tafluprost (Zioptan), bimatoprost (Lumigan) and latanoprostene bunod (Vyzulta). Possible side effects include mild redness and stinging of the eyes, darkening of the iris, darkening of the eyelash pigment or eyelid skin, and blurred vision. This class of drugs is prescribed for once daily use.
- Beta blocker. It reduces fluid production in the eye, helping to lower eye pressure. Examples include timolol (Betimol, Istalol, Timoptic) and betaxolol (Betoptic S). Possible side effects include difficulty breathing, slowed heart rate, decreased blood pressure, impotence and fatigue. This class of drugs can be prescribed for use once or twice a day depending on your condition.
- Alpha-adrenergic agonists. This reduces the production of fluid flowing through the entire inside of the eye. They also increase the outflow of fluid in the eyes. Examples include apraclonidine (Iopidine) and brimonidine (Alphagan P, Qoliana). Possible side effects include irregular heartbeat; high blood pressure; Fatigue; red, itchy or swollen eyes; and dry mouth.

This class of drugs is usually prescribed for twice-daily use but can sometimes be prescribed for use three times a day.

- Carbonate anhydrase inhibitors. These drugs reduce the production of fluid in the eye. Examples include dorzolamide and brinzolamide (Azopt). Possible side effects include a metallic taste, frequent urination, and tingling in the fingers and toes. This class of drugs is usually prescribed for twice-daily use but can sometimes be prescribed for use three times a day.
- Rho kinase inhibitors. This drug lowers eye pressure by suppressing the enzyme rho kinase which is responsible for increased fluid. It is available as netarsudil (Rhopressa) and is prescribed for once daily use. Possible side effects include eye redness and eye discomfort.
- Myotic or cholinergic agents. This increases the outflow of fluid from the eyes. An example is pilocarpine (Isopto Carpine). Side effects include headaches, eye pain, smaller pupils, possible blurred or dim vision, and nearsightedness. This class of drugs is usually prescribed for use up to four times a day. Due to the potential for side effects and the need for frequent daily use, these medications are not prescribed very often anymore.

Because some eye drops are absorbed into the bloodstream, it may experience some side effects that are not related to the eyes.

1. Oral medication Eye drops alone may not lower eye pressure to the desired level. So the ophthalmologist can also prescribe oral medications. This drug is usually an anhydrase carbonate inhibitor. Possible side effects include frequent urination, tingling in the fingers and toes, depression, abdominal pain, and kidney stones.
2. Surgery and other therapies Other treatment options include laser therapy and surgery. The following techniques can help drain fluid inside the eye and lower eye pressure:
 - Laser therapy. Laser trabeculoplasty (truh-BEK-u-low-plas-tee) is an option if eye drops are intolerable. It can also be used if the drug does not slow down the progression of the disease. An ophthalmologist may also recommend laser surgery before using eye drops. It is done in an ophthalmologist's office. An ophthalmologist uses a small laser to improve the drainage of the tissue located at the angle where the iris and cornea meet. It may take several weeks before the full effects of this procedure become apparent.
 - Filtration operations. This is a surgical procedure called trabeculectomy (truh-bek-u-LEK-tuh-me). The ophthalmologist creates a hole in the

white part of the eye, which is also known as the sclera. The surgery creates another space for the fluid to leave the eye.

- Drainage tubes. In this procedure, the eye surgeon inserts a small tube in the eye to drain excess fluid to lower eye pressure.
- Minimally invasive glaucoma surgery (MIGS). An ophthalmologist may suggest a MIGS procedure to lower eye pressure. This procedure generally requires less immediate postoperative care and has less risk than trabeculectomy or using drainage devices. The MIGS procedure is often combined with cataract surgery. There are a number of MIGS techniques available.

Eye Problems and Blindness

According to Mulyani, et al (2024) Most eye disorders are visual impairment and blindness in children (2.8%). Retinal and lens abnormalities are the main causes of vision impairment. Causes of visual impairment and blindness that can be treated with refractive disorders, cataracts, aphachia/pseudo-farkie, glaucoma, retinopathy of prematurity, uveitas, inflammation. The inevitable causes of vision disorders and blindness are eye disorders, retinal dystrophy, photonological disorders, and cortical vision disorders.

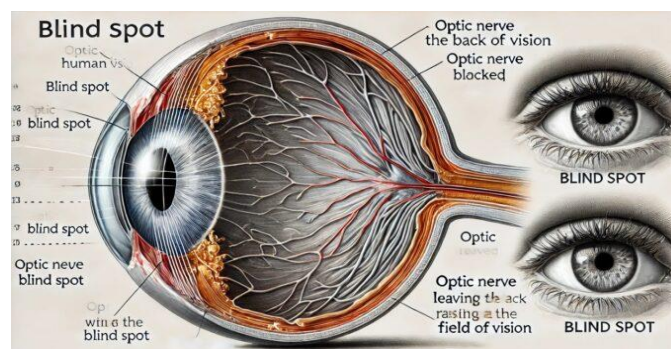


Figure 4. Blind Spot

In terms of avoiding the problem of disorders of the human visual sensory system, it can be done in several ways:

- The first refers to having an eye exam on how important it is to have a test once or twice a year on a regular basis, even if the symptoms are not available in the eye. It helps implement early detection of chronic asymptomatic diseases such as diabetic glaucoma and retinopathy.
- The second is device usage restrictions in terms of age restrictions that allow you to use the device and time limits based on age.
- The third step can also be the use of personal protective equipment against light loads, namely the glare of ultraviolet rays. Ultraviolet light can cause

pre-existing diseases such as pterygoids, cataracts, and age-related macular degeneration.

Anisometropia

Anisometropia is a visual disorder characterized by a difference in the refraction of the cylindrical or cylindrical lens between the right and left eyes of more than 1 diopter. The condition has a prevalence of 2-4% in the population and is often the cause of unilateral vision impairment in adults under 60 years of age. Early detection and treatment are essential to prevent serious complications such as Ambliopia, which can lead to permanent vision loss if not treated accurately. This article aims to discuss the etiology, classification, method of diagnosis, and execution of anisometropia based on the latest literature survey. Etiology and Anisometropia The classification of Anisometropia can be caused by both congenital and acquired factors. Congenital factors include abnormal eyeball axis growth (too long or short) and genetic factors. Meanwhile, factors include trauma, cataract surgery, or changes in lens strength due to aging.

Based on the cause, anisometropia is divided into:

- Axial anisometropia: due to the long-term difference in the axis of the eyeball between the right and left eyes.
- Refractive Anisometropia: Due to the difference in refractive strength between the two points.
- Based on the strength of refraction, anisometropia is classified into:
- Absolute Anisometropia: occurs when one of the points has a significant refractive force. It is further divided into:
 - Moderate: One eye is normal (emetropia), the other eye is myopic or hyperopia.
 - Compounds: both eyes myopic or hyperopia of different degrees.
 - Mixed: One point MIOPIA, the other hyperopia eye.
- Relative anisometropia: Occurs when both eyes have the same fire-resistant strength but different accounts of refreach, often accompanied by astigmatism. Symptoms of anisometropia are often indeterminate, especially in children.

Risk factors such as malnutrition, excessive use of electronic devices, and a lack of parental attention to a child's health can exacerbate this condition. 2.3 Complications and Conditions Anisometropia can cause Amblyopia, especially if the refractory difference exceeds 1-2 dioptries for hypermetropia or 3 diops for myopia. Amblyopia is a sharp drop of vision without structural abnormalities in the eye. Anisometropia is a vision disorder that requires early detection and treatment to prevent complications such as Ambliopia. The

classification of anisometropia is based on the cause and strength of refraction, with cycloplegic retinoscopy being the most widely reclaimed diagnostic method. Risk factors such as the use of electronic devices and the lack of parental attention should be reduced. Proprietary rights include refractive correction, therapy, or the use of atropine, which has been shown to be effective in preventing the condition.

The first step is to correct the difference between the eyes and glasses (or contact lenses in some cases). This may be all the brain needs to start using both eyes at the same time, but glasses/contacts should be worn as directed, usually throughout the day. If the vision in the "lazy" eye has not improved enough with glasses/contact alone, you need to force the brain to pay attention to the weak eye so that vision improves. This can be done by covering or patching stronger eyes, using drops to blur vision in stronger eyes, or by using filters over glasses (Helly, 2022). Children's glasses recipes do change as they grow, but the difference between the two eyes may still exist even as they get older. In general, treatments to improve the brain-eye connection work better if the child is treated at a younger age. Final vision largely depends on the age of the child when treatment begins, whether the treatment is carried out as recommended, and how the prescription of glasses changes over time. Some children may exceed their need for glasses/contacts, while many others will need glasses for life.

CONCLUSION

The study highlights the significant impact of sensory impairment, especially visual impairment, on an individual's quality of life. Through a comprehensive literature review, it identifies the main causes of visual dysfunction, including cataracts, glaucoma, and anisometropia, emphasizing its prevalence and the importance of early detection and intervention. Cataracts, as the leading cause of blindness globally, can be effectively managed through surgical procedures such as phacoemulsification, which not only restore vision but also stabilize intraocular pressure. Glaucoma, often asymptomatic in its early stages, requires timely treatment to prevent irreversible damage to the optic nerve. Anisometropia, which is characterized by a difference in bias between the eyes, underscores the need for early correction to avoid complications such as amblyopia.

The study also addresses the growing concern of digital device use, which contributes to visual impairment, especially among younger populations. Preventive measures, such as regular eye check-ups, controlled screen time, and protective glasses, are essential in reducing these risks. These findings

underscore the need for public awareness campaigns and accessible health services to effectively combat visual sensory disorders.

REFERENCES

- Dizayang, F., Bambang, H., & Purwoko, M. (2020). *Characteristics of Glaucoma Patients at Muhammadiyah Palembang Hospital for the period of January 2017-April 2018*. Journal of Health Sciences, 13(1), 66-73.
- Fahreiza, D., Himayani, R., & Sangging, P.A. (2023). *Anisometropia Vision Disorder*. Journal of Student Research (JSR), 1(3), 186-191.
- Hapsari, R. I., Prahasta, A., & Enus, S. (2013). *Reduction of intraocular pressure after cataract surgery in the corner group of closed and open front eye spaces*. Bandung Medical Magazine, 45(1), 56-61.
- Harianja, G. M., Fatmawati, N. K., & Sulistiawati. (2024). *Reduction of Intraocular Pressure After Cataract Surgery with Phacoemulsification Technique at SMEC Samarinda Eye Clinic*.
- Hello Healthy. "Anosmia Therapy." Hello Healthy, <https://hellosehat.com/tht/hidung/terapi-anosmia/>.
- Mulyani, E., Arti, F., & Septadina, I. S. (2024). *Causes of visual impairment and blindness in children*. Journal of Medicine and Health, 11(1), 39-47.
- Ministry of Health of the Republic of Indonesia. (2022, June 7). Cataract Disease is the Highest Cause of Blindness in Indonesia. Ministry of Health of the Republic of Indonesia. <https://www.kemkes.go.id/article/view/202206070001/penyakit-katarak-penyebab-kebutaan-tertinggi-di-indonesia.html>
- Praba, V.M., Primitasari, Y., Oerip, M.F., & Loebis, R. (2021). *Medical Therapy Selection for Glaucoma Patients at the Outpatient Eye Clinic of Soetomo General Academic Hospital Surabaya*. Folia Medica Indonesiana, 57(4), 324-333.
- Rayungshisa, A. (2018). *Characteristics of Primary Glaucoma at the Outpatient Clinic of RA Basocni Hospital, Mojokerto, Indonesia*. Folia Medica Indonesiana, 54(3), 172-178.
- Romadhani, A. S., Hidayah, A. A. N., Rayshabila, A., Wardhani, A. S., Wulandari, A., & Arini, L. D. (2025). *Sensory Systems in Humans: Interest Between Disorders in the Sensory System and Human Health*. Nian Tana Sikka: Student Scientific Journal, 3(2), 1-6.
- Siloam Hospital. (2023). What is glaucoma?. Siloam Hospital. <https://www.siloamhospitals.com/informasi-siloam/artikel/apa-itu-glaukoma>