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ANALYSIS OF THE DISTRIBUTION OF EYE DISEASES (A CASE STUDY OF GENERAL HOSPITAL, OBANGEDE, KOGI STATE, 2005 – 2014)

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ABSTRACT

This study is on analysis of the distribution of the occurrence of eye diseases (a case study of general hospital, Obangede, Kogi state: 2005 – 2014). The eye diseases examined are conjunctivitis, cataract, glaucoma, corneal injury and myopia. Analysis of variance (ANOVA) was used to test whether there exist significant differences in the distribution of the diseases due to the selected diseases and over the period examined. From the analysis, it was shown that there are no significant differences in the distribution of the diseases in respect to the selected diseases and over time. It can be observed from table 3 that the total number of reported cases of the occurrence of conjunctivitis is extremely high as compared to the other eye diseases. Thus, the government and other relevant stake holders should intensify efforts in putting in place necessary medical facilities to fight eye diseases, most especially conjunctivitis which have rendered many people unproductive by staying indoors.

Keywords: Distribution, Analysis, Variance, Diseases, Eye.

Introduction

Eye is the sense organ of sight. It is very similar in all human beings. The eyes of a man are situated on either side of the anterior portion of the head. Each eyeball is lodged in a shallow bony cavity in the skull called the eye socket or orbit. The wall of the eyeball is composed of three layers. These are the outer sclerotic layer, a middle choroids layer and an inner layer - the retina. The sclerotic layer is a whitish, tough, fibrous non elastic layer of connective tissue which protects the delicate inner structures of the eye. In front of the eyeball is the sclerotic layer known as the cornea. At the back of the eyeball, it is perforated by the optic nerve. The second layer, the choroids layer, is brownish in colour due to pigmentation, and has a rich supply of blood capillaries which provide nourishment to the cells of the eye. The third layer which is the inner most layer of the eyeball, the retina, is elastic vascularized, pigmented and sensitive to light. It acts as a screen which receives the image of object focused by lens. The retina does not line the entire inner surface

of the eye but thins off and terminates behind the ciliary muscles of the choroid layer. The retina is made up of sensory cells, the distribution of which is not uniform.

The common eye reported diseases of the eye clinic of the general hospital Obangede, Kogi State are: conjunctivitis, cataract, glaucoma, corneal injury and myopia (short sightedness) and this study will be centered on these five eye diseases that are particularly at high increasing wave in the area considered. The other diseases in their monthly or yearly statistical summary records are negligible.

Conjunctivitis is an infection of the conjunctiva (the front skin of the eye). It is a very common disease usually caused by virus, bacteria and other micro organisms. It is the inflammation of the conjunctiva of the eye. One or both eyes become red or pink; they may be sticky or watery and may have surface irritation. Most cases clear in a few days without any treatment. Conjunctivitis can be prevented by isolation of infected patients. **Cataract** is the opacity of the lens of the eye. That is when the lens developed cloudy area in one or both lens. It causes partial or complete blindness and it can be corrected by surgical means. **Glaucoma** is the high intraocular pressure. When the optic nerve is functionless, it results to slight loss of vision or absolute blindness. It is idiopathic (unknown cause). **Corneal injury** occurs when the cornea of the eye has either blunt or penetrating injury. This eye problem is peculiar to the farmers, welders etc. Also it can be caused by severe slap on the eye. **Myopia**, also known as short sightedness, is the inability to see far objects. It can be caused by hereditary or long eyeball and it can be corrected with concave glasses or lens. The **hypermetropia**, which is also known as long sightedness, is a condition whereby an individual can see object that are far off clearly but cannot see near objects. The reason is because the eyeball is too short of the lens too flat. As a result, the images are brought to focus behind the retina. This can be corrected by convex glass or lens. This research is based on the reported cases of eye diseases of the eye clinic, General Hospital Obangede, Kogi State - 2005 to 2014.

Statement of the Problem

The provision of good health base on eye diseases has been one of the problems faced by the people of the rural areas of the Local Government (Okehi local Government Area) and the State in general. Although this study may not provide the exact or accurate account of the phenomenon due to less manpower and inadequate facilities, the importance of the study cannot be over emphasized. It is worth noting that it may not be all the eye patients in the Local Government Area that attends the eye clinic in General Hospital Obangede. Probably, some eye patients prefer road side dispensary or chemist to government owned eye clinic while other privileged ones travel outside the country for best treatments.

This study is aimed at testing whether there exist significant differences in the distribution of the diseases due to the selected diseases and over the period examined. The Analysis of Variance shall be used for the analysis. Although the study is centered on the analysis of the distribution of the occurrence of the selected eye diseases, there is the need to have basic understandings on them.

Review of Literatures

Eye diseases are common among people of all ages ranging from children to adults. Eye diseases can be defined as an impairment or abnormal functioning of the eye which leads to visual disturbance. Eyes are the organ of vision. They detect light and convert it into electro-chemical impulses in neurons in higher organisms. The eye is a complex optical system which collects light

from the surrounding environment, regulates its intensity through a diaphragm, and focuses it through an adjustable assembly of lenses to form an image. Common eye problems or diseases are Conjunctivitis, Cataract, Glaucoma, Corneal Injury and Myopia.

CONJUNCTIVITIS – also called pink eye is an inflammation of the thin, clear covering of the white of the eye (conjunctiva). Although the conjunctiva is transparent, it contains blood vessels that overlay the sclera of the eye. Anything that triggers inflammation will cause these conjunctival blood vessels to dilate. This is what causes red, bloodshot eyes. It can have several causes but many doctors use the term "pink eye" to refer only to viral conjunctivitis, a highly contagious infection caused by a variety of viruses (www.allaboutvision.com/conditions/ conjunctivitis.htm).

Causes

The primary types of conjunctivitis, based on causes are:

i. Viral conjunctivitis: This is caused by a virus, like the common cold. This is very contagious but usually will clear up on its own within several days without medical treatment.
ii. Bacterial conjunctivitis: This is caused by bacteria and can cause serious damage to the eye.
iii. Allergic conjunctivitis: This is caused by eye irritants such as pollen, dust and animal dander among susceptible individuals. Allergic conjunctivitis may be seasonal (pollen) or flare up year – round (dust, pet dander).

Others include Gonococcal and Chlamydial conjunctivitis, Neonatal conjunctivitis, Giant papillary conjunctivitis, Non infectious conjunctivitis. According to National health and Medical Research Council (NHRC, 2014), the disease is caused by the bacterium Chlamydia trachomatis and leads to repeated conjunctivitis and a mucous discharge. The eye is also irritated and the cornea can be damaged by: a reduction in amount of tears produced, difficulty in closing the eyelids (which lubricates the eye and help flush dust and dirt), the triggering of trichiasis, where the eye lid and eye lashes turn in on the eye.

Prevention

There are preventive measures or precautions that can significantly help to reduce the risk of getting conjunctivitis. Some of them are:

i. Never share personal items such as washcloths, hand towels or tissues.
ii. Cover your nose and mouth when coughing or sneezing, and avoid rubbing or touching your eyes.
iii. Never (ever) share your colour contact lenses or special effects contacts with friends
iv. Wash your hands frequently, especially when spending time at school or in other public places.
v. Keep a hand disinfectant (e.g. purell) handy and use it frequently.
vi. Frequently clean surfaces such as countertops, bathroom vanities, faucet handles and shared phones with an appropriate antiseptic cleaner.
vii. If you know you suffer from seasonal allergies, ask your doctor what can be done to minimize your symptoms before they begin.

viii. If you wear contacts, be sure to follow your eye doctor's instruction for lens care and replacement, and use contact lens solutions properly or consider switching to daily disposable contacts.
ix. When swimming, wear swim goggles to protect yourself from bacteria and other microorganisms in the water that can cause conjunctivitis.
x. Before showering, using a hot tub or being in water of any kind, remove your contact lenses to avoid trapping bacteria between your eye and the lenses (www.allaboutvision.com/ conditions/conjunctivitis.htm).

CATARACT is a clouding of the lens in the eye that affects vision. Most cataracts are related to aging. By age 80, more than half of all Americans either have a cataracts or have had cataract surgery. It can occur in either or both eyes. It cannot spread from one eye to the other. (https://nei.nih.gov/health/cataract/cataract_facts). It begins when proteins in the eye form clumps that prevent the lens from sending clear images to the retina. It develops slowly and eventually interferes with your vision. You might end up with cataract in both eyes but they usually don't form at the same time (www.healthline.com/health/cataract).

The lens is a clear part of the eye that helps to focus light, or an image on the retina. The retina is the light – sensitive tissue at the back of the eye. In a normal eye, light passes through the transparent lens to the retina. Once it reaches the retina, light is changed into nerve signals that are sent to the brain. The lens must be clear for the retina to receive a sharp image. If the lens is cloudy from a cataract, the image you see will be blurred (https://nei.nih.gov/health/cataract/cataract_facts).

Causes

They are different types of cataracts, classified based on where and how they develop in the eye. These are:
i. Nuclear cataracts formed in the middle of the lens and cause the nucleus or center to become yellow or brown.
ii. Cortical cataracts are wedge – shaped and form around the edges of the nucleus.
iii. Posterior capsular cataracts form faster than the other two types and affects the back of the lens
iv. Congenital cataracts, which are present at birth or form during a baby's first year, are less common than the age – related cataracts.
v. Secondary cataracts are caused by disease or medications. Diseases that are linked with the development of cataracts include glaucoma and diabetes. The use of the steroid prednisone and other medications can sometimes lead to cataracts.
v. Traumatic cataracts develop after an injury to the eye, but it can take several years for this to happen.
vi. Radiation cataracts can form after a person undergoes radiation treatment for cancer (www.healthline.com/health/cataract).

Prevention

To reduce the risk of developing cataracts, below are some preventive measures:
i. Protect your eyes from UVB rays by wearing sunglasses outside
ii. Have regular eye examinations.

iii. Stop smoking
iv. Eat fruits and vegetables that contain antioxidants.
v. maintain a healthy weight
vi. Keep diabetes and other medical conditions in check (www.healthline.com/health/cataract).

According to NHMRC (2012), though there is significant controversy about whether cataracts can be prevented, a number of studies suggest certain nutrients and nutritional supplements may reduce the risk of cataracts.

GLAUCOMA is a group of diseases that damage the eye's optic nerve and can result in vision loss and blindness. However, with early detection and treatment, you can often protect your eyes against serious vision loss (https://nei.nih.gov/health/glaucoma/glaucoma_facts). It is a condition that causes damage to the eye's optic nerve and gets worse over time. It is often associated with a buildup of pressure inside the eye. The increased pressure is called intraocular pressure. It tends to be inherited and may not show up until later in life. An untreated glaucoma can cause total permanent blindness within a few years (www.webmd.com/eye-health/glaucoma-eyes). The optic nerve is a bundle of more than one million nerve fibers that connects the retina to the brain. The retina is the light sensitive tissue at the back of the eye. A healthy optic nerve is necessary for good vision (https://nei.nih.gov/health/glaucoma/glaucoma_facts).

According to the National health and Medical Research Council (NHMRC 2012), myopia occurs when image are formed in front of the retina because the eye is relatively too long or the refractive powers of the cornea and lens of the eye are relatively too strong. The result is a blurred image. Myopia or nearsightedness is not inherited but is caused by excessive reading and other close work. After doing prolonged close work, the focusing muscle inside the eye locks up into a state of near focus. Over time, this leads to permanent nearsightedness, an abnormal lengthening of the eye.

Causes

Glaucoma usually occurs when pressure in your eye increases. This can happen when eye fluid isn't circulating normally in the front part of the eye. Normally, this fluid, called aqueous humor, flows out of the eye through a mesh – like channel. If this channel becomes blocked, fluid builds up, causing glaucoma. The direct cause of this blockage is unknown, but doctors do know that it can be inherited, meaning it is passed from parents to children.

Less common causes of glaucoma include a blunt or chemical injury to the eye, severe eye infection, blockage of blood vessels in the eye, inflammatory conditions of the eye, and occasionally eye surgery to correct another condition. Glaucoma usually occurs in both eye, but it may involve each eye to a different extent (www.webmd.com/eye-health/glaucoma-eyes). It is often called the "silent thief of sight", because most types typically cause no pain and produce no symptoms until noticeable vision loss occurs (www.allaboutvision.com/conditions/glaucoma.htm).

There are two major categories of glaucoma. These are:

i. Open-angle glaucoma (OAG) and

ii. Narrow - angle glaucoma (NAG).

The "angle" in both cases refers to the drainage angle inside the eye that controls the outflow of the watery fluid (aqueous) that is continually being produced inside the eye. If the aqueous can access the drainage angle, the glaucoma is known as open angle glaucoma. If the drainage angle is blocked and the aqueous cannot reach it, the glaucoma is known as narrow angle glaucoma.

Variations of OAG include: primary open angle glaucoma (POAG), normal-tension glaucoma (NTG), pigmentary glaucoma, pseudoexfoliation glaucoma, secondary glaucoma congenital glaucoma. Variations of narrow angle glaucoma include: acute angle closure glaucoma, chronic angle closure glaucoma and neovascular glaucoma (www.allaboutvision.com/conditions/ glaucoma.htm).

Prevention

Higher levels of physical exercise appear to provide a long term benefit of reducing the incidence of low ocular perfusion pressure (OPP), an important risk factor for glaucoma.OPP is mathematical value that is calculated using a person's intraocular pressure and his or her blood pressure. Thus, maintaining an active life style appears to be an effective way for people to reduce their risk of glaucoma and may and many other serious health problems. In addition to regular exercise and n active lifestyle, you also can reduce your risk for glaucoma by not smoking, maintaining a healthy weight, and eating a varied and health diet

CORNEAL INJURY OR ABRASION is a defect in the surface of the cornea that is limited to the most superficial layer, the epithelium, and does not penetrate the Bowman membrane. In some cases, the bulber conjunctive is also involved. Severe corneal injuries can also involve the deeper, thicker stromal layer, in this situation, the term corneal ulcer may be used. It is probably the most common eye disease and perhaps one of the most neglected. It occurs because of a disruption in the integrity of the corneal epithelium or because the corneal surface scratched or scraped away as a result of physical external forces. Corneal epithelial abrasion can be small or large. Corneal abrasions usually heal rapidly. Consequently, they are often considered of little consequence. However, deep corneal involvement may result in facet formation in the epithelium or scar formation in the stroma (emedicine.medscape.com/article/1195402-overview).

The cornea is a transparent cover over the anterior part of the eye that serves several purposes: protection, refraction and filtration of some ultraviolent light. It has no blood vessels and receives nutrients through tears as well as from the aqueous humor. It is innervated primarily by the ophthalmic division of the trigeminal nerve as well as the oculomotor nerve. It is composed of five layers. These are corneal epithelium, Bowman layer, corneal stroma, Descemet membrane and corneal endothelium (emedicine.medscape.com/article/1195402-overview).

Causes

Small children are common source of corneal injuries because they can accidentally poke the eyes of whoever is holding them. In some cases, the immediate cause of a corneal abrasion may not be apparent, as symptoms may occur hours after the injury to the cornea. Some of the causes of corneal injuries are:

i. Something hitting or blowing into the eye, such as plant matter, sawdust, or ash.
ii. Foreign matter such as dust, dirt or sand getting stuck under the eyelid.
iii. Sport injuries

iv. Improperly fitted or maintained contact lenses
v. Something poking you in the eye
vi. Rubbing your eyes vigorously especially if you feel something is caught in your eye.
vii. Certain eye conditions including trachoma, a bacterial infection
viii. Undergoing surgery under general anesthesia (www.aao.org/eye-health/tips-prevention/corneal-abrasion-cause)

The causes of abrasions: includes scratches or scrapes on the surface of the cornea; chemical injuries caused by almost any fluid that gets into the eye, contact lens problems, over use of poor fit, or sensitivity to contact lens, foreign bodies, exposure to something such as sand or dust, ultra violet injuries caused by sunlight, sun lamps, snow or water reflections or arc welding. NHMRC (2012).

Prevention

Some of the means by which corneal injury can be prevented includes:
i Wear protective eye goggles when you are around machinery that causes particles of wood, metal or other materials to fly into the air.
ii. Keep your fingernails trimmed short. Cut infants' and young children's fingernails short.
iii. Trim low-hanging tree branches.
iv. Use care when putting in contact lenses and make sure you clean them properly each day.
v. Don't sleep in your contact lenses (familydoctor.org/familydoctor/en/prevention-wellness /staying-healthy/first-aid/corneal-abrasions.html)

MYOPIA, also known as nearsightedness or shortsightedness is a common type of refractive error where close objects appear clearly, but distant objects appear blurry. This occurs when the eyeball becomes too long and prevents incoming light from focusing directly on the retina. It may also be caused by an abnormal shape of the cornea or lens. It's easily treatable with contact lenses as well as eye glasses and it's not strictly hereditary. High myopia is a severe form of the condition. In high myopia, the eyeball stretches and becomes too long. This can lead to holes or tears in the retina and can also cause retinal detachment. Abnormal blood vessels may grow under the retina and cause changes in vision. People with high myopia need comprehensive dilated eye exams more than often. Early detection and timely treatment can help prevent loss of vision. In refractive errors, the shape of the eye prevents light from focusing on the retina. The length of the eyeball (longer or shorter), changes in the shape of the cornea, or aging of the lenses can cause refractive errors. (https://nei.nih.gov/health/errorr/myopia).

Causes

Myopia occurs when the eyeball is too long, relative to the focusing power of the cornea and lens of the eye. This cause light rays to focus at a point in front of the retina rather than directly on its surface. It also can be caused by the cornea and /or lens being too curved for the length of the eyeball. In some cases, myopia is due to a combination of these factors. It typically begins in childhood and one may have higher risk if parents are nearsighted. In most cases, it stabilizes in early adulthood but sometimes it continues to progress with age (www.allaboutvisio.com/conditions/ myopia.htm). It is not inherited but is caused by excessive reading and other close works like the use of computer. After doing prolonged close work, the

focusing muscles inside the eye locks up into a state of near focus. Over time, this leads to permanent nearsightedness, an abnormal lengthening of the eye (www.myopia.org/)

Prevention

The National Institutes of Health says there is no known way of preventing myopia, and the use of glasses or contact lenses does not affect its progression. There is no universally accepted method of preventing myopia; proposed procedures have not been studied for effectiveness. Various methods have been employed in an attempt to decrease it's progression, although studies show mixed results. (https://en.m.wikipedia.org/wiki/myopia). However, some means by which myopia can be prevented or slowed down includes:

i. Get outside at least 12 hours a week. Outdoor time is one of the ways to prevent myopia.
ii. Minimize the amount of processed sugar in the diet. It's recommended to consume less than eight teaspoons of sugar a day.
iii. Apply the 20/20 rule. For every twenty minutes you read or stare at a computer/Smartphone, take a 20 seconds break and look at the window or at something 20 feet away. The eyes need to focus and work harder while doing near work and they relax when viewing in the distance. Another theory of myopic progression is that the eyes become nearsighted due to excessive near work. Thus, whenever close work is done without the protection of reading glasses, it is important to hold the work as far away as possible and use as much light as possible in order to reduce the size of the pupil and consequently the accommodation.
iv. Wear up –to –date glasses. When under corrected (i.e. old prescription or not wearing glasses), the eyes get worse at a faster rate of nearsightedness. The use of reading glasses when doing close work may provide success by reducing or eliminating the need to accommodate. (www.naturaleyesofweston.com/myopiacontrol.cfm)

Methodology

The method of analysis to be used for this research work is the Analysis of Variance. The two forms of Analysis of variance are the Complete Randomized Design (CRD) and the Complete Randomized Block Design (CRBD). For the purpose of this work however, the Complete Randomized Block Design (CRBD) shall be applied.

Complete Randomized Block Design (CRBD)

In many experimental problems, it is necessary to design the experiment so that variability arising from extraneous sources can be systematically controlled. Experiments are carried out by investigator in all fields of study either to discover something about a particular process or to test the effects of several factors on some phenomena. Design of experiment can be referred to as the process of planning the experiment so that appropriate data will be collected, which may be analyzed by statistical methods resulting in valid and objectives conclusions. The complete randomized block design utilized experimental units that are matched sets assigning one from each set to each treatment. The matched sets of experimental unit are called blocks. The concept of the randomized complete block design is that the sampling variability of the experimental units in each block will be reduced in turn reducing the Measure of Error.

The Design Layout

Suppose we have several treatments to be compared as well as several blocks, the complete randomized block design (CRBD) layout is as shown in the table below:

Table 1: The Design Layout For The Complete Randomized Block Design (CRBD)

	BLOCKS					
TREATMENTS	**Block 1**	**Block 2**	**. . . . .**	**J**	**. . . . . .**	**Block n**
Treatment 1	y_{11}	y_{12}	. . . . .	y_{1j}	. . . . .	y_{1n}
Treatment 2	y_{21}	y_{22}	. . . . .	y_{2j}	. . . . .	y_{2n}
.	.	.	. . . . .	.	. . . . .	.
.	.	.	.	.	.	.
Treatment i	y_{i1}	y_{i2}	.	y_{ij}	.	y_{in}
.	.	.	. . . . .	.	. . . . .	.
.	.	.	. . . . .	.	. . . . .	.
Treatment p	y_{p1}	y_{p2}	. . . . .	y_{pj}	. . . . .	y_{pn}

There is only one observation per cell and each observation is determined randomly where treatments and blocks are considered as fixed factors. The statistical linear model for this design is:
$Y_{ij} = \mu + \alpha_i + \beta_j + e_{ij}$, For i =1, 2, 3 . . . . . , p and j = 1, 2, 3 . . . . . , n; where:
μ is the overall mean
α_i is the effect of the i^{th} treatment
β_j is the effect of the j^{th} block
e_{ij} is the error associated with y_{ij} (the random error term)
The treatments and blocks effects are defined as deviation from the overall mean so that:
$\sum \alpha_i = 0$ and $\sum \beta_j = 0$
In this research work, the years shall be considered as our treatments while the different types of eye diseases shall be the blocks. A total of ten years and five different types of eye diseases shall be considered.

Sum of Square Identities

Let $T_{i.}$ = the total of all observation taken under treatment i, T.j= the total of all observation in block j, $T_{..}$ = the grand total of all observations and np = the total number of observations.
The sum of square identities are given as:

Total Sum of Squares (SST) = $\sum\sum (y_{ij} - \bar{y}_{..})^2 = \sum\sum y_{ij}^2 - T^2_{..}/pn$; where $T^2_{..}/pn$ is the correction factor.

Treatment Sum of Squares (SS_{Treat}) = $n\sum (\bar{y}_{i.} - \bar{y}_{..})^2 = (1/n)\sum T_{i.} - T^2_{..}/pn$

Block Sum of Squares (SS_{block}) = $p\sum (\bar{y}_{.j} - \bar{y}_{..})^2 = (1/p)\sum T_{.j} - T^2_{..}/pn$

Error Sum of Squares (SS_{error}) = $\sum\sum (y_{ij} - \bar{y}_{i.} - \bar{y}_{.j} + \bar{y}_{..})^2$

Expressing the sums of square symbolically, we have
$SST = SS_{treat} + SS_{block} + SS_{error;}$ so that: $SS_{error} = SST - SS_{treat} - SS_{block}$

Hypothesis Testing

Since we are interested in testing whether there exist significant differences in the distribution of eye diseases due to the selected diseases and over time, the appropriate test of hypotheses are:

For Treatments (years)

$H_{o(1)}$: $\alpha_1 = \alpha_2 = ... = \alpha_{10}$ (i.e. the distribution over the years are the same) vs
$H_{1(1)}$: at least two of the α_{is} are not equal (i.e. the distribution over the years are not the same)

For Blocks (selected eye diseases)

$H_{o(2)}$: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$ (i.e. the distribution of the selected eye diseases are the same) vs
$H_{1(2)}$: at least two of the β_{js} are not equal (i.e. the distribution of the selected eye diseases are not the same)

Decision rule

We reject H_o if the $F_{cal} > F_{tab}$ and conclude, otherwise, we do not reject;
Where $F_{1cal} = MS_{treat} / MS_{error}$, $F_{2cal} = MS_{block} / MS_{error}$, $F_{1tab} = F_{(p-1),(p-1)(n-1)}(\alpha)$, and $F_{2tab} = F_{(n-1),(p-1)(n-1)}(\alpha)$, at α% level of significance.

Analysis of Variance Table (ANOVA Table)

The necessary details of all the analysis of the design are usually presented in the Analysis of Variance (ANOVA) Table. The layout is as presented in the table below:

Table 2: Analysis Of Variance Table (ANOVA Table)

SOV	**DF**	**SS**	**MS**	$\mathbf{F_{cal}}$	$\mathbf{F_{tab}}$
Years	p-1	SS_{treat}	MS_{treat} = SStreat / p-1	$\mathbf{F_{1cal}}$	F_{1tab}
Eye Diseases	n-1	SS_{block}	$MS_{block} = SS_{block} / n-1$	$\mathbf{F_{2cal}}$	F_{2tab}
Error	(p-1)(n-1)	SS_{error}	$MS_{error} = SS_{error} /(p-1)(n-1)$	-	-
Total	pn-1	SST	-	-	-

Where:
SOV implies source of variation, DF implies degrees of freedom, SS implies sum of squares and MS implies mean squares.

Data Presentation

The data collected on the reported cases of eye diseases from the eye clinic, General Hospital Obangede, Kogi State - 2005 to 2014 is presented in table 3

Table 3: In-Patients/Out-Patients cases of yearly returns on eye diseases at the General Hospital Obangede, Okehi Local Government Area, Kogi State

YEAR	CONJUNCTIVITIS	CATARACT	GLAUCOMA	CORNEAL INJURY	MYOPIA	TOTAL
2005	150	77	78	43	28	376
2006	174	50	113	32	42	411
2007	139	45	68	19	35	306
2008	137	74	47	15	46	319
2009	142	53	45	35	51	326
2010	192	88	32	36	31	379
2011	232	60	50	34	21	397
2012	192	49	93	27	61	422
2013	167	38	36	45	46	332
2014	128	71	82	25	59	365
TOTAL	**1,653**	**605**	**644**	**311**	**420**	**3,633**

Analysis

From the tabulated data in table 3, we have:

$SST = \sum\sum y_{ij}^2 - T^2_{..} / pn = 399453 - 263973.78 = 135479.22$

$SS_{trt} = (1/n)\sum T_{i.} - T^2_{..} / pn = 266950 - 263973.78 = 2976.82$

$SS_{blk} = (1/p)\sum T_{.j} - T^2_{..} / pn = 378629.1 - 263973.78 = 114655.32$

So that:

$SSerror = SST - SS_{trt} - SS_{blk} = 135479.22 - 2976.82 - 114655.32 = 17847.08$

From the results of the analysis, we have the ANOVA Table:

Table 4: Analysis of Variance (ANOVA) Table

SOV	DF	SS	MS	F_{cal}
Year (trt)	9	2976.82	330.76	0.6672
Diseases (blk)	4	114655.32	28663.83	57.819
Error	36	17847.08	4955.75	-
Total	49	135479.22	-	-

Critical values

Using 0.05 level of significance (α), we have

$F_{1tab} = F_{9, 36}(0.05) = 2.12$ while

$F_{2tab} = F_{4, 36}(0.05) = 2.61$

Decision

For the treatments (years), since $F_{cal} = 0.6672 < F_{tab} = 2.12$, we accept the null hypothesis H_0 and thus conclude that the distribution of the eye diseases over the years are the same. Also, for the blocks (the selected diseases), since $F_{cal} = 57.819 > F_{tab} = 2.61$, we reject the null hypothesis $H_{0,}$ and thus conclude that the distribution of the selected eye diseases are not the same. This implies that there exist significant differences in the occurrences of the eye diseases under consideration.

Conclusion

From the results of the analysis and decisions, we conclude that there is no significant difference in the distribution of the occurrences of the diseases over time. However, there exist significant differences in the distribution of the occurrences of the selected eye diseases. It can be observed from table 3 that the total number of reported cases of the occurrence of conjunctivitis is extremely high as compared to the other eye diseases. Thus, the government and other relevant stake holders should intensify efforts in putting in place necessary medical facilities to fight eye diseases, most especially conjunctivitis.

References

emedicine.medscape.com/article/1195402-overview
familydoctor.org/familydoctor/en/prevention-wellness/staying-healthy/first-aid/corneal-abrasions.html
National Health and Medical Research Council, 2012, 2014
https://www.allaboutvision.com
https://www.nhmrc.gov.au
https://www.omicsonline.org
https://nei.nih.gov/health/cataract/cataract_facts
https://nei.nih.gov/health/glaucoma/glaucoma_facts
https://nei.nih.gov/health/errorr/myopia
https://en.m.wikipedia.org/wiki/myopia
www.aao.org/eye-health/tips-prevention/corneal-abrasion-cause
www.allaboutvision.com/conditions/ conjunctivitis.htm
www.allaboutvision.com/conditions/ glaucoma.htm
www.allaboutvisio.com/conditions/ myopia.htm
www.healthline.com/health/cataract
www.myopia.org/
www.webmd.com/eye-health/glaucoma-eyes
www.webmd.com/eye-health/glaucoma-eyes
www.naturaleyesofweston.com/myopiacontrol.cfm