

# Pattern of Manifest Strabismus in Children Seen in a Tertiary Hospital in Rivers State, Nigeria

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**Abstract:** *Objectives:* Manifest strabismus in children is a major cause of suboptimum visual experience with attendant impact on their development. This study aims to determine the pattern of manifest strabismus among children attending the Paediatric Ophthalmology clinic of the University of Port Harcourt Teaching Hospital, Rivers State. *Materials and method:* One hundred and twenty-five (125) children, aged 6 months to 18 years with manifest strabismus were consecutively selected and examined out of one thousand eight hundred and ninety-seven (1897) children seen at the Paediatric ophthalmology clinic of the University of Port Harcourt Teaching Hospital over a period of 18 months. Severely ill children with manifest strabismus, children with phoria, pseudo-strabismus and microtropia were excluded. *Results:* There were sixty-nine females (55.2%) and 56 males (44.8%). The male to female ratio was 1: 1.2. The prevalence of manifest strabismus was 6.6%. Eighty-two (4.3%) children had esotropia, 38 (2.0%) had exotropia while 5 (0.27%) had vertical deviation. Infantile (congenital) esotropia 34 (27.2%) was the most common type of esotropia observed, followed by accommodative esotropia 13 (10.4%), while infantile (congenital) exotropia 19 (15.2%) was the predominant type of exotropia. *Conclusion:* The prevalence of Manifest strabismus among children attending the Paediatric Ophthalmology clinic is high. Esotropia was the commonest form of Manifest strabismus seen.

**Keywords:** Strabismus, Children, Prevalence, Pattern

## 1. Introduction

Strabismus is a relatively common condition worldwide especially among newborns [1] with a prevalence of 1.3% - 5.7% in all children [2]. It affects 3-5% of the population worldwide [3] with an increased prevalence associated with assisted delivery, low birth weight, prematurity, and associated neuro-developmental disorders [1]. Asian population reveals a lower prevalence of 0.7-1.9% [4, 5]. About 3-4% of Caucasian children have also been reported to be affected by strabismus [6]. The prevalence in Africa is generally low compared to Caucasians and Asians as seen in various studies [7, 8]. In Nigeria, the prevalence of strabismus is between 0.01-2.4% in

different populations [8-15].

Strabismus is commonly seen in children with a positive family history, [16, 17] history of maternal cigarette smoking during pregnancy, [18] low birth weight, [19] prematurity and those who have developmental ocular abnormalities such as craniofacial abnormalities (e.g., Crouzon Syndrome), [20] and ocular abnormalities such as cataract, [21] retinoblastoma, [22] retinopathy of prematurity [23] and refractive error [24]. A study done in Ilorin showed that hypermetropia was most found among children with esotropia and myopia among children with exotropia [24, 25] therefore refractive error is a particularly important risk factor.

Other risk factors include systemic disorders such as meningitis, [26] encephalitis, [27] neonatal jaundice and cerebral palsy, [28-30] Strabismus is also seen in children with congenital abnormalities e.g., Down syndrome [31] and fetal alcohol syndrome [32, 33] Assisted delivery and caesarean section have also been implicated in children with strabismus [34] In such children higher level of surveillance is recommended.

Therefore, this study sought to describe the pattern of manifest strabismus in children seen in a tertiary hospital in Rivers State, South-south Nigeria.

## 2. Materials and Method

It was a hospital-based descriptive cross-sectional study conducted over a period of eighteen months. A total of 125 consecutive children with manifest strabismus out of 1897 children aged 6 months to 18 years seen at the Paediatric Ophthalmology clinic of the University of Port Harcourt Teaching Hospital, Port Harcourt were recruited into the study. The study was done in compliance with the tenets of the Helsinki declaration involving human subjects. Appropriate ethical clearance was taken from the Institution Ethical Committee (UPTH/ADM/90/SH/VOL.XI/4) issued on the 27<sup>th</sup> May 2016 and informed consent taken from the parents of the children. Inclusion criteria include children older than six months and younger than eighteen years. Exclusion criteria include children with pseudo-strabismus, phoria and microtropia.

A self-designed interviewer-administered questionnaire was administered in the clinic to the assenting patients whose parent/guardian has given consent. Relevant information on socio-demographic characteristics such as birth history, age at onset of squint, history of previous trauma, previous eye surgery and family history of squint were obtained from either parent/guardian via interviews.

Visual acuity (VA) was tested in preverbal children (0-2 yrs)

using preferential looking methods, whether the child was able to maintain central steady and Maintained fixation or fix and follow bright light or bright coloured toy. While in verbal children (>2 yrs), visual acuity was done with either Kay's pictures test) or Snellen acuity chart. If the visual acuity was worse than 6/12 pin-hole testing will be done for subjects.

To evaluate the squint, Hirschberg test were carried out after which alternate prism cover testing was done for both near (33 cm) and distant (6 m) object. When the visual acuity was too low in one or both eyes and the patient was not cooperative, modified krimsky testing was done.

Anterior segment examination was done with a bright pen torch and slit lamp (Keeler SL - 16) to assess the eyelids, size of the globe and extraocular muscles motility, conjunctiva, and pupils. Dilated funduscopy was done for all children using a binocular indirect ophthalmoscope (Keeler, Model number 1945-P-1001) and 20D lens (Volks lens) to assess the macula, optic disc, and peripheral retina for any pathology such as retinoblastoma, glaucoma, optic disc coloboma, toxoplasmosis etc.

All data generated was entered into an excel sheet and were analyzed using the Statistical Package for Social Sciences (IBM-SPSS) version 23. Test for statistical significance were done with Chi-square analysis and fisher's exact test "as appropriate" confidence interval was determined at the 95% level and p-value of less than 0.05 was considered statistically significant.

## 3. Results

One thousand eight hundred and ninety-seven children were seen in the paediatric ophthalmology clinic during the study period (October 2016 to March 2018) out of which one hundred and twenty-five (6.6%) children had manifest strabismus. Sixty-nine were females (55.2%) while 56 were males (44.8%). Male to female ratio was 1: 1.2. The age and sex distribution are shown in table 1.

**Table 1.** Age and sex distribution of study population.

Sex			
Age Range (yrs.)	Male n (%)	Female n (%)	Total n (%)
<1 year	6 (10.7)	11 (15.9)	17 (13.6)
1 – 3 years	15 (26.8)	22 (31.9)	37 (29.6)
4 – 6 years	14 (25.0)	13 (18.8)	27 (21.6)
7 – 9 years	9 (16.1)	12 (17.4)	21 (16.8)
10 – 12 years	4 (7.1)	7 (10.1)	11 (8.8)
13 – 15 years	5 (8.9)	2 (2.9)	7 (5.6)
16 – 18 years	3 (5.4)	2 (2.9)	5 (4.0)
Total	56 (44.8)	69 (55.2)	125 (100.0)

Fisher's exact test = 4.235; p-value = 0.661.

The age and gender distribution of the study population is shown in Table 1. The age of the subjects ranged between six months and eighteen years with a mean age of  $5.53 \pm 4.42$  years. The age range of 1-3 years had the highest proportion 37 (29.6%) while those 16-18 years had the least representation 5 (4.0%). The differences in the

proportion of manifest strabismus of the age categories between the males and females were not statistically significant ( $p = 0.661$ ).

Esotropia had a prevalence of 4.3%, 38 (2.0%) subjects had exotropia while that for vertical deviation was 0.27%. The overall prevalence for heterotropia was 6.6%. Table 2.

**Table 2.** Prevalence and gender distribution of types of manifest strabismus.

Type of strabismus	Males	Females	M: F	Total	Prevalence (95% CI)
Horizontal					
Esotropia	39	43	1: 1.1	82	4.32% (3.48% - 5.31%)
Exotropia	15	23	1: 1.5	38	2.00% (1.49% - 2.77%)
Vertical					
Hypertropia	0	3	0: 3	3	0.16% (0.04% - 0.43%)
Hypotropia	2	0	2: 0	2	0.11% (0.02% - 0.35%)
Total	56	69	1: 1.2	125	6.59% (5.54%-7.78%)

M: F – Male to Female ratio, CI – Confidence Interval.

**Table 3.** Pattern of strabismus based on aetiology.

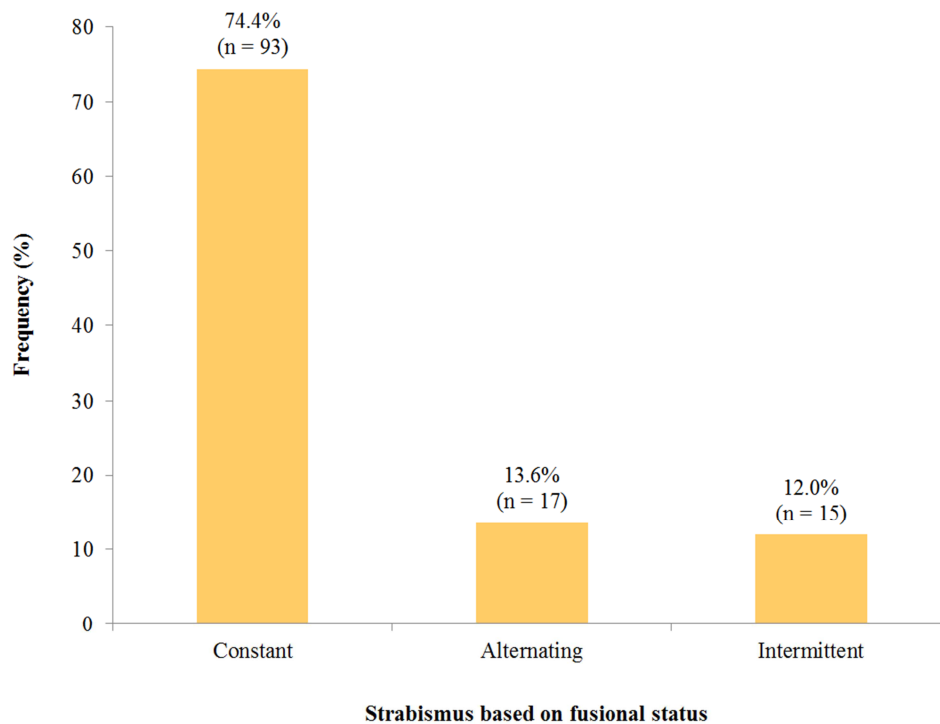
Type of strabismus (N=125)	N	%
Esotropia		
Congenital	34	27.2
Accommodative		
Refractive	13	10.4
High accommodative convergence/accommodation ratio	6	4.8
Non Accommodative		
Sensory	11	8.8
Basic	7	5.6
Paralytic	11	8.8
Total	82	65.6
Exotropia		
Congenital	19	15.2
Basic	7	5.6
Divergence excess	3	2.4
Convergence insufficiency	5	4.0
Sensory	4	3.2
Total	38	30.4
Hypertropia		
Inferior oblique muscle overaction	3	2.4
Hypotropia		
Superior oblique muscle overaction	2	1.6
TOTAL	5	4.0

Table 3 illustrates the aetiology of manifest strabismus studied. Esotropia was the predominant type of horizontal strabismus and accounted for 82 (65.6%) of the subjects' population.

Congenital esotropia was the commonest esotropia accounting for 34 (27.2%) while paralytic esotropia was least prevalent. Exotropia was observed in 38 (30.4%) children with congenital exotropia accounting for 19 (15.2%) being the most prevalent exotropia. Hypertropia from inferior oblique overaction and hypotropia from superior oblique overaction were seen in 3 (2.4%) and 2 (1.6%) respectively.

The fifteen (12.0%) cases of sensory esotropia and exotropia resulted from visually significant cataract in 10 (66.7%) children, oculocutaneous albinism 3 (20%) and congenital glaucoma 2 (13.3%).

Majority, 93 (74.4%), of the children examined in this study presented with constant strabismus, 17 (13.6%) of them presented with intermittent strabismus while alternating strabismus was found in 15 (12.0%) respectively, as shown in figure 1 below.

**Figure 1.** Pattern of strabismus based on fusional status.

## 4. Discussion

The prevalence of manifest strabismus in this study was 6.6% which was comparable to hospital-based studies carried out in Tanzania (5.9%) [35] and Australia (7.3%) [36]. It was slightly higher than the global prevalence of 3–5% [3] and higher than the prevalence rates of 0.01–2.4% [8–15] reported in studies conducted in Nigeria. Other studies conducted in Nigeria were primarily done to assess ocular diseases in children except for a few, therefore standardized methods of examining strabismus may not have been applied which could have led to cases of missed strabismus [8, 9, 37]. In developed countries where there is better awareness, improved health care facility, maternal nutrition and perinatal child health care, the prevalence of strabismus has been found to be low. The relative high prevalence in this study could be attributed to the fact that all children presenting with strabismus were included in this study (not just healthy children) and the prevalence was calculated in relation to the total number of children presenting within the study period. Additionally, this study was hospital-based in nature; however better awareness of availability of facilities to manage strabismus for the increase in the number of consultations. A previous study carried out before the training of a paediatric ophthalmologist in the center where this study was carried out showed a lower figure [9]. Most studies on prevalence of strabismus have been carried out among older or noticeably young children which could account for the low prevalence reported in those studies [18, 38]. Generally, knowledge regarding the prevalence of manifest strabismus is limited in our environment because it is commonly believed that it is not an ocular health problem but rather a family inheritance hence the general population do not see it as a reason to present to the hospital [38].

Horizontal strabismus was found to be the more prevalent form of manifest strabismus in this study compared to vertical strabismus. This agrees with the findings of other hospital-based studies [9, 39–40]. A school eye health study also found horizontal strabismus to be more common. Vertical strabismus is not quite common as seen in this study and this is consistent with the observations in previous studies [6, 9, 39]. However, Tanaka *et al* [41] found that vertical strabismus is relatively more prevalent (16.2%) among the studied subjects in comparison to horizontal strabismus (13.5%). It is worth of note that this study was conducted among subjects with pathological myopia. This might have accounted for this disparity.

The predominant form of horizontal strabismus in this study was esotropia; this is consistent with other studies done in different parts of the world. In the United States, Mohny *et al* found esotropia to be 60.1%. [6] In Australia, [41] Pakistan, [39] North India, [43] Sudan, [44] Tanzania [45] and the Republic of Congo [46], studies have shown that esotropia was the more prevalent. In Nigeria similar studies have shown that esotropia is more prevalent and such studies include the ones conducted in Port Harcourt, [9] Benin, [14]

Sagamu, [10] Ibadan [13] and Ilorin, [8] which reported esotropia as the commonest form of strabismus seen in Nigeria. However, studies have shown that exotropia was predominant in Australia, [42] Brazil, [47] Hong Kong, [48] Japan, [49] Korea [50] and China [37]. This could be attributed to the differences in genetics and race, environment, intensity of exposure to sunlight, anatomy, and refractive status [9]. Asians are predisposed to myopia with subsequent exotropia, this is because myopes have weak fusional control for distant vision and large accommodation lag [51].

In this study 74.4% of the manifest strabismus was constant; and it is like the findings in Pakistan [41] and China [37]. This can be attributed to disruptions in extraocular muscles (EOM), orbital connective tissues, cranial nerves, fusion centers, and the visual cortex [52]. Amblyopia may be present especially in cases of unilateral constant strabismus [53]. Also, consistent with other findings, intermittent strabismus was the second most prevalent with respect to fusional status, with alternating strabismus being the least occurring [53].

Concerning the types of esotropia, congenital esotropia was the commonest type of esotropia seen in this study; this could be ascribed to the fact that the age group examined is young. This is consistent with the finding by Shaikh *et al*, [39] Musa *et al* [54] and Akpe *et al* [14]. This is followed by accommodative esotropia (majority of which is refractive 13 (10.4%) and high AC/A ratio 6 (4.8%)), this large number of subjects with accommodative esotropia could be attributed to the likelihood of decompensation from esophoria in the older children. Non-accommodative esotropia (sensory and paralytic) accounted for almost as much as accommodative esotropia, the least of which is paralytic esotropia. For the exotropic type of strabismus, congenital exotropia is commonest, and the reason is same as that of congenital esotropia and deficiency of convergence innervation. This is comparable to the findings in Tanzania [45] and contrary to the findings in the studies from Lagos [54] and Benin [15].

## 5. Conclusion

Manifest strabismus has been shown in this study to be a significant ocular morbidity in the pediatric age-group attending the Eye clinic in the University of Port Harcourt Teaching Hospital. Esotropia was the commonest form of Manifest strabismus seen similar to other Nigerian studies.

## Competing Interest

The authors declare that they have no competing interests.

## Authors' Contributions

The article conceptualization, data collection and processing, and the writing of the initial draft were done by Nwachukwu H. Nathaniel GI did the literature search; then Adio AO and Musa K reviewed and wrote the final draft.

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