



Prevalence rate of amblyopia suspect among Yemeni workers

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ABSTRACT

Background: Defective vision of one eye and strabismus, influence daily life and pertinent to education and occupation. This study outlined the prevalence rate and etiology of amblyopia suspect in Yemeni males who came to fulfill visa applications for works outside the country.

Method: A cross sectional community-based study enrolled adult males, ages 18 to 55 years. From 8827 visa applicants, sample of (1162) referred to the outpatient clinic for visual clearance, these had defects in visual acuity equal or less than 6/12, glasses wear and abnormal looking eyes, lid or orbit. In the clinic, they underwent documentation of their basic data, unaided, aided vision, refraction, anterior and posterior eye segment evaluation to outline the defective vision cause. The amblyopia limited by unable to see the 6/9 line or worse in one eye after best correcting glasses without any organic eye lesion.

Results: out of (1162) referred for visual clearance applicants, there were (472) eyes, with prevalence rate 5.3%, had amblyopia of variable degrees from could not attain 6/9 in visual acuity to less than 6/60. Among the amblyopic eyes, (411) 4.66% in prevalence rate had a preventable refractive element with a percentage of 87.08%. These who were drivers would lose their target work. (53) 22.9 % of these having decreased visions were illiterate. The study found (948) 81.6% had no glasses at time of screening. **Conclusion:** The prevalence rate of amblyopia was high 5.3%, the controllable refractive amblyopia occupied 87.08%.

1. Introduction:

Amblyopia: derived from *Greek / Ambly*; dull, *opia*: vision, or lazy eye, is the leading cause of unilateral defect of vision dated in childhood. Amblyopia persists and resists best visual correction by glasses prescription, retaining eye transparency or visual axes alignment.¹ It is a matter acquired if the eye exposed to a visual obstacle within the critical period of visual development, which is from birth to 12 years of age. In this period, the anatomical and physiological changes of retinal receptors, lateral geniculate body cells and visual cortex

connections by sequences of suppression of blurred retinal image, but fortunately, in this period, the optimum treatment of visual obstacle could achieve or resume eye vision.^{1, 2} In other ward, amblyopia is a consequence of prolonged suppression, which is reversible, until ages more than 5 years or ultimate 9-12 years depending on the density, onset and nature of the obstacle.¹⁻³ The treatable refractive errors do co-exist and prevalent in child hood, occupying more than 90% of amblyopia came along with strabismus, congenital or acquired opacities in childhood.¹⁻⁴

Amblyopia varies from mild visual acuity defect (not seeing 6/6 well) to functionally blind eye of 6/60 or worse.² It is unilateral or infrequently bilateral that not attributable directly to any underlying structural abnormality of the eye or visual pathways.^{1,5}

Amblyopia is categorized as follows:

1. Anisometropic amblyopia— difference in refractive error between the two eyes of 2.5 diopter spherical equivalent, with no other causes present.
2. Strabismic amblyopia—amblyopia associated with strabismus, with no other causes present.
3. Meridional amblyopia—amblyopia associated with high astigmatism (measured in minus cylinder and defined as cylindrical error 2.0 diopters), with no other causes present.
4. Form deprivation amblyopia— amblyopia associated with congenital cataract, ptosis, corneal pathology, or other significant media opacities obstructing vision during the sensitive period of visual development.
5. Combination—includes cases where more than one of the above causal factors was present (for example, anisometropia with strabismus, meridional astigmatism with strabismus).^{1,2}
6. Others: structural amblyopia includes cases that do not fall into the above categories, undiagnosed optic nerve or macular lesions.²

Amblyopia is a frequent cause of lifelong unilateral visual impairment. In adults, it is an important cause of monocular visual defect superpose these due to trauma, macular degeneration or even diabetic retinopathy also from its early age impact on vision.² The suppression of vision from any obstacle as refractive errors squint, opacities at ages less than 12 years will lead to amblyopia. It is mainly unilateral, infrequently bilateral, it causes permanent visual defect mainly central. Visual acuity in amblyopia, varied from mild to blind ($\leq 6/120$), depending on the age of onset, treatment

compliance and visual obstacle in-counterred in terms of type, degree, and nature.²⁻⁵ Amblyopia represents a syndrome of compromising deficits including: decreased sensitivity to contour interaction, poor eye tracking ability, abnormal spatial distortions, uncertainty, reduced contrast sensitivity, unsteady or inaccurate monocular fixation and inaccurate accommodation response. The triad of amblyopia, anisometropia and strabismus are associated with disabilities, as misjudging near and intermediate distances; reduced fine motor skills; clumsiness; somatization with unclear mechanism.^{1, 2, 4, 5, 6,}

⁷In addition, interpersonal sensitivity; obsession-compulsion as anxiety and depression.^{1, 3, 6, 7, 8}

The binocular single vision is largely impaired or lost in amblyopia, so their work should be away from machine deal, violence as sports or army.¹

Defective vision of one eye and strabismus, influence daily life and pertinent to education and occupation. Certain occupations need high level of visual performance as driving, navigating or piloting some form of moving vehicle or machines, or the armed forces although computer assisting has role in regressing man-relayed on work and surgery with binocular microscope- especially ophthalmic and neurosurgery in which there is a widespread belief that binocular vision is important.⁸⁻¹⁰

However, hypermetropic amblyopia and strabismus reduced monocular vision and are a cause-and-effect variables and either can influence learning, sport and social activity, and performance in school, as well as restrict choice in profession and hobbies.¹⁰ In addition, 19% may get trauma to the healthy eye.^{1, 2} The parent's knowledge of amblyopia is high efficiency of treatment of the amblyopia patient's morale.¹⁴ However, the risk factors for amblyopia that have been described were prematurity, small for gestational dates or who have a first-degree relative with amblyopia. In infants with neuro-developmental delay, the prevalence of amblyopia is six times higher than in healthy, full-term infants.^{1, 2, 3}

In strabismus, the diplopia caused by the misalignment can lead to binocular rivalry and suppression of input from the non-dominant eye at the level of the visual cortex. Infantile esotropia, (congenital esotropia) generally presents before six months of age, when the developing visual system is at most risk of amblyopia. If not corrected early, the resultant amblyopia can be profound and difficult to reverse. In patients who have had early surgery with an outcome of good visual acuity in both eyes, very poor stereopsis can still result due to the early disruption of binocular vision. Refractive error represents a risk for developing amblyopia, either due to creation of dissimilar images in anisometric amblyopia or as a driving factor for accommodative esotropia.^{1-3, 9, 10}

The earlier onset of any visual obstacle, the more rapid and deep suppression and prompt early and efficient treatment of that visual obstacle will lead to rapid recovery.¹⁻³ The treatment of opacities and strabismus should be even at age of 4 months and before the 8 years old for refractive errors up to 12 years old if mild degree. Further, they need follow up to control relapses.¹ Therefore, amblyopia control needs cost effective screening, parent's attention and efficient pediatric ophthalmic centers.

Is there any hope? amblyopia is permanent but it noticed, after loss of the healthy eye, an efficient vision returned in that single amblyopic eye.¹ There are many electronic, electric stimuli and pharmacological trials to activate the visual centers and the occlusion even trial extend to 17 years.^{1, 2, 11}

Practically, among adults, we explain and reassure them about the nature of amblyopia, as being life long, stationary and do not affect the healthy eye. In addition, adults need to be away from violence (work or sports), that carry risk of trauma to the healthy eye 19%¹ also choose works away from using machines for the amblyopics has no binocular single vision.^{1, 12, 13, 14}

This study aimed to show the prevalence rate of amblyopia in Yemeni adults' workers. The

amblyopia precluded travelling especially drivers. The onset was from their childhood. Early ages history of glasses wear was an index for the awareness of childhood visual correction impotence among population.

Patients and Method:

The study is a cross sectional population based applied from February 2011 to January 2012. In that year, the launch year of Arabic Spring events, a large number of travelers sought for work outside the country came to the hospital for compulsory fulfill their working visa by the Embassies.

All applicants were not aware about their medical or vision potentials and passively attended the eye clinic to fulfill their visa application. The study-involved adults' male ages between 18-55 years (37±18 year) and mainly of low education levels seeking works. The visa medical application was a compulsory clearance as medical, ophthalmic, viral profile to get visa for all travelling aims. Azal private hospital was one of trusted hospitals to issue medical clearance referred by foreign Embassies as Gulf region, USA, China and others. The Saudi Arabia was the main destination by travelers for the available driver-work visa. The study excluded all patients attended the clinic by their requests.

All visa applicants underwent vision screening by Snellen-E-chart outside the clinic. They were 8837 active adults and 1162 of them referred to the eye clinic for eye and vision clearance. The referrals were all who had visual acuity less than 6/12, abnormally looking eye, lid or orbit as strabismus, eye atrophy, lid mal-positions, as well as all these wore glasses at time of screening.

A (411) 35.4% of the sample were drivers (Table (1)) and these entirely and directly referred for clearance, which consisted of both eyes alignments, color vision, absence of progressive organic lesions and at least 6/9 visual acuity with or without glasses correction to be fit to get the driver- visa. The other non-drivers' applicants

considered fit without referral, if they attained at least 6/12 in either or both eyes.

In the clinic, all subjected to full history including address, target work, illness onset and history. Examination of vision there repeated by Landolt's C ring and these confirmed of having less visual acuity than 6/9 were subjected to glasses trials according to Canon auto-refractometry. The anterior and posterior segments evaluation for these had uncorrected aided vision. The applicants having reduced visual acuity \leq half 6/9 optotype by pinhole or slit hole over their glass's correction with absence of any organic lesion in either or both eyes were registered as amblyopia suspect.

The term *amblyopia suspect* was to describe these did not attain 6/9 or worse in this study, by the subjective correcting glasses with pinhole.

The eye number put between brackets in these studies, referred to the mean of both right and left eyes, as no significant differences between of right and left eye numbers statistically with a very high (Pearson's coefficient, 0.783).^{7, 9} Studies varied in respecting either right or left eye only for final statistical resolution or respected their mean as this study.^{14, 15}

A written agreement signed by the medical director to get weekly, the total applicants' numbers, whom subjected to visual acuity screening from the registering office 1/2/ 2011 to 31/1/ 2012. Data analysis was by SPSS version 23 (IBM, Armonk. NY, USA).

Results:

From Table (2) and Figure (1), the applicants getting visual acuity 6/12 or better in the screening room considered fit and constituted (7665) 86.54% out of a total sample (8827). The rest (1162) underwent clearance in the eye clinic. The refractive errors were in 1098 eyes (respecting the mean right and left eyes) with a

prevalence rate of 12.44% of total 8827 and a percentage of 94.49% from those (1162) eyes. Between them, the mean eyes got almost 6/6 correction by glasses were (629) in a prevalence of 7.13% and 53.13% in percentage. The rest eyes had either amblyopia suspect or organic lesions.

Table (2) and (3) also showed the suspected amblyopic eyes were in (472) as 5.3% in prevalence rate. (411) eyes occupied 87.08% of them had refractive errors and (61) 12.92% had strabismus as well. These had chance for correction, if got glasses or muscle alignment, before the age of 10 years. From Table (2), the prevalence rate of amblyopia suspect, as mainly monocular problem were in (472 from which 17 applicants had binocular) with 5.0 % in prevalence. This lead to visual defect and among the visa applicants might lose their travelling and work opportunity especially more if they had driver visa. Among amblyopics, refractive errors occupied 87 % representing 34.37% of these had visual defects in a prevalence rate of 4.6%.

Table (1) showed these had defective vision were illiterate and from Table (5) showed 81.6% had no glasses at time of screening. Figure (1): The total applicants got amblyopia found to occupy 40.62% of the (1162) eyes underwent visual clearance. The organic lesion were unilateral and prevalent only in 0.3 with a percentage of 2.3% of these getting low vision than 6/9 as the sample was not hospital based because, they had no attention about their stable visual condition and the purpose of examination was compulsory for getting visa.

The degree of amblyopia increased by increasing anisometropia as seen in Table (4). The limit 1.5 D of anisometropia is amblyogenic in the textbooks. High refractive errors more than 6.0 D are also amblyogenic and these included in the different grades of anisometropia.^{1, 2}

Table (1): Education pattern among the 1162 referred applicants

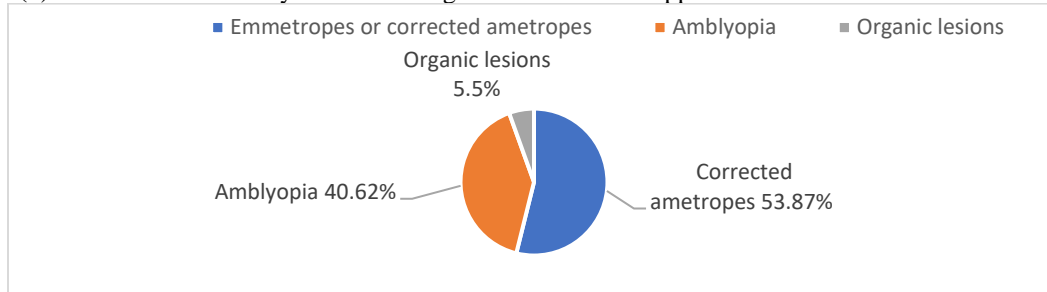
Education Level	(No)	%	Target work	(No)	%
\leq 1ry school	(217)	23.3%	Visitors	(14)	1.2%
2ry school	(665)	57.2%	Drivers	(411)	35.4%
Institute skills	(116)	10%	Very Simple	(484)	41.7%
University	(80)	6.9%	Skills	(216)	18.6%

Master / Doctor	(30)	2.6%	Academic	(37)	3.2%
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Table (2): Etiology of defective vision among the referred applicants

Low VA. <6/9	Prevalence(N)	rate	Percentage
Refractive errors	(1098)	12.361 %	94.49%
Almost got 6/6	(629)	7.13%	
Amblyopia suspect	(411)	5.35%	
Organic lesions	+ (61) strabismic		
Total	(61) 1162	0.7%	5.51%

Population =8827

Figure (1): Pattern of ultimate eye vision among the 1162 referred applicants.**Table (3):** Etiology of defective vision of the mean eyes among the referred applicants

Pattern of defective vision among the applicants	N	8827 Prevalence rate %	1162 Percentage%	95% CI	
Corrected Ametropia	629	7.13	54.13	4.3	9.9
Refractive.	411	4.66	35.37	87.08	
Strabismic +refractive	37	0.42	3.18	7.84	
Alternating	24	0.27	2.07	5.08	
Total Amblyopia suspect	472 (17 BE)	5.35	40.62	100	2.5 8.1
Anterior segment	14	0.159	1.21	22.95	
Posterior segment	17	0.193	1.46	27.86	
Both or eye loss	10	0.113	0.86	13.39	
Total organic lesion	61	0.691	5.25	100	
Total	1162	13.164	100	0	

Population =8827 BE: both eyes, CI: confidence interval

Table (4): The anisometropia grades as visual acuity best correction among the referred applicants.

Visual out comes per cause	N	%
Anisometropia \leq 1.5 D corrected to 6/6 by glasses and isometropia	450	38.73
Anisometropia $>$ -1.5 D and corrected to 6/6	154	13.25
Anisometropia $<$ 1.5 D with amblyopic (\leq 6/9)	193	16.6
Anisometropia $>$ 1.5 D with amblyopia (\leq 6/9)	304	26.16
Organic lesion	61	5.25
Total	1162	100.0

Table (5): Glasses wear at time of examination among the applicants.

Glasses	N	%
Not wore glasses	948	81.6
Wore glasses after childhood	179	15.4
Wore glasses in childhood	20	1.7
No need for glasses	15	1.3
Total	1162	100

Discussion

Amblyopia have described in many studies. Its prevalence varied from 0.5% to 7.6% with without strabismus.^{3, 5, 7, 8, 11, 16} Correction of refractive errors in early ages, which are the main cause of amblyopia, could decrease the chance of amblyopia and then its prevalence might be less in these countries having efficient and feasible eye services.^{1, 2, 15}

Refractive causes of amblyopia either from anisometropia and / or concomitant strabismic amblyopia were account for the vast majority of amblyopia in over 90 percent of all amblyopia. Isoametropic amblyopia is rare, accounting for only 1-2 % of all refractive amblyopia. The prevalence rate of deprivation amblyopia, as opacities is also rare.^{1, 2, 17, 18}

In European studies and in heterogeneous ethnics 2-5% in North America and 2.9% in Austria¹². However, it varies among world populations because of differences in distribution of refractive errors and strabismus among ethnics, civilization, education levels, health eye standards and infra structures.^{13, 14, 19, 20}

The factor's causing amblyopia is related much to deficiency of eye health infrastructures for refractive errors correction. That are screening facilities in labor room and preschool age³, and community education for the value of glasses wear in early life ages when the main causes of the adverse effects of uncorrected refractive errors in childhood that would be affected life in adulthood as being amblyopic and getting low learning score in some skills.^{8, 17} In this study, the amblyopia is suspected among these adults not attained 6/9 best corrected visual acuity and further, the prevalence rate might be exaggerated by false positive as amblyopia diagnosis depended on glasses correction, refined by pinhole and no contact lens prescription and so corneal causes of refractive errors might be overlooked. It observed little difference in the prevalence of amblyopia among Chinese, Indian, and Malay men. The minor racial/ethnic variation in the causes of amblyopia, however, may possibly reflect racial/ethnic differences in

the frequency and impact of refractive errors and other ocular disorders in Asian people.^{4, 18}

Direct comparison of these findings with others is problematic because of differences in study design, from emmetropic or ametropia population, demographics, and diagnostic criteria of studies.^{5, 6, 7}

The low prevalence rates of amblyopia in studies explained by age factor: very young aged samples for example; among 6 months, less than 5 years had less estimated amblyopia than older samples for more exposure to various risks as traumatic cataract, added to them these with no compliance in wearing glasses.³ The other factor is the visual deterioration was the respected 6/18 or worse limit of visual acuity used by WHO planning studies. Hence, if prevalence rate respects visual acuity 6/9, as this study, the rate would be higher up to 10%, these studies found among clinical bases aiming best correction, as this study.^{7, 17}

Apart from recommended national annual visual acuity checks screening program, started in early life, to screen, detect and treat amblyopia among schoolchildren (even preschool ages), no data, however, to verify that these programs were effective in reducing amblyopia.^{1, 2, 8, 20}

Literatures proved the long-term follow up until age 9-12 years, remark heavily on the cooperation of parents also trained personnel for screening in early life ages, and follow up including school authorities.^{8, 15, 16}

The lifetime models show that the cost-effectiveness of amblyopia screening depending on the long-term utility effects of unilateral vision loss. There is limited evidence on any such effect, although our subjective interpretation of the available literature is that the utility effects are likely to be minimal. Any utility study investigating such effects would need to be careful to avoid introducing bias.

The reference case model did not represent potential treatment-related utility effects, primarily due to an increased probability of treated children being bullied at school. The evidence indicates that this may be a problem, and additional sensitivity analyses show that

small utility decrements from bullying would improve the cost-effectiveness of early screening significantly.^{13, 19, 20, 21, 22, 23}

Collectively, most of studies indicate that treatment for amblyopia is effective in reducing the overall prevalence and severity of visual loss from amblyopia.^{7, 12} It through public awareness; especially parents, school workers and pediatrics, screening protocols and full access to medical care. Further relapses after successful treatment of suppression; the precursor sensitive name of amblyopia in the younger ages, is documented and mandate the long term follow up every 3 months up to 12 years age at which visual centers establish optimum growth and development.^{1, 2, 3, 19, 20, 21} The American Academy of Ophthalmology recommended screening of all children by age 3 yrs. and thereafter per 2 years, in term of visual acuity, corneal reflex, refraction, fixation preference and stereo-acuity. The American Academy of Pediatrics suggested visual screening should begin at birth and continue as part of child regular medical checkup and then infant at risk should undergo detailed evaluation.^{1, 2, 18}

Some countries, add free dispensing glasses among young pupils either by associates or by governmental plans after screening, especially in United States, and United Nation programs.^{19, 20, 21} Table (2) showed 94.5% of defected vision were from refractive errors.^{22, 23, 24}

It is worth to mention that: In 1970s to early 1980s, there was an obligate medical clearance forum at first school entry, through the School Health Administration, that time entirely rolled by Egyptian staff. One item of this forum was the visual acuity. That was effective, if applied with follow up, in detecting and treating mild defective vision among pupils and they could have chance to prevent or decrease amblyopia burden. Visual screening should be even among earlier ages.^{1, 2, 3, 20} Pupils with defective vision at school entry, still in critical or sensitive period of visual centers development and could get reversal of mild suppressions by wearing corrective glasses with maintaining the eye transparency or visual axis alignment.

A compulsory application of routine eye screening at time of vaccination program by trainee and even in labor room by midwives, in purpose to detect and refer any young who at risk, for qualifying, follow up and getting efficient pediatric ophthalmic specialization management was recommended by many ophthalmic workers.^{15, 18, 23, 24}

To establish good eye vision throughout life, periodic follow up of these subjected to amblyogenic factors until their 12 years age and recently expanded up to twenties, to correct their refraction changes, stimulating media to optimize visual acuity by activating their neural connections and reverse relapses and amblyopia.^{1, 8}

- 1- Treatment of the visual obstacle: Classes for ametropias and surgery for lens opacity and strabismus.
- 2- Focusing optimum on the macula by glasses with follow up / 6 months
- 3- Adjusted occlusion or penalization, if mild, of the healthy eye with follow up to 12 years old (partial occlusion is recommended if no eye deviation, as full-time occlusion could interrupt the binocular single vision if no strabismus.^{15, 23}

Limitations of the study:

In the screening room, the study might not register some of the mild to moderate isoametropic amblyopia as the fitness attained at 6/12 line and then had not referred to the clinic, together with these got benefits of pinhole effects by narrowing their palpebral fissures. Fortunately, this is the least type of amblyopia and the driver applicants (third of the sample) and these had glasses or apparent eye abnormalities all referred to the eye clinic (Table (3).

Incontrary, the study might register optic nerve or macular minute lesions as moderate or severe amblyopia and were not diagnosed by the sophisticated tools as optical coherent tomography or electrophysiological. Fortunately, also, these subclinical diseases are occasions.^{1, 2, 15}

The study chose the term amblyopia suspect, because contact lenses were not applied to reach best-corrected visual acuity limit, also this term was among the very few applicants who denied the long duration of their visual defects in trial to get the target work or keep their paid visa.

Conclusion:

The prevalence rate of amblyopia was near the upper limit of the amblyopia records in the matched age and attained 5.3%. An 87% of which were due to the controllable refractive amblyopia. This reflected the need of increase attention of parents, as well as health workers and school authorities toward importance of visual obstacles treatment among Childs. An adult with amblyopia maintained permanent mono-ocular visual defect with lost binocularity and he has to select his work accordingly.

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