Prevalence and causes of childhood blindness in camps for displaced persons in Khartoum: results of a household survey

Z. Zeidan,[1] K. Hashim,[2] M.A. Muhit[3] and C. Gilbert[3]

انتشار العمى بين الأطفال في مخيّمات النازحين في الخرطوم وأسبابه: نتائج مسح أسري

زيدان عبده زيدان، خالد هاشم، محمد موهيت، كلير قلبرت

الخلاصة: حُدِّدت أسباب، ومدى انتشار العمى بين 29 048 طفلاً تقلّ أعمارهم عن 16 عاماً، ينتمون إلى جميع الأُسَر التي تضمُّها خمسة مخيّمات للنازحين داخلياً في الخرطوم، بالسودان. وفي أعقاب زيارات قام بها عاملون صحيون مدرَّبون من منزل إلى منزل، خضع 916 طفلاً لإجراءات تقييم إضافية، تبيَّن من خلالها إصابة 2.7% منهم بالعمى، و1.6% بضَعْف وخيم في البصر، و5.5% بضَعْف في البصر، وفق معايير منظمة الصحة العالمية. وقُدِّر انتشار العمى بين الأطفال في المخيمات بـ 1.4 لكل 1000 من الأطفال، وتبيَّن أن الأسباب الرئيسية للإصابة بالعمى هي عتامات القرنية (40%) الناجمة بشكل أساسي، عن عَوَز الفيتامين A، يليها الغَمَش amblyopia (32.5%).

ABSTRACT The prevalence and causes of visual impairment and blindness were determined in 29 048 children < 16 years in all households of 5 camps for internally displaced people in Khartoum State, Sudan. After house-to-house visits by trained health care workers, 916 children received further assessment, 2.7% of whom were found to be blind, 1.6% to be severely visually impaired and 5.5% to be visually impaired, according to World Health Organization criteria. The prevalence of blindness in children in the camps was estimated as 1.4 per 1000 children. The leading causes of blindness were found to be corneal opacities (40.0%), mainly due to vitamin A deficiency, followed by amblyopia (32.5%).

Prévalence et causes de la cécité infantile dans les camps pour personnes déplacées de Khartoum : résultats d'une enquête auprès des ménages

RÉSUMÉ La prévalence et les causes des déficiences visuelles et de la cécité ont été déterminées chez 29 048 enfants de moins de 16 ans dans chacun des foyers hébergés dans 5 camps pour personnes déplacées situés dans l'État de Khartoum au Soudan. À la suite d'une enquête porte à porte effectuée par des personnels de santé dûment formés, 916 enfants ont fait l'objet d'une évaluation approfondie : 2,7 % d'entre eux étaient atteints de cécité, 5,5 % de déficience visuelle partielle et 1,6 % de déficience visuelle grave, selon les critères de l'Organisation mondiale de la Santé. La prévalence de la cécité chez les enfants logés dans ces camps a été estimée à 1,4 pour 1000 enfants. Les principales causes de cécité identifiées étaient l'opacité cornéenne (40,0 %), essentiellement due à une carence en vitamine A, suivie de l'amblyopie (32,5 %).

[1]*Department of Community Medicine, Faculty of Medicine, University of Khartoum, Khartoum, Sudan (Correspondence to Z. Zeidan: drziedan61@hotmail.com).*
[2]*Walidain Eye Hospital, Khartoum, Sudan*
[3]*London School of Hygiene and Tropical Medicine, London, United Kingdom.*
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Introduction

Five per cent of worldwide blindness involves children younger than 15 years of age; in developing countries this age group constitutes 50% of the population. By World Health Organization (WHO) criteria, there are 1.5 million children worldwide who are blind: 1.0 million in Asia, 0.3 million in Africa, 0.1 million in Latin America and 0.1 million in the rest of the world. There are marked differences in the causes of childhood blindness in different regions due to different socioeconomic factors. In developing countries, 30% to 72% of such blindness is avoidable: 9% to 58% is preventable and 14% to 31% is treatable. The leading cause of blindness in children in developing countries is corneal opacification caused by a combination of measles, xerophthalmia and the use of traditional eye medicine [*1*]. Infectious diseases, malnutrition, vitamin A deficiency and measles are the main causes of avoidable blindness in children of poor countries [*2*].

In Sudan there is an absence of population data on the prevalence of blindness in children. However, the prevalence of blindness in all ages in Sudan was found to be 1.78%, the major causes being cataract, corneal opacities, uncorrected refractive errors, trachoma and onchocerciasis [*3*].

It has been found that the causes of blindness in children are the same as the causes of under-5 mortality (e.g. premature birth, measles, vitamin A deficiency, congenital rubella syndrome and meningitis) [*4*]. Therefore the under-5 mortality rate can be taken as a proxy indicator to estimate the prevalence of child blindness. In Sudan, the under-5 child mortality rate was found to be 104/1000 live births.

The number of displaced people in Sudan has been estimated to be about 4 million [*5*]. The primary reason for leaving their origin was war, followed by food insecurity, economic opportunities and employment. Approximately 340 000 internally displaced persons (IDPs) live in the 5 official camps, which are located at the peripheries of 3 large cities (Khartoum, Khartoum North and Omdurman). They live in cardboard or mud houses in poor hygiene conditions and with a lack of water supply [*3*]. The results of an interagency household survey in displaced camps in Khartoum indicate that the crude mortality rate for children under 5 years is near the emergency threshold of 1 per 10 000 per day. The main cause of death in all areas is diarrhoea. Other causes included chest infections, pneumonia and measles [*6*]. Clearly living conditions are poor in the camps and child mortality is high, which suggests visual impairment may also be high among such children.

We aimed to determine the prevalence and leading causes of visual impairment and blindness in children in the above-mentioned camps. The outcome of this study will provide baseline information that may assist in measuring the progress of the VISION 2020 programme in fighting causes of childhood blindness in the country.

Methods

Subjects

Children under 16 years who were living in the IDP camps around Khartoum for at least a 6-month period before the study were the target population.

The 5 IDP camps in Khartoum State are Mayo Farms, Jebel Awlia, El Salaam, Wad el Bashier and Karton Kassala with a total populations of 72 621 during the study period (5–10 October 2003). Each camp was divided into 30 clusters, each having between 34 and 66 households, i.e. average population per cluster ranged between 408

and 792 individuals. Every 7th household in each cluster was visited.

The eligible children were those under 16 years who had been living in these households for a minimum period of 6 months before the survey and contracted eye problems from birth until the time of the study. Health workers who were trained in conducting field surveys to detect eligible children with eye problems or defective vision were involved in the house-to-house surveys. The health worker asked the parents whether their children had recent or previous eye problems, or if they had noticed any change in the eyesight of their children. Visual acuity was not measured during household interviews, but children with eye problems were registered and the heads of the households were given a card and requested to be present with their children on pre-determined days in the camp clinics to see the ophthalmic medical assistants and optometrists to assess their eye problems and visual acuity.

Examination in the field

Children found by the field health workers to have eye problems were later examined in the camp clinics by an examination team using portable equipment. The examining team in each camp consisted of 4 ophthalmic medical assistants, 1 optometrist, 2 medical officers, who were trained in the eye hospital, 2 health workers from the local health units of the camps, 5 medical students, a records clerk and a driver. At the camp clinic, each child was first registered by the health workers and a history was taken from each child or their parents by the health workers or medical students. Visual acuity was measured in each eye separately at 6 m and 3 m using a Snellen E chart. Impairment in visual acuity in children under 5 years was determined by showing bright objects. The following WHO categories of visual loss were used for visual acuity in the better eye: 6/18 or better – not impaired; < 6/18–6/60 – visual impairment; < 6/60–3/60 – severe visual impairment; < 3/60 – blind [*7*]. Trained ophthalmic medical assistants using a 4× magnifying loupe and a hand-held flashlight examined the anterior segment of the child's eye. Posterior segments were not examined at this level.

Acute eye problems were treated free of charge. Children with complicated eye diseases or visual acuity < 6/18 were referred to Alwaldain Eye Hospital, Omdurman Province. Transport was offered free of charge.

Examination in eye hospital

At the referral eye hospital, the ophthalmologist reviewed the field results. In children aged 5 years or more the external eye and anterior segment were examined using a slit lamp and posterior segments were examined with a direct ophthalmoscope after dilating the pupils, if necessary. A diagnosis of glaucoma was made on the basis of anterior and posterior segment signs, as visual testing was not possible. Glaucoma cases were assessed using a Schiotz tonometer to assess intraocular pressure.

Visual acuity was measured again and refraction was performed for all children. If there was difficulty measuring visual acuity in children under the age of 3 years of age, they were examined and refracted under local anaesthesia.

For each child with a visual acuity of < 6/18 in the better eye, the examining ophthalmologist sought to identify the reasons for visual loss.

All the findings were recorded on a data sheet and were entered into a database. The data were analysed using *SPSS*, version 10.

Results

The target population included 29 048 children under 16 years of age. Of these, 1115 children were registered by the health workers as having a history of recent or previous eye problems during the house-to-house interviews. Of these, 916 came to the camp clinics where they were examined and treated by the field team; 105 of them were found to have visual acuity < 6/18 and were referred to the eye hospital for further refraction and examination.

Out of the 105 referred to the eye hospital, 15 were found to be severely visually impaired (visual acuity < 6/60 in the better eye) and 25 blind (visual < 3/60). The prevalence of severe visual impairment among the referred children was 1.6% whereas the prevalence of blindness was 2.7% and the prevalence of blindness and severe visual impairment together was 4.4% (Table 1).

The prevalence of blindness was higher in males compared to females although this difference was not statistically significant, but it was significantly higher in the older age group than in the younger age groups in males ($P < 0.05$) (Table 2).

The commonest anatomical sites of visual loss in the 40 blind and severely visually impaired children were the corneas in 40% (corneal scaring), the higher centre of the brain in 32.5% (amblyopia), the lens (cataract) in 12.5%, retina in 7.5%, the whole globe in 2.5%, optic nerve in 2.5% and uvea (glaucoma) in 2.5% (Table 3).

In all, 35 (87.5%) of the blind or severely visually impaired children presented with avoidable causes of blindness and vision loss: vitamin A deficiency (22.5%), trauma (10.0%) and measles (7.5%), which are preventable causes, and amblyopia (32.5%) and cataract (12.5%), which are treatable causes (Table 4), although amblyopia is only treatable up to 9 years of age.

Of the 40 children with severe visual impairment and blindness, 23 were referred for surgery, 10/23 (43.4%) for corneal scaring and 8/23 (34.8%) for cataract surgery (Table 5).

Table 1 **Visual acuity of 916 children in camps for internally displaced people, Khartoum 2003**

Category of visual loss	Presenting acuity in the field		After refraction in the clinic	
	No.	%	No.	%
6/6–6/18	811	88.5	826	90.2
< 6/18–6/60	65	7.1	50	5.5
< 6/60–3/60	0	0.0	15	1.6
< 3/60	40	4.4	25	2.7
Total	916	100.0	916	100.0

Discussion

The prevalence of blindness in children varies between countries as it is influenced by socioeconomic status, and it is reflected by the childhood mortality rate. While eye lesions are the main causes in high-income countries, corneal scarring due to measles and vitamin A deficiency are the main causes in low-income countries [*1*]. In our study the prevalence of blindness and severe visual impairment in children in displaced camps in Sudan was 1.4/1000, which is consistent with the prevalence of childhood blindness in low income countries with low under-5 mortality rates, where the prevalence may be as high as 1.5 per 1000 children [*8*]

Our rate is similar to some population-based studies in other countries. For example, the prevalence of blindness was 1.5/1000 in the age group of 5–15 years in Chile but the main causes of blindness were not available [*9*]. In India it was found to be 1.2/1000 in the age group of 7–15 years,

Table 2 **Prevalence of blindness in children according to age and sex at camps for internally displaced people, Khartoum 2003**

Age group (years)	Males			Females			Total			95% CI
	No. examined	No. blind	%	No. examined	No. blind	%	No. examined	No. blind	%	
0–5	174	4	2.3	185	5	2.7	359	9	2.5	0.9–4.1
6–16	264	10	3.8	256	6	2.3	520	16	3.1	2.3–3.9
Unknown	11	0	0.0	026	0	0.0	37	0	0.0	–
Total	449	14	3.1	467	11	2.4	916	25	2.7	0.7–4.7

Blindness indicated by visual acuity < 3/60.
CI = confidence interval.

where retinal disorders, corneal opacities, congenital anomaly and amblyopia were the main causes of blindness [*9*]. In Nepal the prevalence of blindness was found to be 1.5/1000 in the age group of 5–15 years, but the main causes of blindness were not available [*9*].

Examining the main causes showed that corneal scarring (mostly related to vitamin A deficiency disorders) and lens opacity (cataract) were responsible for 40% and 13% of childhood blindness and severe visual impairment respectively. These 2 conditions are entirely avoidable (prevention for vitamin A deficiency disorders and early diagnosis and surgical treatment for cataract). Our result is consistent with the recommendations and priorities of WHO VISION 2020 initiative which identifies corneal scarring and cataract as the major causes of childhood blindness in most developing countries [*7*].

The majority of surgical operations that were done at the eye hospital were for corneal opacities and cataract, which suggests

Table 3 **Anatomical sites and causes of blindness or severe visual impairment in the 40 children with visual acuity of < 6/60 in the better eye, Khartoum 2003**

Anatomical classification	No. (*n* = 40)	%
Corneal opacity	16	40.0
Vitamin A deficiency	9	22.5
Trauma	4	10.0
Measles	3	7.5
Higher centre of the brain (amblyopia)	13	32.5
Lens (cataract)	5	12.5
Retina	3	7.5
Retinitis pigmentosa	2	5.0
Vascular abnormality	1	2.5
Uvea (glaucoma)	1	2.5
Whole globe anomaly (microphthalmos)	1	2.5
Optic nerve (optic nerve atrophy due to unknown cause)	1	2.5

Table 4 **Avoidable causes of severe visual impairment and blindness among the 40 children with visual acuity < 6/60 in the better eye, Khartoum 2003**

Avoidable causes	No. (*n* = 40)	%
Preventable		
Vitamin A deficiency	9	22.5
Autosomal dominant	2	5.0
Trauma	4	10.0
Measles	3	7.5
Treatable[a]		
Cataract	5	12.5
Glaucoma	1	2.5
Total avoidable	24	60.0

[a]*Amblyopia (32.5%) was not included as it is only treatable up to 9 years of age.*

Table 5 **Distribution of the children referred for surgery by type of eye disease, Khartoum 2003**

Type of eye disease	No.	%
Corneal opacities	10	43.5
Cataract	8	34.8
Divergent squint	3	13.0
Others	2	8.7
Total	23	100.0

the need to initiate a training programme on paediatric eye surgery for the doctors, so as to prevent further complication to blindness.

Although 25 blind cases and 15 with severe visual impairment are a small number, not all cases were determined by initial screening and thus these figures are an underestimate of the number of cases. Nonetheless out data provide useful baseline information for programme planners involved in addressing childhood blindness in Sudan.

Improving vaccination for measles and distribution of vitamin A supplements will assist in prevention of severe visual impairment and blindness in the majority of children in these camps. A public health eye programme based on VISION 2020 should be established to combat childhood blindness problems focusing on the primary health care level.

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