

# Dual sensory impairment in special schools in South-Eastern Nigeria

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## ABSTRACT

In a cross-sectional study to determine the magnitude of dual sensory impairment (DSI-combined hearing and vision loss) in children in single-disability special education schools, children in schools for the blind and schools for the deaf in four states in South-East Nigeria were examined by an ophthalmologist and otorhinolaryngologist to determine the level of their disability and to identify other disabilities if any. Participants were all students with childhood blindness or childhood deafness. The magnitude and causes of DSI and the burden of undetected DSI were the main outcome measures. A total of 273 students were examined. About 7% of these students had DSI out of which over 60% (12/19) was previously undetected. There was more DSI in the blind schools than in the deaf schools ( $p=0.003$ ). There is a large burden of undetected DSI in children in special schools in Nigeria. There is a need to create awareness of this problem and advocate appropriate screening, rehabilitative and educational strategies for children who have it.

## BACKGROUND

Children with a disability may often have additional undetected disabilities. This is especially important in low income, middle income countries (LMICs) where inclusive education is not implemented and special schools usually only cater for children with a single disability. Dual sensory impairment (DSI) is the condition of being affected by a combination of varying degrees of visual and hearing loss. It has also been called deafblindness.<sup>1 2</sup> Its prevalence ranges from 0.01% to 1.3% in the general population but there is a paucity of data on the prevalence of DSI in children.<sup>3</sup> However, in Denmark the prevalence of deafblindness in children has been estimated to be 1:29 000 (0.3/10 000)<sup>4</sup> and 11/110 200 or 1/10 000 population in the UK.<sup>5</sup> A recent survey of childhood sensory and physical impairments in Bangladesh did not report any case of DSI.<sup>6</sup> Nigeria is an LMIC with a population of about 170 million people. About 30 million are  $\leq 5$  years, while 88 million are  $< 18$  years, (2012).<sup>7</sup> The prevalence of DSI in Nigerian children is unknown. However, the prevalence of childhood blindness and hearing loss in Nigeria is estimated to be 1.6/10 000 children<sup>8</sup> and 13.9%, respectively.<sup>9</sup> Several studies in schools for the deaf in both developed and LMIC countries have revealed a high proportion (24–61%) of deaf students with ocular disorders. These range from non-visually disabling lesions like chalazion and blepharitis to sight-threatening lesions like retinitis pigmentosa.<sup>10–12</sup> A study in a deaf school in South-West Nigeria also revealed that 1.3%

students were blind and 3.2% were visually impaired.<sup>13</sup> Blind children may also have undetected forms of hearing impairment (HI). Deafness is the ‘hidden disability’ or ‘unseen deformity’ frequently unnoticed by the general public and health workers.<sup>14</sup> DSI affects social, cognitive and language development especially if hearing or visual loss is undetected in the critical early years of life.<sup>1 12</sup> The aim of this study is to determine the magnitude and causes of DSI in special schools in South-East Nigeria.

## METHODS

This was a multidisability study and part of the methodology has been reported elsewhere.<sup>15</sup> All the schools for the blind and deaf in South-Eastern Nigeria were visited.

The eye examination included visual acuity measurement, anterior segment examination with a simple head loupe and pen-torch and dilated funduscopy using a Keeler Spectra indirect ophthalmoscope. The ocular examinations were done by an ophthalmologist (AEA) and the findings were recorded on the WHO Prevention of Blindness form. Refraction, when indicated was performed by the optometrist. A brief history was taken by an experienced otorhinolaryngologist. In the deaf schools, this was interpreted by a teacher using signing. Additional history was obtained by mobile phone from the participants’ parents.

Ear examination was done by the otorhinolaryngologist using an illuminated loupe and an otoscope. Those with ear problems, for example, wax, otorrhoea, foreign bodies were treated on site or referred to the nearest Ear, Nose and Throat facility. Audiometry was done in the quietest part of the school using an Oscilla battery-powered screening audiometer model SM 910. The ambient noise was recorded using a Maplin sound meter. Ambient noise did not exceed 40 dBA. The hearing thresholds at 0.5 KHz, 1. 2 KHz and 4 KHz were measured for each ear. The average threshold was calculated for each ear while the lower threshold was taken as hearing threshold of the participants according to WHO guidelines.<sup>16</sup> All findings were recorded on the WHO/PBH form according to WHO coding instructions.<sup>17</sup> The data were entered into a specially created database in Microsoft Access and transferred to STATA V.12.1 (Statcorp, Texas, USA) using STATtransfer. From here frequency tables were generated. Differences in proportions of children with DSI by school type and age group were analysed using the z-test statistic in STATA. Tests of significance were set at the 95% level.



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**Table 1** WHO categories of vision of the participants

WHO vision category	Level of vision	Blind schools	Deaf schools	Total
		n (%)	n (%)	n (%)
Not impaired	6/6–6/18	0 (0.0)	139 (95.1)	139 (50.9)
Visually impaired	<6/18–6/60	3 (2.4)	3 (2.1)	6 (2.2)
SVI	<6/60–3/60	11 (8.6)	1 (0.7)	12 (4.4)
Blind	<3/60-PL	48 (37.8)	0 (0.0)	48 (17.6)
Blind	NPL	65 (51.2)	0 (0.0)	65 (23.8)
Believed sighted*		0 (0.0)	3 (2.1)	3 (1.1)
Total		127 (100.0)	146 (100.0)	273 (100.0)

\*All the believed sighted were  $\leq 7$  years old.

Approval was obtained from the London School of Hygiene and Tropical Medicine, from the University of Nigeria Teaching Hospital Medical Ethics Review Board and also the State ministries of education. Informed consent to have the children examined was obtained from the parents of the children and head teachers of the participating schools.

### Study definitions

Blindness and visual impairment were classified according to WHO categories.<sup>18</sup> Similarly, deafness and HI were classified according to WHO hearing-level categories.<sup>16</sup> The WHO categories of blindness and HI are shown in tables 1 and 2, respectively. For the purpose of this study, disabling hearing loss was taken as any participant with an audiometric reading of  $>40$  dB in the better ear.

Participant: consenting student who developed HI or visual impairment before the age of 15 years.

DSI: For the purpose of this study, DSI was defined as presenting VA  $<6/18$  in the better eye and average audiometric reading  $>40$  dB in the better ear.

Subjective DSI: DSI detected in a participant by staff or pupils without any objective measurement.

Objective DSI: DSI in a participant detected by audiological and visual testing.

Special school: a school that exclusively educates the deaf or the blind students.

### RESULTS

There were 273 participants. In the blind schools the coverage was 127/139 (91.4%) while in the deaf schools it was 146/167

(87.4%). The male female ratio was 1.2:1. Their mean age was  $14.7 \pm 4.6$  years.

The majority (95.1%) of children in the deaf schools had normal vision, while 89% of children in the blind schools were blind as shown in table 1.

In the blind schools, almost 30% of students were considered to have slight HI while 12% of them had disabling HI  $>40$  dB. The various grades of HI of the children are shown in table 2.

DSI was detected by the schools in  $<3\%$  cases (subjective) while the rest were diagnosed after the study (objective) as shown in table 3.

### Detected (subjective) DSI

There were seven subjective cases of DSI in the special schools. The four detected cases of DSI in the deaf schools were visually impaired from Goldenhar's syndrome with limbal dermoids, corneal dystrophy and two cases of correctable refractive error. Their causes of deafness were microtia with congenital aural atresia from Goldenhar's syndrome, postinfective otosclerosis and two cases of undetermined hearing loss.

The three cases of detected DSI in the blind school were blind from optic atrophy, anophthalmos and cataract. The causes of HI were undetermined. Their level of HI ranged from moderate to severe.

### Total (objective) DSI

As many as 19/273 (7%) children in the special schools had DSI as shown in table 3. There was almost a threefold increase in the number of participants that were objectively detected when compared with the subjectively detected cases of DSI. About 12% (15/127) of students in the blind school had objectively determined DSI. There was more DSI in the blind schools than in the deaf schools ( $p=0.003$ ). About 63.2% (12/19) of DSI was previously undetected. The most common causes of visual impairment in children with DSI in the blind schools were cataract/aphakia (26.7%) and measles/VAD (20%) (as shown in table 4), while in the deaf schools it was refractive error (50%).

As much as 53.4% of blindness in students with DSI was avoidable (preventable or treatable). The causes of deafness in deaf students were indeterminate (82.8%), suspected congenital rubella syndrome (6.8%) and suspected genetic causes (otosclerosis) (5.5%).

Among the blind students with DSI two students with corneal lesions had chronic suppurative otitis media, while one student with cataract/aphakia had impacted cerumen in both ears, the removal of which did not change the category of her HI. One

**Table 2** WHO categories of hearing of the participants

WHO category	Level of hearing impairment	Levels of hearing impairment in the special education schools			
		Blind schools n (%)	Deaf schools n (%)	Total n (%)	
0	No impairment	25 dB and below	67 (52.7)	0 (0.0)	67 (24.5)
1	Slight	26–40 dB	38 (29.9)	0 (0.0)	40 (14.7)
2	Moderate	41–60 dB	10 (7.9)	5 (3.4)	13 (4.8)
3	Severe	61–80 dB	2 (1.6)	3 (2.1)	5 (1.8)
4	Profound	$>81$ dB	0 (0.0)	118 (80.8)	118 (43.2)
*	Believed deaf		3 (2.4)	20 (13.7)	23 (8.4)
*	Believed hearing		7 (5.5)	0 (0.0)	7 (2.6)
	Total		127 (100.0)	146 (100.0)	273 (100.0)

Precise audiometric readings could not be obtained.

**Table 3** Dual sensory impairment (DSI) in the special schools

	Subjective DSI			Objective DSI		
	Blind schools n (%)	Deaf schools n (%)	Total n (%)	Blind schools n (%)	Deaf schools n %	Total n (%)
DSI	3 (2.4)	4 (2.7)	7 (2.6)	15 (11.8)	4 (2.7)	19 (7.0)
No DSI	124 (97.6)	142 (97.3)	266 (97.4)	112 (88.2)	142 (97.3)	254 (93.0)
Total	127 (100.0)	146 (100.0)	273 (100.0)	127 (100.0)	146 (100.0)	273 (100.0)

student with optic atrophy was suspected to have otosclerosis. All the others had undetermined causes of HI.

## DISCUSSION

This study shows that the majority of DSI was unrecognised. Subjectively, the frequency of blind children with HI was underestimated. This difference in the frequency of objective and subjective identification of children with HI has been noted in a previous study in Bangladesh.<sup>6</sup> This is partly because deafness is an unseen deformity and is therefore not easily detected. In children with multiple handicaps, HI is often overlooked,<sup>16</sup> yet permanent HIs in children especially of the moderate, severe or profound type has a detrimental effect on language development.<sup>19</sup> The combination of hearing and vision impairment is more disabling than the sum of the impairments, often referred to as  $1+1=3$ .<sup>1</sup> This has far-reaching consequences for the social, educational and emotional development of the child. The proportion of blind students with disabling hearing loss in this study is comparable to the findings in a study in Liverpool where it was reported that 8% of visually impaired children were found to have severe hearing loss.<sup>5</sup>

The frequency of DSI in this study doesn't take into account the visually impaired children with mild hearing loss. Though not considered to be disabling, research has shown that even mild hearing loss could have a negative impact on learning in children.<sup>20</sup> There are no data on the impact of mild HI in blind children and this should be studied. The results of the children with mild hearing loss (25–40 dB) should be interpreted with caution as the ambient sound level was  $\leq 40$  dBA and this may confound the results of mild hearing loss. Nevertheless, the majority of students in the blind schools was able to distinguish sounds at  $\leq 25$  dB under similar conditions and was deemed to

have no hearing loss. These results however, indicate that children with visual impairment should undergo routine audiological assessment to detect any hearing loss and to treat appropriately and that deaf children should undergo routine visual screening. Special needs children with undetected additional disabilities have been reported in the literature. In a study of children in a special needs school in Wales, about a third of them who had never had an eye test, were found to have significant refractive errors on examination.<sup>21</sup> Also, in another study of severely or profoundly deaf children in Sheffield, a significant proportion of them was found to be visually impaired.<sup>22</sup> Therefore, the importance of screening children with one disability for other disabilities cannot be overemphasised. In developed countries, children typically developing are routinely screened for hearing and visual impairments. This screening does not occur in many LMICs, hence Olusanya<sup>23</sup> suggests universal newborn hearing screening programmes (NHSPs) to detect and treat hearing loss, so as to prevent permanently delayed and damaged speech and language development. However, limited resources and systems mitigate against implementation. This has prompted the advocacy for the development of context-specific strategies for NHSP<sup>24</sup> in Nigeria. It has been suggested that school entry hearing screening (SEHS) may be important where legislation to undertake mandatory NHSP is non-existent.<sup>25</sup> Again, the lack of resources and low level awareness of the risk of HI are challenges to developing and implementing SEHS by health or educational authorities in Nigeria.<sup>26</sup> As a fail-safe mechanism, high-risk children could be targeted in the absence of universal coverage, for example, children with a history of familial HI, exposure to ototoxic drugs or otitis media.<sup>25</sup> Our study shows that in Nigeria, blind and visually impaired children should be included in the 'children at risk list' and routinely screened for HIs at the point of diagnosis. Over 50% of childhood blindness in LMIC countries is avoidable<sup>8</sup> (preventable like vitamin A deficiency and measles or treatable like cataract) and this was reflected in the proportion of avoidable blindness in students with DSI. In the UK, children routinely undergo an eye examination at birth, at 6–8 weeks and at school entry. In addition, it is advocated that children with hearing disorders undergo targeted ocular examinations.<sup>27</sup> In LMICs the situation is different. Institutional childhood vision screening is not routinely done. So, Muhi<sup>28</sup> suggests a community-based detection, referral, treatment and follow-up programme for childhood blindness. Other authors<sup>8 15</sup> have suggested opportunistic vision screening of children and the health education of caregivers concerning childhood blindness prevention at any routine point of contact with the health system, for example, postnatal checks, immunisation or in maternal and child health clinics. This has been piloted in Tanzania with moderate success.<sup>29</sup> Vision screening has the potential to identify, refer and manage avoidable causes of blindness.

Much of DSI is avoidable. In the deaf schools, 50% of the deaf children with DSI had correctable refractive errors. However, the cause of HI in these schools was largely

**Table 4** Causes of blindness and levels of hearing impairment of children with DSI in the blind schools

Causes of blindness	Level of HI		Total N	Per cent
	Moderate	Severe		
Treatable blindness				
Cataract/aphakia	3	1	4	26.7
Buphthalmos	1	0	1	6.7
Preventable blindness				
Cornea (measles/vitamin A deficiency)	3	0	3	20.0
Others				
Optic atrophy	0	2	2	13.3
Anophthalmos/microphthalmos	0	2	2	13.3
Disorganised/removed/phtthisis	1	0	1	6.7
Cortical blindness	2	0	2	13.3
Total	10	5	15	100.0

DSI, dual sensory impairment; HI, hearing impairment.

indeterminate. This is not unusual as the cause of deafness in LMIC countries is not easy to determine, especially where history is sketchy<sup>14</sup> and there are no clinical records.

The combined problem of vision and hearing loss is a neglected issue,<sup>30</sup> more so for children in LMIC countries. The majority of the developed countries have special needs and educational services for people with deafblindness.<sup>1</sup> In LMICs, educational and social services for childhood disability are undeveloped and tend to alienate rather than integrate disabled children into the wider society.<sup>31</sup> Also, children with disability are inadequately assessed and therefore their choice of educative rehabilitation may be inappropriate.<sup>32</sup> The deafblind category is not recognised in Nigeria and hence there is no specific provision for educating the child with DSI. The United Nations Convention for the Rights of People with Disabilities encourages member states to ensure that visually and hearing impaired children are appropriately educated with effective individualised support to maximise their academic and social development.<sup>33</sup> There is a need to create awareness that this group of persons exists and to formulate policies that will facilitate their inclusion in social and educational environments.

### Recommendations

The majority of DSIs was avoidable. There is a need to build the capacity of primary healthcare workers for early detection of lesions causing blindness or deafness.<sup>34</sup> Children with one impairment be screened for other impairments as early in life as possible, especially children with visual impairment. Robust context-specific operational research should be carried out to determine the most cost-effective and appropriate strategies for screening. Rehabilitative services for school children should be developed. There should be intersectoral cooperation between the rehabilitative, educational and health services.

### Limitations of the study

The audiological exam was done in a classroom in the quietest area in the school. It was not possible to sound proof the classroom. A portable generator was used to power the audiometer and this may have added to the ambient sound level. Notwithstanding, audiometry was carried out when the ambient sound levels were always  $\leq 40$  dBA.

### CONCLUSION

It is hoped that the results of this study will be used as an advocacy tool for planning intervention strategies for children with disabilities in Nigeria.

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**Data sharing statement** The authors are willing to share the original study protocol and anonymised data set used for the analysis on request to fellow researchers.

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