

# Child Deafness in Sub-Saharan Africa: Experience of Two ENT Services in Casamance, South of Senegal

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## Abstract

**Introduction:** Hearing impairment is the most common sensory deficit at birth. It is a public health problem because of the repercussions on the communication development, on the education and subsequent social integration of the child. The objective of this study was to determine the epidemiological, clinical, audiometric and etiological profiles of child deafness in Casamance, South of Senegal. **Materials and Methods:** This was a retrospective multi-center study, which extended a period of 7 years from January 1<sup>st</sup>, 2012 to December 31<sup>st</sup>, 2019. All children aged between 1 to 18 years old and received during their first ENT consultations at the regional and PEACE hospital in Ziguinchor were included. **Results:** One hundred and seventy-eight records of children were collected during this period, that is a prevalence of 1.30%. The average age was 9 years old. Conductive hearing loss was found in 68% of patients, followed by reception hearing deafness in 24%. The deafness was acquired in the majority of cases (93%) and the predominant etiology was infectious. However, the cause was unknown in 7.51% of cases. **Conclusion:** Child deafness is common in Casamance and is most often underdiagnosed. The acquired forms are the most common, hence the importance of early detection after a rigorous family investigation.

## Keywords

Deafness, Children, Casamance, Senegal

## 1. Introduction

Deafness is the most commonly encountered sensory deficit in children [1]. Deafness in children differs from that in adults because it prevents normal speech and language acquisition [2]. The hearing impaired child is one whose hearing acuity is insufficient and may impact psychosocial development [3]. The World Health Organization (WHO) estimates that 32 million worldwide children suffer from disabling hearing loss, or a hearing loss superior to 30 decibels (dB) in the better ear. It ranks third on the list of disabling non-fatal conditions in low- and middle-income countries and is a public health problem because of its significant developmental implications of communication, and subsequent social integration of the child [4] [5]. In sub-Saharan Africa, the WHO estimated in 2012 a prevalence of deafness at 1.9% [6] and while there are studies on hearing impairment overall, those of child deafness are not numerous. However, the available data indicate that this prevalence remains high and that a large part of this deafness is preventable or curable [4] [5].

In Senegal, the child deafness problem constitutes a major societal challenge. This is why lines of research should be increasingly considered to better understand the deafness of children.

The objective of our study was to shed light on the situation of deafness children in southern Senegal and to analyze the epidemiological, clinical, audiometric and etiological profiles of deafness in children.

## 2. Patients and Method

We conducted a retrospective multicentric study in the ENT departments of the regional and peace hospital in Ziguinchor over a period of 7 years, from January 1<sup>st</sup>, 2012 to December 31<sup>st</sup>, 2019. The target population was children and older children aged between 1 to 18 years with a hearing impairment who had benefited from functional exploration when necessary. We have selected the medical records of patients meeting these selection criteria. Information was collected from consultation records, operating report registers and archives retained for this research. Analysis of the series was performed using data from the patient's clinical observation charts. The studied variables were grouped into epidemiological, clinical, audiometric and etiological parameters. They were: sex, age (at the first consultation), geographic origin (Casamance borders Gambia and Guinea Bissau), the reason for consultation, the risk factors, the deafness type, the deafness degree (assessed on the average of the tonal thresholds, on the frequencies 500, 1000, 2000 and 4000 Hz on the better ear), as recommended by the International Bureau of Audiophonology [7], or, for children whose diagnosis was made while they were too young to respond reliably and accurately on a tonal audiometric examination by the V-wave detection threshold on the recording of early auditory evoked potentials. Deafness was classified as mild for a threshold between 21 dB and 40 dB, medium for a threshold between 41 and 70 dB, severe for a threshold between 71 and 90 dB and deep for a threshold superior to 90 dB, the side of the impairment and etiology. Thus, collected data were analyzed us-

ing the software Epi info 7.2.2.6 and Microsoft Excel 2016. Data were entered and processed using Microsoft Word and Excel software from the Office 2016 pack.

### 3. Ethical Considerations

Not required for this retrospective study. The database was kept in a secure location accessible only by medical staff.

### 4. Results

Out of a total of 13.641 patients seen in ENT consultation during the study period, 178 children had a hearing impairment, that is to say a hospital prevalence of 1.30%. There were 104 boys and 74 girls, a sex ratio of 1.4. The average age was 9 years with extremes ranging from 1 to 18 years. One hundred and sixty patients (89.9%) came from the city of Ziguinchor (**Figure 1**).

Clinically, the involvement was bilateral in 135 patients. Hearing loss was the most common reason for consultation in 175 patients followed by otalgia (**Figure 2**).

By referring to the risk factors of hearing impairment defined by the joint committee of infant hearing, we found risk factors of deafness in 24.71% patients (n = 44). Recurrent ear infections were the most common risk factor (**Table 1**).

**Audiometric data:** In our series, 123 patients received an introductory tone audiogram, or 69.10% of the studied cases. The recording of auditory potentials (AEP) was carried out in 03 children (1.69%).

In the majority of cases it was conductive deafness (**Figure 3**) and the deafness was bilateral in 76% of cases. It was mild in 53 patients, medium in 26 patients, deep in 24 patients and severe in 13 patients. In addition, 2 patients presented had a cophosis.

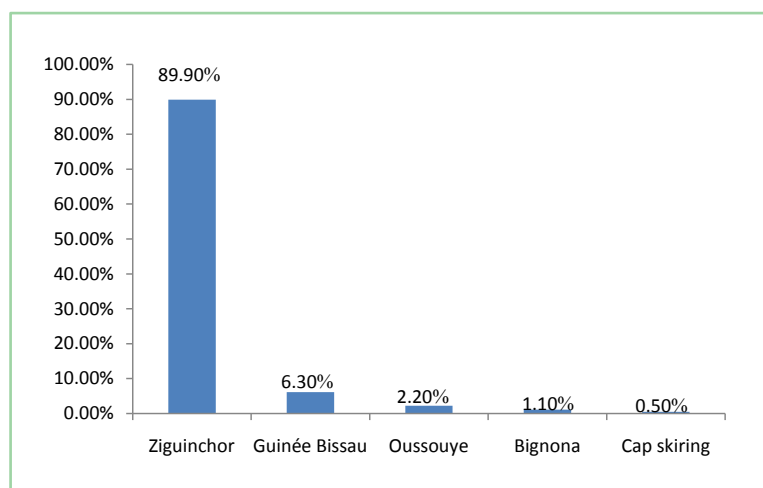
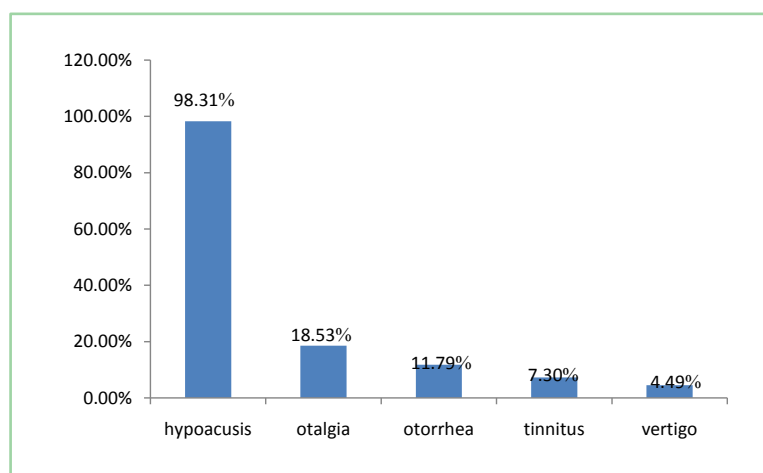
**Etiological data:** Acquired etiologies predominated 93.26% over congenital etiologies. They were mainly represented by ear infections followed by obstacles in the outer ear (earwax plug or foreign body) (**Table 2**). In 7.51% of cases the etiology of the deafness was unknown.

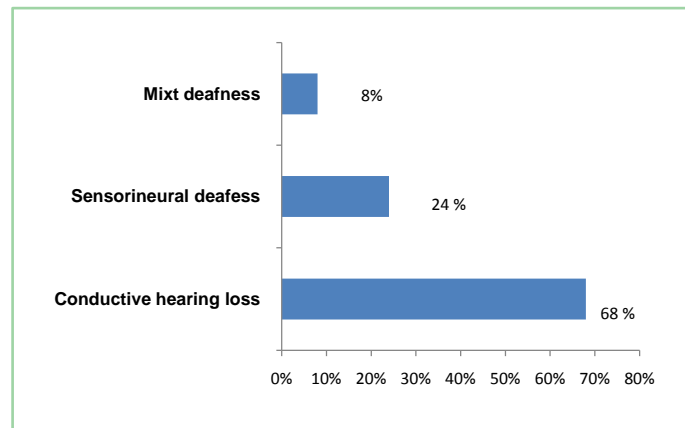
**Table 1.** Risk factors for deafness.

Risk factor for deafness	Number of cases	Percentage
Recurrent ear infections	25	56.81
Bacterial meningitis	9	20.45
Head trauma	4	9.09
Neuromalaria	2	4.54
Surgery	1	2.27
Neonatal suffering	1	2.27
Consanguinity	1	2.27
Varicella	1	2.27
Total	44	100

**Table 2.** The etiologies of deafness.

Etiologies	Number of cases	Percentage
Ear infections	89	50.20
Neonatal suffering	1	0.58
Surgery	1	0.58
Foreign bodies	2	1.16
Varicella	1	0.58
Head trauma	4	2.31
Neuromalaria	2	1.16
Bacterial meningitis	9	5.20
Earwax plugs	56	30.64
Unknown	13	7.51
Total	178	100

**Figure 1.** Distribution of patients by geographic origin.**Figure 2.** Distribution of children according to the reason for consultation.



**Figure 3.** Distribution of children by type of deafness.

## 5. Discussion

**Epidemiological data:** Between 3 and 6 per 1000 worldwide children were born with a hearing problem in at least one ear. Deafness is thus one of the most common disorders in newborns. The overall prevalence of disabling deafness in sub-Saharan Africa is estimated at 1.9% among children [6]. In Ivory Coast on a sample of 6459 children, 218 had deafness, that to say a prevalence of 3.37% [8]. In our study, in Casamance, the hospital prevalence of deafness was 1.30%.

We obtained a sex ratio of 1.4 with a male predominance. Tea and al. reported in their study that there were as many deaf girls as there were boys [8]. In Greece [9], a study involving 153 deaf children has reported 57% of boys and 43% of girls. This male predominance, also almost constant in African literature, has been reported by Diallo in Guinea Conakry and Boko in Togo [5] [10]. The causes of this disparity remain unknown but do not seem to influence the etiological data [11]. According to Garabedian, the common age for diagnosis of child deafness is 16 to 23 months with deep deafness [2]. The diagnosis average age found in our study was 9 years. It is superimposable on that of Ndiaye [12]. We therefore observe a late diagnosis of deafness in our country. This fact is explained by the trivialization of deafness by those around them who often ignore the indirect signs. They only realize the problem when their children start school [12]. The lack of screening tests in children at risk contributes to the increase in the age of diagnosis. In black Africa, in many countries, there is still no established policy for the early diagnosis of deafness.

**Clinical data:** The child deafness diagnosis is always an emergency because subsequent language development is at stake. The time between the first doubts on the part of people around them and rehabilitation is still dramatically long and detrimental for the child [11]. Often difficult to detect, a child's deafness can be diagnosed either after the discovery of warning signs by the child's entourage, his school environment or health professionals (which motivates a consultation), or following an audiological assessment systematically performed for children at high risk of hearing impairment [13]. Gesell and Amatruda [14] very minutely

described, from 1947, a certain number of symptoms leading to suspect hearing impairment in children, classifying them with these rubrics: hearing and comprehension of language, vocalization and sound production, visual attention and mutual understanding, emotional behavior. In our study, hypoacusis was the first sign noticed by parents and relatives and prompted a consultation.

The Joint Committee on Infant Hearing (JCIH) defined the risk factors for hearing impairment [15] and grouped them into antenatal, neonatal and post-natal factors.

These risk factors should lead to verification of the hearing and therefore to the practice of an audiological assessment. JCIH's first recommendations were based on screening only children at high risk of hearing damage. However, this targeted screening can only detect 50% of deafness. This implies the need to apply a universal screening program for deafness in children; this program should be of interest not only to children at risk but also to children without risk factors [11].

An ENT group that had developed a neonatal hearing screening program for the Champagne Ardenne region in France, involving 29,944 births in 2 years of experience, reported a rate of 54% of cases with one or more risk factors [16]. Prematurity is a major risk factor. The literature on hearing impairments associated with the perinatal period reports that there is a high rate of hearing impairment in children who weigh very little at birth [11]. Ozturk reported that 0.5% of studied child deafness were former premature babies [13].

In the literature, embryofetopathy represents 5% of all sensorineural hearing loss in children [10]. The fact that we did not have any in our study would be due to unsuccessful or poorly monitored pregnancies and the screening for un-systematic TORCH infections in expectant mothers. In our series, 2.27% of the children had neonatal distress. These results can be superimposed on the data in the literature where the prevalence of child deafness that required a stay in an intensive care unit is 2% to 4% [11]. The post-meningitis deafness represented 20.45% in our study. This rate is much higher than that of certain data in the literature where 9% of acquired hearing loss in children was due to meningitis [17]. It therefore appears necessary to do an audiometric examination after any meningitis, without waiting for the warning signs, so as to quickly establish appropriate treatment, giving the child the best chances of acquiring or preserve oral language [11]. The risk factors for deafness found in our study are roughly similar to studies carried out in Togo [10] and in Côte d'Ivoire [8].

These results should arouse considerable epidemiological interest, and lead to discussion of a real preventive policy.

**Audiometric data:** According to data from the literature, conductive hearing loss is the most common hearing loss in children, due to middle ear problems with possible medical or surgical treatment and therefore often transient [2]. They are 10 times more frequent than sensorineural hearing loss which often affects the inner ear with greater severity and the treatment of which is radically

different [2] [17]. Asbaisi and Ozcan had found a strong predominance of sensorineural hearing loss with a very high rate of 92.2% [11] [13]. The value of binaural listening has been recognized for years. Hearing with two ears makes it possible to localize sounds and understand the sound space [18]. In our study, there were more children who were deaf in both ears than in one ear. Mbou's study in Martinique children reported similar results [19]. Until recent years, the diagnosis and treatment of children with unilateral deafness was neglected by most teams. However, recent work has shown that this one-sided deafness can cause communication and learning difficulties. In children, unilateral deafness causes speech recognition problems in ambient background noise such as that which exists in primary classes. These children are ten times more likely to repeat a grade than children who can hear well [11]. The prevalence of deafness varies depending on the severity of the condition (Table 3). Studies by Fortnum and Davis [20] show that the prevalence of postnatal deafness (PNS) decreases with increasing severity and almost half of neonatal deafness is moderate hearing loss.

**Etiological data:** The etiological assessment is an essential step in the diagnosis of deafness. Some characteristics specific to child deafness in Casamance seem useful to note: deafness due to consanguineous marriages, iatrogenic deafness (ototoxicity, traditional treatment, etc.), neonatal deafness due to lack of adequate obstetric and pediatric care in remote areas, post-meningitis deafness, deafness resulting from chronic infectious processes of the middle ear (cholesteatoma), deafness after surgery, deafness as a result of cerebral form of malaria. An African study on the prevalence and causes of hearing loss in Africa, had reported that more than 75% of hearing loss occurring in infancy is secondary or acquired hearing loss (Table 4) [21]. In our study, congenital deafness was isolated and therefore non-syndromic although no genetic counseling was performed. In a study of the western population, Mansbach *et al.* [22] found about 50% of deafness in children of genetic origin (congenital), 40% of non-genetic (acquired) origin and about 10% of unknown cause. This indicates the importance of genetic counseling in children in search of an etiology for the deafness [5].

## 6. Study Limits

In our context and during the period of our study, the diagnosis of deaf children in Casamance was not at all easy. The limits were financial and the technical platform insufficient. In terms of the technical platform: We only had one tonal audiometer for the entire region. Children who needed other deafness diagnostic tools (acoustic otoemissions, potential auditory evokes, behavioral audiometry, impedancemeter, etc.) had to go to the city of Dakar, the capital of Senegal. Newborn screening was impossible. Financially: The deafness of many children could not be explored because it was necessary to go to Dakar, located about 460 km from Casamance. Their parents did not have the financial means.

**Table 3.** Severity of hearing impairment.

Studies	Moderate deafness	Severe deafness	Deep deafness
FORTNUM United Kingdom [20]	56%	18%	26%
OZCAN OZTURK Turkey [13]	9%	23.3%	67.7%
<b>Our study</b>	<b>22.03%</b>	<b>20.34%</b>	<b>11.02%</b>

**Table 4.** Acquired etiologies.

	ASBAISI [11]	DIALLO [5]	Our study
Meningitis	20%	42%	<b>5.20%</b>
Otitis	15.2%	–	<b>50.20%</b>
Mumps	17%	–	–
Measles	–	2.4%	–
Cerumen cap	15.4%	–	<b>30.64%</b>
traumatic	2.6%	–	<b>2.31%</b>
Neonatal	19.3%	9.7%	<b>0.58%</b>
cerebral malaria	–	–	<b>1.16%</b>
Foreign bodies in the ear	–	–	<b>1.16%</b>
Varicella	–	–	<b>0.58%</b>
Ototoxicity	21%	3.2%	–
Unknown	23.6%	22.6%	<b>7.51</b>

–: undetermined.

## 7. Conclusion

Hearing is an infinitely precious sense for a child. In Casamance the difficulty and the peculiarity lie in the ignorance of the entourage of the deaf child, the delay in diagnosis, the absence of specialized audiology units with pediatric orientation and of specialized personnel, the preponderance of etiologies acquired, and the inadequacy of schooling. It is essential that the parents and those close to the deaf child can recognize the signs likely to suggest a hearing loss and without delay take him to a specialist consultation. About half of deafness cases could be prevented. Diagnosed and treated early, the child has every chance of developing favorably.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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