# What are the Predictive Causes of Conductive Hearing Loss in School-Age Children in Jordan?

*Wala' S. Alaqrabawi,[1] Amneh Z. Alshawabka,[2] Zainab M. Al-Addasi,[3]*

*Jehad A. Alaraifi [1]*

**Abstract**

**Objective:** The aim of this study was to investigate the types and the possible causes of hearing loss in school-age children in Jordan to raise awareness in the society regarding the importance of early identification and intervention. It is based on the results of a tested sample of school-age children in the city of Amman in Jordan.

**Methods:** A sample of 90 school-age children (50 males, 40 females) who failed the hearing screening which was conducted in 40 randomly selected schools. Their ages ranged from 5 to 15 years. Testing was conducted using otoscopic examination, tympanometry and pure tone audiometry screening.

**Results:** It was concluded that those school-age children who presented with conductive hearing loss were the vast majority of the sample (60%) compared to those with sensorineural hearing loss (40%). As for the predicted cause of conductive hearing loss, the biggest cause was most probably due to ear wax (46%), followed by otitis media with effusion (22%), eustachian tube dysfunction (17%), tympanic membrane perforation (11%) and other causes (4%) respectively.

**Conclusions:** Audiological health services and hearing care awareness in the school system in Jordan must be addressed and improved.

**Keywords:** Audiological health services and hearing care awareness in the school system in Jordan must be addressed and improved.

*(J Med J 2016; Vol. 50 (4):187-194)*

| ***Received*** | ***Accepted*** |
|---|---|
| *Feb. 10, 2016* | *Aug. 21, 2016* |

## Introduction

According to American Speech Language and Hearing Association (ASHA), the number of individuals who have hearing loss in the United States increased radically during the last 30 years[1]. Many studies have reported that hearing loss among school-age children is a serious health problem specially in developing countries.[2,3,4,5] The prevalence of hearing loss in school-age children in Jordan is 5.5%.[6] Hearing loss in children will affect their receptive as well as expressive language development. Vocabulary repertoire will be

**1. Department of Hearing and Speech Sciences, School of Rehabilitation Sciences, The University of Jordan.**
**2. Department of Orthotics and Prosthetics, School of Rehabilitation Sciences, The University of Jordan.**
**3. Hearing and Speech Clinic, The University of Jordan, Amman, Jordan.**
**** Correspondence should be addressed to:***
**Wala' S. Alaqrabawi, Department of Hearing and Speech Sciences, School of Rehabilitation Sciences, The University of Jordan.**
**E-mail: w.aqrabawi@ju.edu.jo**

less than expected and they may have problems, in several language components, such as syntax and semantics. Speech skills will also be behind; their articulation skills as well as voice (e.g., pitch and loudness) might be affected. Moreover, they will have academic, social and emotional difficulties.[7,8] Additionally, literacy skills as well as academic achievement will be affected negatively in those children. These children may not continue their higher education. A study conducted on speech of university students in Jordan stated that none of the students reported a hearing problem,[9] and this could be due to the fact that individuals with hearing loss may not continue their higher education. Hearing loss has also negative impacts on the social life of the child. Children with hearing loss might become socially isolated because of the difficulties they have in making a proper communication with other children. These children might also be criticized due to their low communication performance. This might result in a low self-esteem.[10] According to the World Health Organization, the negative impacts of hearing loss in children are much more pronounced in developing countries than other countries in the world.[2]

Hearing loss can be conductive, sensorineural or mixed. There are several causes of conductive hearing loss (in the outer or middle ear) in children which might be wax, tympanic membrane perforation or otitis media with effusion. Sensorineural hearing loss (in the inner ear or the eighth cranial nerve) might occur as a result of infectious diseases such as meningitis and measles, ototoxic drugs, exposure to noises or hereditary.[11,12]

A number of studies have investigated the causes of hearing loss in the school systemin different countries in the world.[11,13,14] According to available information, two studies were conducted on infants focusing on the prevalence and risk factors of hearing loss in Jordan.[15,16]One study reported a prevalence of1.5% [15] and another study reported a prevalence of 1.37%.[16] In India, it was reported that 12.5% of school-age children have hearing loss with the biggest number of school-age children having ear wax, then otitis media with effusion, then with suppurative otitis media respectively.[5] Another study was conducted on 45 Saudi preschool children found that 84.4% of the children had conductive hearing loss while 15.6% of the children had sensorineural hearing loss. The biggest number of children presented with otitis media with effusion, followed by chronic otitis media and wax, then tympanic membrane perforation consecutively.[17] A study was conducted on school-age children in Egypt found that the majority of the hearing loss cases diagnosed was eustachian tube dysfunction, then sensorineural hearing loss, impacted cerumen, secretory otitis media and suppurtive otitis media, respectively.[18]Some kinds of hearing loss are treatable and can be controlled as soon as the problem is detected, such as ear wax and tympanic membrane perforation. Children with hearing loss might also need sound amplification devices and aural rehabilitation. Therefore, the earlier the problem is identified, the better treatment results are.[19]Early intervention is very important in pointing out children who present with hearing loss and addressing their problems. A team including the audiologist and the speech pathologist is held in order to provide hearing and speech intervention.[20]Some countries screen hearing for newborns which makes it easier to provide early intervention and target hearing issues

earlier if hearing loss is detected.[21] However, this is not applied in Jordan yet. It is hoped that there will be an early speech and hearing intervention so that it can be easier to help infants and children before it is too late.

There is a scantiness of information about the causes of hearing loss in Jordan. The present study will tackle pathologies of hearing loss in Jordan and discuss issues related to the findings. The main goal of this paper is to raise awareness among the society, especially the parents and professionals in charge of dealing with young children. It also justifies the need for further studies and early intervention regarding hearing loss in Jordan.

## Method

### Participants:

This study used the same sample of school-age children, equipments and procedure as those reported in the previous study.[6] Hearing screening was carried out on 1649 child (990 males and 659 females) from 40 randomly selected schools. A sample of 90 school-age children, who failed hearing screening (50 males, 40 females) was studied with regard to the most probable cause of their hearing loss (based on the testing results). Their ages ranged from 5 to 15 years and their mean age was 7.9 years. The tested children were from government schools as well as private schools in the capital of Jordan, Amman. There was no consideration for economic status or the location of the school in Amman. Testing was performed between November 2010 and October 2014.The reason why the studied sample was collected from the school system was to figure out the predicted causes of hearing loss in students who were still studying and attending everyday classes without being discovered.

### Procedure:

Before conducting testing, consents were obtained from school administrators and parents. Otoscopic examination and tympanometry were performed for all school-age children to examine their outer ear canals and tympanic membranes. Tympanometry was performed with the Interacoustic MT10 portable tympanometer (Interacoustics, Assens, Denmark) by using a 226-Hz probe frequency. The results of Tympanometry were analyzed based on the British Society of Audiology recommended procedure for Tympanometry (2013).[22]Tympanograms were categorized as normal (pass) if the middle ear pressure was between -100 and 50 daPa and the middle ear compliance was between 0.3 and 1.6 $cm^3$. Eustachian tube dysfunction was expected if the middle ear pressure was less than -100 daPa. Otitis media with effusion was expected if a flat tympanogram was obtained with a normal ear canal volume (ranged from 0.4 -1.0 $cm^3$) and a reported bulging, dull or red tympanic membrane in otoscopic examination. A perforated tympanic membrane seen in otoscopic examination was confirmed by a flat tympanogram with an abnormally large ear canal volume results.

An ANSI s36-2004 calibrated portable audiometer (American National Standards Institute, 2004) with the TDH'39 supra-aural headphones was used for hearing screening. Initially, a biologic noise level check was performed at all frequencies for a normal hearing person who was previously tested on the same day of each testing. A continuous 2 to 3 seconds length pure-tone was presented at 25 dB HL in each ear individually, staring with the right then the left ear. Tested frequencies were applied in the following order: 1000, 2000, 4000 and 500 Hz. Children who failed

the testing were tested twice and the child fails the testing if he/ she does not respond to more than one frequency. Results were calculated using IBM SPSS Statistics for Windows, Version 20.0., (2011) software.

After testing was conducted, the results were shared with the schools and the parents. Additionally, children who failed hearing screening were referred for further in depth hearing evaluation and appropriate counseling regarding the importance of having hearing evaluations and the possible need for speech therapy was provided to the school teachers.

## Results

In this study, the main outcome measures included the prevalence of hearing loss types and causes among children. It was found that those who presented with conductive hearing loss were the vast majority of the sample (54, 60%), followed by sensorineural hearing loss (36, 40%). In terms of children with conductive hearing loss, it was found that 21children (23%) have bilateral hearing loss while 20 children (22%) have unilateral hearing loss in the right ear and 13 children (15%) have unilateral hearing loss in the left ear. For children with sensorineural hearing loss, half of the children (18 children, 20%) were found to have bilateral hearing loss and the other half of children have unilateral hearing loss either in the right ear (6 children, 10%) or in the left ear (6 children, 10%) (Figure 1).

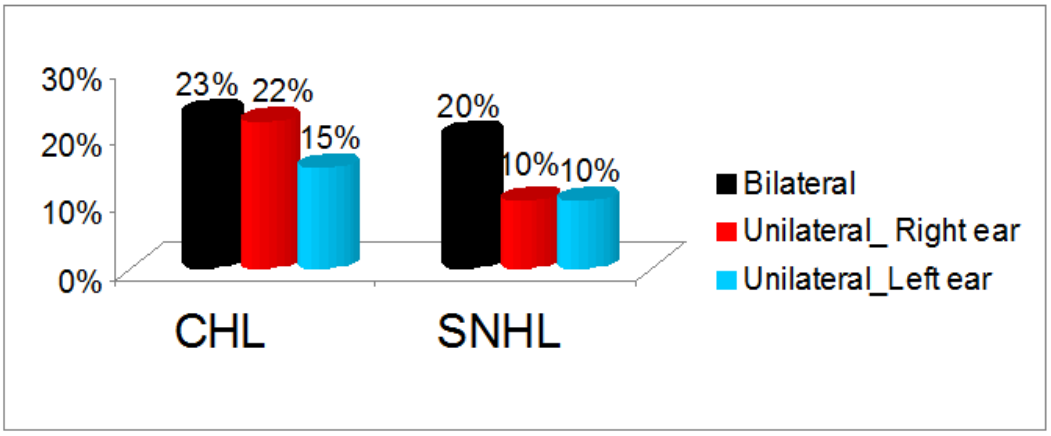


**Figure 1: Percentage of school-age children with conductive hearing loss (CHL) and sensorineural hearing loss (SNHL)**

There were 54 children (60%) who had conductive hearing loss at least in one ear due to the following possibilities: (1) Otitis Media with Effusion (OME) (12 children, 22.2%), (2) occluded earwax (25 children, 46.3%), (3) perforated tympanic membrane (6 children, 11.1%), (4) eustachian tube dysfunction (9 children, 16.6%) and (5) other factors such as external ear canal stenosis and atresia (2 children, 3.8%) (Figure 2).

## Discussion

This is the first study on the prevalence of possible types and causes of hearing loss among Jordanian school-age children. Our results show that conductive hearing loss is more prevalent than sensorineural hearing loss among school-age children. This finding is consistent with the findings of previous studies of hearing loss among children in Saudi Arabia, Egypt and India.[17,18,5] One possible

explanation for this reported high prevalence of conductive hearing loss could be that children have more horizontal, wider, shorter and straighter eustachian tubes than those for adults.[23] These eustachian tube characteristics make it easier for children to have a bacterial or viral middle ear infection and make it harder for their ears to clear the fluid. Furthermore, direct contact between the large numbers of children in schools makes the spread of ear infectious diseases rapid and easy.[23] A high prevalence of conductive hearing loss can be significantly decreased as most of conductive hearing loss causes can be medically treated while other untreatable conductive hearing loss effect can be minimized by sound amplification devices such as F. M. system and hearing aids.[24]

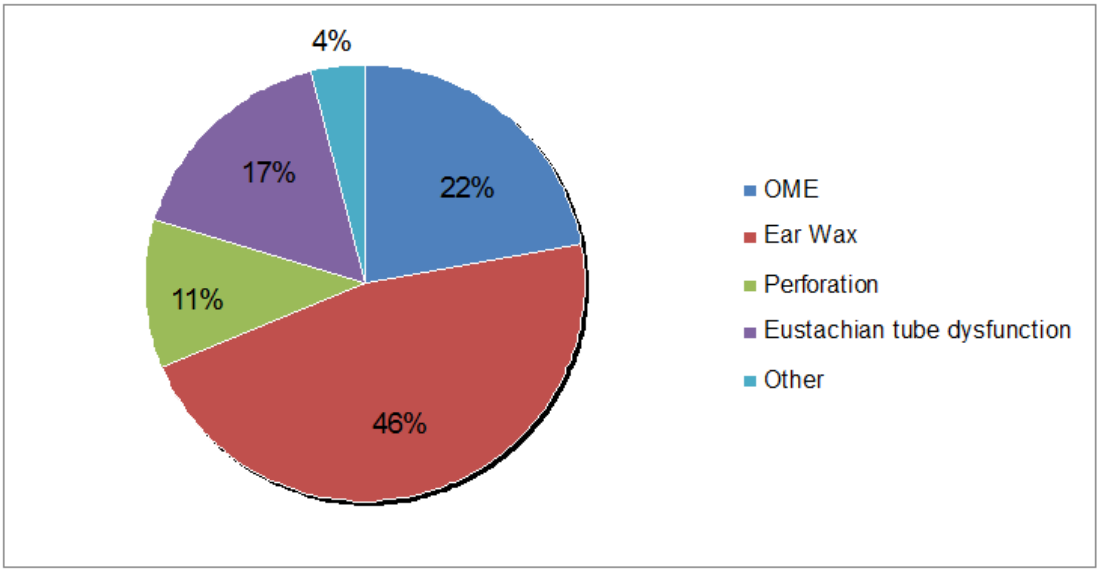


**Figure 2: Percentage of the possible causes of conductive hearing loss**

In the present study, we have found that the most common cause of conductive hearing loss is occluded earwax followed by otitis media with effusion, eustachian tube dysfunction, perforated tympanic membrane and other causes such as congenital malformations of external ear canal respectively. These findings are consistent with the findings of the causes of conductive hearing loss in India.[5] However, according to the results of the previous studies in other middle eastern countries, the most common cause in Saudi Arabia is otitis media[17] and in Egypt is eustachian tube problems.[18]This dissimilarity in the results might be due to the better health services and better ear and hearing care awareness in Saudi Arabia. For example, the study conducted in Saudi Arabia mentioned that audiological screening is routinely conducted in the schools that were included in the study[17].

The current study found a high prevalence of unidentified sensory neural hearing loss. This seems reasonable probably because of the lack of newborn hearing screening and absence of parents and teachers awareness in Jordan. The results of this study showed that there is a fairly big number of school-age children who silently suffer from hearing problems that can be treated (such as ear wax and otitis media with effusion), and nothing

was done to help them. These children might be facing academic as well as social problems and frustration.[8] This issue is very important because lack of intervention leads to an individual who faces the society with hearing and communication disabilities and this could have been avoided. Early intervention is a need and it should be targeted in schools. Additionally, teachers should know that some students' performance might be due to factors such as hearing loss. Parents should also be encouraged to contact otolaryngologists, audiologists, or speech pathologists if they suspect that their child has any hearing difficulty.

**Limitations and Future Directions**

This cross sectional study is useful in giving a basic idea about the most frequent causes of hearing loss in the school system in Jordan. However, it was conducted in one city in Jordan due to time and financial constricts. Having the samples collected from one city will not give a clear idea about the schools in rural as well as urban areas in the whole country of Jordan. It is suggested that future studies target a bigger number of children spreading in different areas in Jordan. It will be more representative and this will help spreading awareness in less served areas. It is also suggested that a future investigation be conducted on the causes of sensorineural hearing loss.

**Conclusion**

According to the research results, there is a high percentage of treatable conductive hearing loss. Therefore, it is recommended to implement and improve audiological health services in Jordan schools to reduce the negative educational, communicational, economic and social effects of hearing loss. A routinely annual hearing screening should be conducted in the school system in Jordan. There is a vital need to spread public awareness among school teachers, parents and other professionals working with school-age children about the causes of hearing loss, how to prevent some kinds of hearing loss and early intervention.

**References**


1. ASHA, 2015c. The prevalence and incidence of hearing loss in children. [Online; retrieved on 2015 Dec 20]. Available from: http://www.asha.org/ public/ hearing/ Prevalence-and-Incidence-of-Hearing-Loss-in-Children/
2. World Health Organization, 2015. Deafness and hearing loss.[Online; retrieved on 2015 Dec 21]. Available from: http://www.who.int/ mediacentre/factsheets/fs300/en/
3. Abdel-Rahman A, Meky F, Allam M, El-Tabakh M, El-Gaafary M. Prevalence and risk factors for hearing disorders in secondary school students in Ismailia, Egypt. East Mediterr Health J. 2007; 13 (3): 586-94.
4. Olusanya B, Okolo A, Aderemi A. Predictors of hearing loss in school entrants in a developing country. J Postgrad Med 2004; 50: 173-179.
5. Vengala R, Suraneni V, Osuri S, Uppalapati P, Amara A. Prevalence and Etiological Factors Causing Hearing Loss in School Going Children of Vizianagaram District. Int J Sci Stud 2014; 2(9): 36-40.
6. Alaqrabawi W, Alshawabkeh A, Aladasi Z. Is there a Silent Hearing Loss among Children in Jordan? Education 2016; 136(4): 503-507.
7. ASHA, 2015a. Effects of hearing loss on development. [Online; retrieved on 2015 Dec 21]. Available from: http://www.asha.org/ public/hearing/Effects-of-Hearing-Loss-on-Development/
8. Dalton C. Social-emotional Challenges Experienced by Students Who Function with Mild and Moderate Hearing Loss in Educational Settings. Exceptionality EduInt J. 2011; 21: 28-45.
9. Alaraifi J, Amayreh M, Saleh M. The prevalence of speech disorders among

university students in Jordan. College Student J. 2014; 48 (3): 425-435.
10. Punch R, Hyde M. The social participation and career decision-making of hard-of-hearing adolescents in regular classes. Deafness EducInt. 2005; 7 (3): 122-138.
11. Isaacson J, Vora N. Differential diagnosis and treatment of hearing loss. Am Fam Physician. 2003; 68 (6): 1125-1132.
12. Dollard S, Grosse S, Ross D. New estimates of the prevalence of neurological and sensory sequelae and mortality associated with congenital cytomegalovirus infection. Rev Med Virol. 2007; 17 (5): 355-363.
13. Nathan S, Minutha R. Hearing loss in otitis media with effusion- types and management- a study of hundred cases. Global Journal of Medicine and Public Health. 2012; 1 (5): 6-10.
14. Levey S, Fligor B, Ginocchi C, Kagimbi L. The effects of noise induced hearing loss on children and young adults. Contemporary Issues in Communication Science and Disorders. 2012; 39: 76-83.
15. Abu-Shaheen A, Al-Masri M, El-Bakri N, Batieha A, Nofal A, Abdelmoety D. Prevalence and risk factors of hearing loss among infants in Jordan: Initial results from universal neonatal screening. Int J Audiol. 2014; 53(12): 915-920.
16. Attias J, Al-Masri M, Abukader L, Cohen G, MerlovP,Pratt H, Othman-Jebara R, Aber P, Raad F, Noyek A. The prevalence of congenital and early-onset hearing loss in Jordanian and Israeli infants. Int J Audiol. 2006; 45: 528-536.
17. Al-Rowaily M, Alfayez A, Aljomiey M, Albadr A, Abolfotouh M. Hearing impairments among Saudi preschool children. Int J Pediatric. 2012; 76 (11): 1674-1677.
18. Taha A, Pratt S, Farahat T, Abdel-Rasoul G, Albtanony M, Elrashiedy A, Alwakeel H, Zein A. Prevalence and risk factors of hearing impairment among primary-school children in Shebin El-Kom district, Egypt. Am J Audiol. 2010; 19: 46-60.
19. Pratt S. Aural habilitation update: the role of speech production skills of infants and children with hearing loss. The ASHA Leader. 2005;10: 8-33.
20. ASHA, 2015b. Roles and responsibilities of Speech-Language Pathologists in early intervention: Guidelines. [Online; retrieved on 2015 Dec 22]. Available fro8-http://www. asha.org/policy/GL2008-00293.htm#sec1.3.4
21. Boswell S. Newborn hearing intervention. ASHA Leader. 2003; 8: 1-18.
22. British Society of Audiology (2013) Recommended Procedure for Tympanometry. [Online; retrieved on 2015 Jan 3]. Available from: http://www.thebsa.org. uk/wp-content/uploads/2014/04/BSA_RP_Tymp_Final_21Aug13_Corrected24June14.pdf
23. Sadler-Kimes D, Siegel M, Todhunter J. Age-related morphological differences in the components of the Eustachian tube-middle-ear system. Ann OtolRhinolLaryngol. 1989; 9: 854–8.
1. Hearing Link, 2012. What are F.M. systems? [Online; retrieved on 2015 Dec 21]. Available from: http://www.hearinglink.org/what-are-fm-systems

# ما هي أسباب فقدان السمع التوصيلي المحتملة لدى الأطفال بعمر المدرسة في الأردن؟

**ولاء العقرباوي[1]، آمنة الشوابكة[2]، زينب العداسي[3]، جهاد العريفي[1]**

**1- قسم علوم السمع والنطق، كلية علوم التأهيل، الجامعة الأردنية، عمان، الأردن.**

**2- قسم الأطراف الاصطناعية، كلية علوم التأهيل، الجامعة الأردنية، عمان، الأردن.**

**3- عيادة السمع والنطق، كلية علوم التأهيل، الجامعة الأردنية، عمان، الأردن.**

**الملخص**

**الهدف:** يقوم هذا البحث بدراسة أنواع وأسباب فقدان السمع لدى أطفال المدارس في الأردن وذلك لرفع مستوى الوعي بأهمية التدخل المبكر لدى المجتمع. ويعتمد هذا البحث على نتائج المسح السمعي لمجموعة من المدارس في مدينة عمان في الأردن.

**الأساليب:** تمت الدراسة على 90 طفل بعمر المدرسة ولم يجتازوا الفحص المسحي للسمع وهم 50 من الذكور و40 من الإناث حيث إن المسح كان قد أجري في 40 مدرسة تم اختيارها عشوائيا. وقد تراوحت أعمار الطلاب ما بين الخمس سنوات إلى 15 سنة. أجري البحث بتطبيق الأوتوسكوب وهو منظار الأذن وفحص الأذن الوسطى وفحص السمع باستخدام النغمة النقية.

**النتائج:** أظهرت النتائج أن أغلبية مرضى السمع كان لديهم فقدان سمعي توصيلي وبلغ عددهم 60 طفل ويليها 41 طفلاً ممن كان لديهم فقدان سمعي حسي. وبما يتعلق بأسباب فقدان السمع التوصيلي فقد كان هناك 47% من الأطفال لديهم تراكم الصمغ في الأذن ويليها 22% من الأطفال كان لديهم سوائل في الأذن الوسطى ويليهم 17% من الأطفال لديهم مشاكل في قناة أوستاكيوس و11% من الأطفال لديهم ثقب في طبلة الأذن و3% كانت هناك أسباب أخرى لمشكلتهم.

**الإستنتاج:** هناك حاجة ملحة للتركيز على وتطوير الخدمات الصحية المتعلقة بالسمع ونشر الوعي بصحة السمع في النظام المدرسي في الأردن.

**الكلمات الدالة:** فقدان سمع توصيلي، مسح سمعي، الأطفال بعمر المدرسة، صمغ الأذن، التهاب الأذن الوسطى، توعية مجتمعية، الأردن.