



## **Evaluation of the Hearing Screening Results of Newborns of Covid-19 Positive Mothers: A Retrospective Study**

Covid-19 Pozitif Annelerden Doğan Yenidoğanların  
İşitme Tarama Sonuçlarının Değerlendirilmesi:  
Retrospektif Bir Çalışma

**Yasemin SÖKMEN<sup>1</sup>, Resmiye KAYA ODABAŞ<sup>2</sup>, Bahadır YAZICIOĞLU<sup>3</sup>**

<sup>1</sup>Ondokuz Mayıs University, Faculty of Health Sciences, Department of Midwifery, Samsun.  
· ysmn0006@outlook.com · ORCID > 0000-0003-0044-4173

<sup>2</sup>Kocaeli University, Faculty of Health Sciences, Department of Midwifery, Kocaeli.  
· resmiye.odabas@gmail.com · ORCID > 0000-0002-4470-0231

<sup>3</sup>Samsun Provincial Health Directorate, Samsun.  
· bahadiryazicioglu@gmail.com · ORCID > 0000-0003-4397-2769

### **Makale Bilgisi/Article Information**

**Makale Türü/Article Types:** Araştırma Makalesi/Research Article

**Geliş Tarihi/Received:** 07 Haziran/June 2024

**Kabul Tarihi/Accepted:** 25 Mart/March 2025

**Yıl/Year:** 2025 | **Cilt – Volume:** 10 | **Sayı – Issue:** 1 | **Sayfa/Pages:** 97-107

**Atıf/Cite as:** Sökmen, Y., Kaya Odabaş, R., Yazicioğlu, B. "Evaluation of the Hearing Screening Results of Newborns of Covid-19 Positive Mothers: A Retrospective Study" Samsun Sağlık Bilimleri Dergisi 10(1), Nisan 2025: 97-107.

**Sorumlu Yazar/Corresponding Author:** Yasemin SÖKMEN

**Yazar Notu/Author Note:** 4th International 5th National Istanbul Midwifery Days Congress, 11.11.2021-14.11.2021, Oral Presentation

## EVALUATION OF THE HEARING SCREENING RESULTS OF NEWBORNS OF COVID-19 POSITIVE MOTHERS: A RETROSPECTIVE STUDY

### ABSTRACT

**Aim:** This study was conducted to evaluate the hearing screening results of newborns of COVID-19 positive mothers.

**Method:** This retrospective study was conducted in a training and research hospital in Turkey between January 2021 and January 2022. A total of 737 women with pregnancy who tested positive for COVID-19 were hospitalized in the related institution for treatment between March 11, 2020 and January 1, 2022, and 342 of them gave birth. The sample of the study consisted of 331 newborns born to COVID-19 positive mothers. Research data were collected with a Data Collection Form.

**Results:** According to the results, 50.5% of the newborns were male, and 88.2% weighed between 2500 and 4000 g. It was determined that 26.0% of the newborns could not pass the first hearing screening test and that 4.6% of these newborns could not pass the second hearing screening test. It was determined that the first newborn hearing screening was completed within seven days after birth.

**Conclusions and Recommendations:** It was determined that four newborns born to COVID-19 positive mothers could not pass the hearing screening test and that approximately one in ten newborns was not brought to the hearing screening test. In line with these results, some arrangements should be made to reduce the number of newborns who do not receive hearing screening during the COVID-19 pandemic.

**Keywords:** Congenital Infections; COVID-19; Hearing Loss; Neonatal Screening; SARS-CoV-2.



## COVID-19 POZİTİF ANNELERDEN DOĞAN YENİDOĞANLARIN İŞİTME TARAMA SONUÇLARININ DEĞERLENDİRİLMESİ: RETROSPEKTİF BİR ÇALIŞMA

### ÖZ

**Amaç:** Bu çalışmanın amacı, Covid-19 pozitif annelerden doğan yenidoğanların işitme tarama sonuçlarını değerlendirmektir.

**Yöntem:** Retrospektif olarak yapılan bu çalışma, Ocak 2021-Ocak 2022 tarihleri arasında Türkiye’de bulunan bir eğitim ve araştırma hastanesinde yürütülmüştür. İlgili kurumda 11.03.2020-01.01.2022 tarihleri arasında Covid-19 pozitif olan 737 gebe tedavi amacıyla yatışı yapılmış olup, 342 gebe doğum yapmıştır. Araştırmanın örneklemini, Covid-19 pozitif annelerden doğan 331 yenidoğan oluşturmıştır. Araştırma verileri, Bilgi Toplama Formu ile toplanılmıştır.

**Bulgular:** Yenidoğanların %50.5’inin cinsiyeti erkek olup, %88.2’si 2500-4000 gram ağırlığındadır. Yenidoğanların %26.0’sının ilk Auditory Brainstem Response testinden geçemediği ve bunlarında %4.6’sının ikinci Auditory Brainstem Response testinden geçemediği belirlenmiştir. Yenidoğan ilk işitme taramasının ise doğum sonu yedi gün içinde tamamlandığı tespit edilmiştir.

**Sonuçlar ve Öneriler:** Covid-19 pozitif annelerden doğan dört yenidoğanın işitme tarama testinden geçemediği ve yaklaşık on yenidoğandan birinin işitme tarama testine getirilmediği saptanmıştır. Bu sonuçlar doğrultusunda, COVID-19 pandemisi sürecinde işitme taraması yaptırmayan yenidoğan sayısını azaltmak için bir takım düzenlemeler yapılmalıdır.

**Anahtar Kelimeler:** Covid-19; SARS-CoV-2; Yenidoğan işitme Tarama; Doğumsal İşitme Kaybı; Congenital Enfeksiyon.



### INTRODUCTION

Hearing loss is the decreasing or loss of sound sensitivity of the hearing system (Joint Committee on Infant Hearing, 2019). Congenital hearing loss causes a delay in the speech and language development of the child, decreased mental activity, learning difficulties, academic failure, social isolation, lack of self-confidence, and professional failure (Garramiola-Bilbao & Rodriguez-Alvarez, 2016). Early diagnosis of congenital hearing loss with hearing screening tests and its treatment enables children to be more successful both in their general developmental pro-

cesses and in language, academic and social areas (Gambacorta et al., 2022). Thus inclusion of all newborns in hearing screening programs is an important issue for public health.

While global prevalence of congenital hearing loss changes between one and three in 1000 live births, this rate increases 10 times in newborns with risk factors (Gohari et al., 2020). While the prevalence of congenital hearing loss is 0.4% in high-income countries, it ranges between 1.8 and 2.2 in South Asia, Sub-Saharan Africa, and Asia-Pacific regions (Stevens et al., 2011). The prevalence of this condition has been reported as 0.02% in our country (Eras et al., 2014).

Infections with intrauterine transmission, such as cytomegalovirus, toxoplasmosis, and syphilis constitute a risk factor for congenital hearing loss (Binay, 2020). There are some studies in the literature examining the intrauterine transmission of COVID-19 infection. In a case presentation, COVID-19 was detected in the throat culture taken from a newborn 16 hours after delivery by a COVID-19 positive woman (Alzamora et al., 2020). In another study, COVID-19 was detected in the throat culture taken from two COVID-19 suspected newborns in the 24 th hour after delivery (Khan et al., 2020). Similarly, immunoglobulin M (IgM) antibodies of COVID-19 were detected in the blood samples taken from the newborns right after delivery (Dong et al., 2020; Zeng et al., 2020). These results support the intrauterine transmission of COVID-19.

Symptoms of COVID-19 are fever, cough, headache, sore throat, muscle and joint pain, fatigue, nasal discharge, sensory loss, diarrhea, dyspnea, pneumonia, and renal failure (T.C. Sağlık Bakanlığı, 2021). Although COVID-19 symptoms differ widely, some studies present hearing loss among these symptoms (Alan & Alan, 2021; Fidan, 2020; Karimi-Galougahi et al., 2020; Kılıç et al., 2020; Sriwijitalai & Wiwanitkit, 2020). Hearing loss was reported in a 39-year-old female patient diagnosed with COVID-19 in Thailand for the first time (Sriwijitalai & Wiwanitkit, 2020). Otalgia and tinnitus, which were not diagnosed previously, were detected in a patient diagnosed with COVID-19 in another study (Fidan, 2020). Also, hearing problems were stated to be observed in COVID-19 patients who had no hearing loss history or did not use otologic drugs (Karimi-Galougahi et al., 2020). Similarly, one of the patients was reported to test positive for COVID-19 in a study conducted with five patients admitted to the otorhinolaryngology clinic with complaints of sudden hearing loss in one ear (Kılıç et al., 2020).

Since intrauterine transmitted infections present a risk factor for hearing loss, there are studies showing the intrauterine transmission of COVID-19, and hearing loss has been detected in patients diagnosed with COVID-19, it is considered that the newborns of COVID-19 positive mothers may have hearing loss. In the literature, there are limited studies reporting the hearing screening results of newborns

born to COVID-19 positive mothers (Alan & Alan, 2021; Ghiselli et al., 2022; Mostafa et al., 2022; Oskovi-Kaplan et al., 2021; Roberto et al., 2022; Yıldız ve ark, 2022; Yılmaz et al., 2022; Veeranna et al., 2022). It is thought that the information to be obtained in the present study will contribute to making arrangements in health services during the COVID-19 pandemic process, improving newborn health, and presenting data to the literature. This study was conducted to evaluate the hearing screening results of newborns born to COVID-19 positive mothers.

Questions of the research:

- What is the prevalence of congenital hearing loss in newborns of COVID-19 positive mothers?

## METHOD

**Study type:** The study was carried out retrospectively in a training and research hospital in Samsun province, located in the north of Turkey, between January 2021 and January 2022.

**Study group:** A total of 737 women with pregnancy who tested positive for COVID-19 were hospitalized in the related institution for treatment between March 11, 2020 and January 1, 2022. Of these women, 342 gave birth and formed the population of our research. In the study, it was aimed to reach the entire population, and eventually, the hearing screening results of 331 newborns were evaluated retrospectively. Newborns born to mothers with positive COVID-19 Polymerase Chain Reaction test were included in the study. However, 11 newborns were excluded from the study because they did not meet the inclusion criteria (two newborns who were intrauterine exitus, one newborn who was exitus postpartum, and eight newborns who were referred to other healthcare institutions). In addition, newborns with hearing loss risk factors specified by the American Academy of Pediatrics Joint Infant Hearing Committee 2007 were excluded from the study.

**Data Collection Tools:** Research data were collected by the researchers by using a Data Collection Form. The form consisted of a total of 27 questions, including six questions on socio-demographic characteristics of women (such as age, family type, education level), 12 questions on their obstetric characteristics (such as gravida, abortus, curettage), four questions on hearing screening results of the newborns (such as the first ABR date, status of passing the first ABR test) and five questions on risk factors (such as syndromes/diseases of the newborn, family history of permanent hearing loss).

**Data Collection Process:** During the data collection process, the first researcher went to the related institution during working hours and identified the mot-

hers who were positive for COVID-19 and gave birth from birth records. She examined the birth records of the mothers and transferred their socio-demographic and obstetric information and the hearing screening records of the newborns to the Data Collection Form.

The newborn hearing screening program in the related institution is carried out in line with a protocol consisting of only Auditory Brainstem Response (ABR) test by two audiometrists. Emission tests and conventional measurements are done in a special room used for hearing screening. During the measurement, care is taken to ensure that the environment is quiet and the baby is calm and still. As the external ear channels of the newborns can be filled with vernix/fluid, they are cleaned, and then suitable probes are selected and inserted. If there is no risk factor for hearing loss in newborns that cannot pass the test for one ear or both ears, an appointment is made for a repeat ABR test one month later, and if there are risk factors, they are referred to the reference healthcare center.

**Statistical analysis:** The data of the study were analyzed using the Statistical Package for the Social Sciences 24 program. Frequency, percentage, arithmetic mean $\pm$ standard deviation, median, and minimum-maximum values were used as descriptive statistics.

#### Validity and Reliability:

**Ethical considerations:** Ethics committee approval and institutional permission were obtained to conduct the study, and the study was carried out in accordance with the principles of the Declaration of Helsinki. Consent of Sağlık Bilimleri University Samsun Training and Research Hospital Non-Invasive Clinical Researches Ethics Board on 27.01.2021 with GOKA/2021/2/8 protocol number with 2021/2 decree number was taken.

## RESULTS

The mean age of the COVID-19 positive mothers included in the study was  $28.30\pm5.61$ . It was determined that 84.6% of them had a nuclear family, 47.7% were high school graduates, and 28.7% were employed. The mean gestational week of COVID-19 positive mothers was  $38.06\pm2.00$ . It was determined that 68.3% of them were multiparous and 86.4% of them had a cesarean section in their last delivery. Also, 50.5% of the newborns were male and 88.2% of them birthweighed 2500-4000 grams (Table 1).

**Table 1.** Characteristics of the mothers and newborns (n= 331)

Characteristics	n (%)	Mean $\pm$ SD <sup>a</sup>
Age	15-17	4 (1.2)
	18-35	289 (87.3)
	36-42	38 (11.5)
Family Type	Nuclear family	280 (84.6)
	Extended family	51 (15.4)
Education Level	Primary school	28 (8.5)
	Secondary school	68 (20.5)
	High school	158 (47.7)
	University	77 (23.3)
Employed Status	Employed	95 (28.7)
	Not employed (housewife)	236 (71.3)
Place of Residence	Village/town	2 (0.6)
	District	143 (43.2)
	Province	186 (56.2)
Gestational week	28-35	27 (8.2)
	36-41	304 (91.8)
Number of Pregnancies	Primipar	105 (31.7)
	Multipar	226 (68.3)
Delivery Method	Normal vaginal delivery	45 (13.6)
	Caesarean delivery	286 (86.4)
Gender of the Newborn	Female	164 (49.5)
	Male	167 (50.5)
Birthweight	<2500	34 (10.3)
	2500-4000	292 (88.2)
	>4000	5 (1.5)

Note: Characteristics of mothers and newborns are presented as percentages.

<sup>a</sup>SD: Standart Deviation; bMin-Max: Minimum-Maximum

It was determined that 70.4% of the newborns included in the study passed the first ABR test, 26.0% could not pass the test, and that 3.6% were not brought for screening. Of the newborns who could not pass the first ABR test and took the second test, 88.4% passed the test, while 4.6% failed. Also, 7.0% of the newborns who could not pass the second test were not brought to the screening (Table 2).

**Table 2.** Hearing screening results of the newborn (n= 331)

Hearing Screening Results		n (%)
ABR test passing condition in the first measurement	Passed	233 (70.4)
	Failed	86 (26.0)
	Did not brought to the screening	12 (3.6)
Second ABR test passing condition (n= 86)	Passed	76 (88.4)
	Failed	4 (4.6)
	Did not brought to the screening	6 (7.0)

Note: Hearing screening results of newborns born to Covid-19 positive mothers are presented.

<sup>a</sup>SD: Standart Deviation; bMin-Max: Minimum-Maximum

This study, 3.6% of the newborns were not brought for first screening and 7.0% of the newborns who could not pass the first test were not brought to the screening. The period from birth to the first hearing screening was determined as seven days (Table 2).

**Table 3.** Hearing screening time (n= 331)

Hearing Screening Results	n (%)	Mean $\pm$ SD <sup>a</sup>
First ABR test did not brought to the screening	12 (3.6)	-
Second ABR test did not brought to the screening	6 (7.0)	-
Mean time between the delivery and first measurement (Min-Max <sup>b</sup> : 1-55)	-	7.99 $\pm$ 8.41
Mean time passing between the first ABR test and control ABR (Min-Max <sup>b</sup> : 1-27)	-	3.63 $\pm$ 7.12

<sup>a</sup>SD: Standart Deviation

## DISCUSSION

In the study conducted to evaluate the hearing screening results of newborns born to COVID-19 positive mothers, it was determined that four newborns could not pass the hearing screening test. Similar to our study finding, several case-control studies confirmed newborns delivered to pregnant mothers infected with the COVID-19 infection during pregnancy had an increased risk of developing neonatal hearing loss (Alan & Alan, 2021; Celik et al., 2021; Veeranna et al., 2022; Yilmaz et al., 2022). The researchers conclude newborns exposed to COVID-19 infection intrauterine have a medial olive cochlear efferent system deficit (Celik et al., 2021). Similarly, revealed that newborns with COVID-19-infected mothers were more likely than the control group to have a refer ABR (Alan & Alan, 2021). Veeranna



et al. (2022) observed normal cochlear function and impaired ABR in newborns whose mothers experienced COVID-19 infection. Contrary to our study finding, there are studies in the literature reporting that there is no relationship between maternal COVID-19 infection and neonatal hearing loss (Dang et al., 2020; Ghiselli et al. 2022; Meng et al., 2022; Mostafa et al. 2022; Oskovi-Kaplan et al. 2021; Roberto et al. 2022; Yıldız et al., 2022). Oskovi-Kaplan et al. compared the TEOAE outcomes of 458 newborns born to mothers with a history of COVID-19 infection during pregnancy to those of 339 newborns born before the COVID-19 infection found no statistically significant difference between the groups (Oskovi-Kaplan et al., 2022). Although these studies imply that maternal infection does not affect the newborn's hearing, none of them had a control group, making it impossible to compare them. After maternal COVID-19 infection, the auditory system of the newborn may be affected due to intrauterine hypoxia and vertical transmission. In mid-and late pregnancy, COVID-19 infection might have a more significant effect on hearing loss in newborns.

An effective screening program should screen at least 95% of newborns and target 100% (American Academy of Pediatrics, 1999). In our study, it was determined that approximately one in ten newborns had not been brought to the screening test. Similar to our study finding, in another study conducted in the United States, it was reported that the number of newborns without hearing screening test increased during the Covid-19 pandemic process (Dundon et al., 2022; Pour Mobarakeh et al, 2022). It has been reported that this situation is caused by the insufficient number of health personnel, the change of working hours and days of health institutions, the early discharge of mothers in the postpartum period, and the postponement of health care services due to parents' concerns about Covid-19 infection (Dundon et al., 2022; Greczka et al., 2022). It is recommended that the working hours of healthcare professionals conducting a hearing screening program should be arranged over seven days during the COVID-19 pandemic period. The process also includes some arrangements, such as conducting the hearing screening test of newborns in maternity services; screening of newborns who didn't take a hearing screening test, failed the test, and are hospitalized in intensive care unit before they are discharged; making an appointment to newborns failing the hearing screening test; prioritizing newborns with risk factors for hearing loss; confirmation of parent contact information (National Health Service in England, 2020). Therefore, we think that more qualified information should be given to postpartum mothers about the importance and continuation of the hearing screening program before they are discharged from the hospital. In addition, it is important that health professionals working in primary care who screen newborns should inform parents about the importance of hearing screening programs and refer them to healthcare centers.

Completion of newborn hearing screening in the first month following the delivery, diagnosing newborns with hearing loss before the third month, and star-

ting treatment in newborns diagnosed with hearing loss before the sixth month constitute the criterion in hearing screening programs (Dundon et al., 2022; Joint Committee on Infant Hearing, 2019). In our study, it was determined that the newborn hearing screening was completed in seven days after delivery. It was observed that the newborn hearing screening program in our study was similar to other studies in the literature and that it was compatible with newborn hearing screening program criteria.

## CONCLUSION AND RECOMMENDATION

In line with these results, to reduce the number of newborns who have not taken a hearing screening test during the COVID-19 pandemic process, the working hours of health professionals should be arranged, newborns should be screened before they are discharged, and newborns at risks should be given priority. It is recommended that mothers should be provided with detailed information on the importance of hearing screening programs by midwives and nurses during the discharge training in the post-delivery period and that mothers coming to primary care institutions in the postpartum period should be questioned about the result of the newborn hearing screening test, and if it was not taken, they should be referred to the related healthcare center. It may be recommended to plan quantitative and qualitative studies with both newborns and adults to examine the effects of infections on hearing loss.

## LIMITATIONS AND STRENGTHS

The study has several limitations. The first is that there are many factors affecting the hearing functions of newborns and confounding factors cannot be controlled in retrospective studies. The second is that the study was also conducted retrospectively.

The strength of our research is that it provides new information to the literature on Covid-19 infection and neonatal health. This study was a retrospective analysis of medical records. Since this study was conducted in only one hospital, its results cannot be generalized to other institutions. In this study, it was concluded that four newborns born to COVID-19 positive mothers could not pass the hearing screening test, approximately one in ten newborns were not brought to the hearing screening test, and that the majority of the newborns were tested within the first seven days after birth.

## Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Conflict of Interest

The authors report that there are no competing interests to declare.

## Author Contribution:

Design of Study: YS (%50), RKO (%30), BY (%20)

Data Acquisition: YS (%100)

Data Analysis: YS (%100)

Writing Up: YS (%70), SB (%20), BY (%10)

Submission and Revision: YS (%50), RKO (%50)

## REFERENCES

- Alan, M. A., & Alan, C. (2021). Hearing screening outcomes in neonates of SARS-CoV-2 positive pregnant women. *Int J Pediatr Otorhinolaryngol*, 146, 110754. <https://doi.org/10.1016/j.ijporl.2021.110754>
- Alzamora, M. C., Parades, T., Caceres, D., Webb, C. M., Valdez, L. M., & La, Rosa, M. (2020). Severe Covid-19 during pregnancy and possible vertical transmission. *Am J Perinatol*, 37, 861-865. <https://doi.org/10.1055/s-0040-1710050>
- American Academy of Pediatrics. (1999). Newborn and infant hearing loss: detection and intervention. Task force on newborn and infant hearing. *Pediatrics*, 103, 527-530. <https://doi.org/10.1542/peds.103.2.527>
- Binay, K. (2020). Covid-19 pandemi sürecinde işitme kayıplı bireylere yaklaşım. *Selçuk Med J*, 1, 54-61. <https://dergipark.org.tr/download/article-file/1208948>
- Celik, T., Simsek, A., Koca, C.F., Aydin, S., & Yasar, S. (2021). Evaluation of cochlear functions in infants exposed to SARS-CoV-2 intrauterine. *Am J Otolaryngol*, 42(4), 102982. <https://doi.org/10.1016/j.amjoto.2021.102982>
- Dong, L., Tian, J., He, S., Zhu, C., Wang, J., Liu, C., & Yang, J. (2020). Possible vertical transmission of SARS-CoV-2 from an infected mother to her newborn. *JAMA*, 323, 1846-1848. <https://doi.org/10.1001/jama.2020.4621>
- Dundon, K., Ema, S., Deng, X., Morrison, J., Brown, T., White, K., Hazard, L., Fort, M., Coverstone, K., Mason, C. A., & Gaffney, M. (2022). Likely impact of the COVID-19 pandemic on newborn hearing screening and follow-up services in the United States in 2020. *JEHDI*, 7(3), 1-5. <https://doi.org/10.26077/bdtm-7v57>
- Eras, Z., Konukseven, O., Aksoy, H. T., Canpolat, F. E., Genç, A., Sakrucu, E. D., Develioğlu, O., & Dilmen, U. (2014). Post-natal risk factors associated with hearing loss among high-risk preterm infants: Tertiary center results from Turkey. *Eur Arch Otorhinolaryngol*, 271, 1485-1490. <https://doi.org/10.1007/s00405-013-2653-3>
- Fidan, V. (2020). New type of corona virus induced acute otitis media in adult. *Am J Otolaryngol*, 41, 102487. <https://doi.org/10.1016/j.amjoto.2020.102487>
- Gambacorta, V., Orzan, E., Molini, E., Lapenna, R., Paniconi, M., Di Giovanni, A., Faralli, M., & Ricci, G. (2022). Critical issues in the management of newborn hearing screening in the time of COVID-19 in Umbria, Italy. *Children*, 9, 1736. <https://doi.org/10.3390/children911736>
- Garramiola-Bilbao, I., & Rodríguez-Alvarez, A. (2016). Linking hearing impairment, employment and education. *Public Health*, 141, 130-135. <https://doi.org/10.1080/09638288.2022.2076938>
- Ghiselli, S., Laborai, A., Biasucci, G., & diğerleri: (2022). Auditory evaluation of infants born to COVID19 positive mothers. *Am J Otolaryngol*, 43(2), 103379.
- Greczka, G., Dąbrowski, P., Zych, M., Szyfter, W., & Wierzicka, M. (2022). The impact of the COVID 19 pandemic on the functioning of the universal newborn hearing screening program in Poland. *Otolaryngol Pol*, 76(4), 36-41. <https://doi.org/10.5604/01.3001.0015.9079>

- Gohari, N., Farahani, F., Gharebaghy, S., Alaei, S., Ahmadi, S., & Mozafari, Z. (2020). The prevalence of hearing loss in infants hospitalized in the neonatal intensive care units. *Aud Vestib Res*, 29, 197-203. <https://doi.org/10.18502/avrv29i4.4638>
- Joint Committee on Infant Hearing. (2019). Year 2019 position statement: Principles and guidelines for early hearing detection and intervention programs. *Journal of Early Hearing Detection and Intervention*, 4(2), 1-44. <https://doi.org/10.15142/fptk-b748>
- Karimi-Galougahi, M., Naeini, A. S., Raad, N., Mikaniki, N., & Ghorbani, J. (2020). Vertigo and hearing loss during the Covid-19 pandemic-is there an association? *Acta Otorhinolaryngol Ital*, 40, 463-465. <https://doi.org/10.14639/0392-100X-N0820>
- Kaynak, S., Tari, Selçuk, K., & Karadaş, A. (2016). Bandırma devlet hastanesi yenidoğan işitme tarama sonuçları (2011-2014). *İKÇÜSBFD*, 1, 9-12. <https://dergipark.org.tr/tr/download/article-file/251743>
- Khan, S., Jun, L., Nawsherwan, Siddique, R., Li Y., Han, G., Xue, M., Nabi, G., & Liu, J. (2020). Association of Covid-19 infection with pregnancy outcomes in healthcare workers and general women. *Clin Microbiol Infect*, 26, 788-790. <https://doi.org/10.1016/j.cmi.2020.03.034>
- Kılıç, O., Kalcioğlu, M. T., Çağ, Y., Tuysuz, O., Pektaş, E., Caskurlu, H., & Cetin F. (2020). Could sudden sensorineural hearing loss be the sole manifestation of Covid-19? An investigation into SARS-COV-2 in the etiology of sudden sensorineural hearing loss. *IJID*, 97, 208-211. <https://doi.org/10.1016/j.ijid.2020.06.023>
- Meng, X., Zhu, K., Wang, J., & Liu, P. (2022). Can SARS-CoV-2 positive pregnant women affect the hearing of their newborns: A systematic review. *Am J Otolaryngol*, 43(5), 103523. <https://doi.org/10.1016/j.amjoto.2022.103523>
- Mostafa, B. E., Mostafa, A., Fiky, L. M. E., Omara, A., & Teaima, A. (2022). Maternal COVID-19 and neonatal hearing loss: a multicentric survey. *Eur Arch Otorhinolaryngol*, 279(7), 3435-3438. <https://doi.org/10.1007/s00405-021-07098-5>
- National Health Service in England. (2020). Newborn hearing screening programmes technical guidance and management of audiology referrals during the coronavirus (Covid-19) pandemi. <https://www.baaudiology.org/app/uploads/2020/04/Newborn-Hearing-Screening-Technical-Guidance-during-Covid19.pdf>
- Oskovi-Kaplan, Z. A., Ozgu-Erdinc, A. S., Buyuk, G. N., Sert-Dinc, U. Y., Ali-Algan, C., Demir, B., Sahin, D., Keskin, H. L., Tayman, C., & Moraloglu-Tekin, Ö. (2022). Newborn hearing screening results of infants born to mothers who had COVID-19 disease during pregnancy: A retrospective cohort study. *Ear Hear*, 43(1), 41-44. <https://doi.org/10.1097/AUD.0000000000001167>
- Pour, Mobarakeh, Z. I., Mehrbakhsh, F., Amiri, M., & Amiri, M. (2023). Have newborn hearing screening programs been affected by the COVID-19 pandemic?, *Hearing, Balance and Communication*, 21, 2, 76-81. <https://doi.org/10.1080/21695717.2022.2122334>
- Roberto, G., Andrea, M., Maria, L. L., Davide, R., Sara, P., Emilia, D., Antonio, P., & Francesco, B. (2022). The Impact of COVID-19 on universal newborn hearing screening. *Ear and Hearing*, 43(6), 1917-1919. <https://doi.org/10.1097/AUD.0000000000001255>
- Sriwijitalai, W., & Wiwanitkit, V. (2020). Hearing loss and Covid-19: a note. *Am J Otolaryngol*, 41, 102473. <https://doi.org/10.1016/j.amjoto.2020.102473>
- Stevens, G., Flaxman, S., Brunskill, E., Mascarenhas, M., Mathers, C. D., & Finucane, M. (2011). Global and regional hearing impairment prevalence: an analysis of 42 studies in 29 countries. *Eur J Public Health*, 23, 146-152. <https://doi.org/10.1093/eurpub/ckr176>
- T.C. Sağlık Bakanlığı. 2021. COVID-19 (SARS-COV-2 enfeksiyonu) genel bilgiler, epidemiyoloji ve tani. <https://covid19.saglik.gov.tr/Eklenti/39551/O/covid-19rehberigenelbilgilerepidemiolojivetanipdf.pdf> [Accessed date: June 12, 2024].
- Veeranna, S. A., Youngblood, P. L., Bradshaw, L., & Marx, C. G. (2022). COVID-19 during pregnancy and its impact on the developing auditory system. *Am J Otolaryngol*, 43(4), 103484. <https://doi.org/10.1016/j.amjoto.2022.103484>
- Yıldız, G., Kurt, D., Mat, E., Yıldız, P., Başol, G., Gündoğdu, E. C., Kuru, B., Topcu, B., & Kale, A. (2022). Hearing test results of newborns born from the coronavirus disease 2019 (COVID-19) infected mothers: A tertiary center experience in Turkey. *The Journal of Obstetrics and Gynaecology Research*, 48(1), 113-118. <https://doi.org/10.1111/jog.15008>
- Yılmaz, Y. Z., Tüten, A., Çakan, D., Kara, E., Akşahin, E., Gülmez, Z. D., & Batioğlu-Karaaltın, A. (2022). The relationship between the presence of Severe Acute Respiratory Syndrome-Coronavirus-2 during pregnancy and neonatal hearing loss. *Istanbul Med J*, 23(2), 144-148. <https://doi.org/10.4274/imj.galenos.2022.83707>
- Zeng, H., Xu, C., Fan, J., Tang, Y., Deng, Q., Zhang, W., & Long, X. (2020). Antibodies in infants born to mothers with Covid-19 pneumonia. *JAMA*, 323, 1848-1849. <https://doi.org/10.1001/jama.2020.4861>