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COMMISSION FOR THE EARLY DETECTION OF HEARING LOSS

Postnatal hearing loss. Progressive, late-onset or acquired hearing loss in children: 2023 CODEPEH recommendations

Sorderas postnatales. Sordera infantil progresiva, de desarrollo tardío o adquirida: recomendaciones CODEPEH 2023

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MINISTRY OF SOCIAL RIGHTS AND THE 2030 AGENDA
ROYAL BOARD ON **DISABILITY**

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SUMMARY

Postnatal childhood hearing loss is the hearing disorder detected after birth. There are three types: progressive, late-onset and acquired. These are compounded by those attributed to the lack of sensitivity of diagnostic technology or non-compliance with protocols.

Progressive hearing loss can be hereditary or associated with syndromes and neurodegenerative diseases. Postnatal hearing loss varies in terms of age, progression rate, affected frequencies and severity. Late-onset hearing loss is related to normal neonatal hearing that deteriorates afterwards. Acquired hearing loss results from external factors that can damage the ear.

This CODEPEH document aims to provide guidance on the need for protocols for the early detection of postnatal hearing loss. New lines of application of the early childhood hearing screening programme are necessary, configured as a continuous hearing prevention service, both to monitor cases that do not pass the neonatal screening or have risk factors and to detect postnatal cases.

KEYWORDS

Early hearing loss detection, late-onset hearing loss, permanent hearing loss in children, risk factors, postnatal hearing screening.

RESUMEN

La hipoacusia infantil postnatal es el trastorno auditivo que se detecta después del nacimiento. Existen tres formas de presentación: progresiva, de desarrollo tardío y adquirida. A éstas se añaden las atribuidas a falta de sensibilidad de la tecnología diagnóstica o al incumplimiento de los protocolos.

La hipoacusia progresiva puede ser hereditaria o asociada a síndromes y enfermedades neurodegenerativas. La pérdida auditiva postnatal se presenta de forma diversa en cuanto a la edad, tasa de progresión, frecuencias afectadas y gravedad. La de desarrollo tardío se relaciona con una audición neonatal normal que se deteriora después. La hipoacusia adquirida resulta de factores externos que pueden dañar el oído.

En este documento de la CODEPEH se pretende orientar sobre la necesidad de protocolos para la detección precoz de la sordera postnatal. Son necesarias nuevas líneas de aplicación del programa de detección precoz de la sordera infantil, configurado como un servicio continuo de prevención auditiva, tanto para realizar el seguimiento de los casos que “no pasan” el cribado neonatal o presentan factores de riesgo, como para detectar los casos postnatales.

PALABRAS CLAVE

Detección precoz de la hipoacusia, hipoacusia de desarrollo tardío, hipoacusia infantil permanente, factores de riesgo, cribado auditivo postnatal.

CONTENTS

1. INTRODUCTION

Early intervention in childhood hearing loss has proven effective in reducing or eliminating the effects of hearing impairment on children's language, cognition and social skills (Yoshinaga-Itano, 2003). Universal neonatal screening programmes have been implemented across Western countries to identify congenital hearing loss early to great success, but not all loss in childhood is detectable in this period.

Monitoring children with risk factors for hearing loss is recommended to ensure the early detection and treatment of postnatal childhood hearing loss (Joint Committee on Infant Hearing, 2019; Núñez-Batalla *et al*., 2015). There is also evidence that follow-up of children with risk factors is not sufficient to detect all cases. The prevalence observed in different studies is variable, with figures for postnatal hearing loss ranging from 16% to 50% (Fortnum *et al*., 1997; Van Naarden *et al*., 1999; Fortnum *et al*., 2001; MacAndie *et al*., 2003). These divergent prevalence data may be explained by the different observation periods of the studies and the different criteria as to when hearing loss is considered postnatal.

The definition of postnatal hearing loss applies to hearing impairment detected after birth, although the time of onset may be unknown. There are three types: progressive, late-onset and acquired. Additionally, some forms of hearing loss can be attributed to lack of sensitivity of the diagnostic technology used or lack of compliance or adherence to established protocols.

Progressive hearing loss is often hereditary or associated with neurodegenerative diseases and syndromes. Hearing loss in newborns can later become more severe with a wide variety of forms of presentation in terms of age, progression rate, affected frequencies and severity. Late-onset hearing loss is related to normal neonatal hearing that deteriorates afterwards. Acquired hearing loss results from numerous external factors that can directly or indirectly damage hearing, such as the after-effects of otitis or meningitis, the administration of ototoxic drugs or head or acoustic trauma (Weichbold *et al*., 2006).

Postnatal hearing loss is the hearing disorder detected after birth, although the time of its onset may be unknown

This new CODEPEH Recommendations Paper aims to provide guidance on the need for effective protocols for the early detection and treatment of postnatal hearing loss. The current debate turns on having scientific benchmarks and new lines of application of the programme for the early detection of childhood hearing loss configured as a continuous hearing prevention service throughout childhood, both to follow up cases that "fail" neonatal screening and for children with hearing risk factors, and to detect cases of postnatal hearing loss. The Paper is centred on the study of postnatal hearing loss, focusing on its classification and aetiology and proposing prevention and detection strategies.

This proposal fits within the actions mandated in our legal framework, which must be developed

within the scope of preventing and reducing the appearance of new disabilities or the intensification of preexisting ones (Ministry of Social Rights and the 2030 Agenda, 2023). It is also posited on and aligned with the Convention on the Rights of Persons with Disabilities (CRPD), in particular articles 25 and 26, especially in terms of "the best interests of the child", which the CRPD states should considered "across all actions undertaken by public or private social welfare institutions (...)". From a rights, equality and nondiscrimination approach, this is the ideal strategic framework and one that brings the precise value to the content addressed in this Paper.

There is a need for scientific benchmarks and new lines of application of the programme for the early detection of childhood hearing loss configured as a continuous hearing prevention service throughout childhood, beyond the neonatal period

2. POSTNATAL HEARING LOSS. DEFINITIONS AND AETIOLOGY

2.1. Progressive and late-onset hearing loss

In clinical practice it is difficult to distinguish between progressive and late-onset hearing loss since they are both diagnosed after birth and the children may have passed the hearing screening. This means the difference between them can only be defined on a theoretical level.

Late-onset hearing loss happens after neonatal screening and is not present at the time of the tests. Hearing is therefore normal at birth. However, the aetiology determining its onset already exists at birth for the development of hearing loss going forwards.

Progressive hearing loss, by contrast, is already present at birth but goes undetected due to limitations in screening technology. The explanation for this is related to mild or restricted hearing loss at certain frequencies of the auditory spectrum not detectable until months or years later when it progresses and becomes recognisable, both symptomatically and in audiological tests.

It is therefore appropriate to study late-onset and progressive hearing loss together.

The most frequent causes include:

Genetics

More than 119 genes are associated with sensorineural or mixed hearing loss (Lieu *et al*., 2020). Thirty percent of genetically caused hearing loss falls within syndromes frequently associated with late-onset or progressive hearing loss, such as Pendred, Usher and Alport syndromes (Sloan-Heggen *et al*., 2016).

In general, many syndromic hearing losses may present as non-syndromic in the first years of life and later manifest other associated anomalies.

Many non-syndromic recessive genes are also associated with late-onset or progressive hearing loss. The genes associated with these cases are GJB2 (connexin 26), MYO15A and STRC. There are also non-syndromic dominant genes that

cause progressive hearing loss, such as TMC1 and KCNQ4.

Infections

Late-onset or progressive hearing loss can also follow congenital infections. Prenatal exposure to agents grouped under the term TORCH complex, which includes toxoplasmosis, others (syphilis, hepatitis B), rubella, cytomegalovirus and herpes simplex, has been associated with congenital hearing loss.

However, the epidemiology of these microorganisms has changed and only congenital cytomegalovirus (CMV) infection is now a substantial cause of late-onset hearing loss in many countries, since more than 43% of children with a congenital CMV infection will pass neonatal screening and develop sensorineural hearing loss years later (Fowler *et al.*, 2017).

Other recently emerged viruses, such as the Zika virus, have also been linked to hearing loss (Ficenec *et al.*, 2019).

Associated to inner ear malformations

Enlarged vestibular aqueduct is the most common innerear malformation associated with sensorineural hearing loss. It has been described within systemic syndromes such as Pendred, Waardenburg and renal tubular acidosis, but can also occur non-syndromically or in isolation (Forli *et al.*, 2021). Its diagnosis is based on imaging tests (computed tomography or magnetic resonance imaging), through which the enlargement of the vestibular aqueduct can be seen when the diameter measurement at the midpoint of the aqueduct exceeds 1.5 mm (Aimoni *et al.,* 2017).

There are three types of postnatal hearing loss: progressive, late-onset and acquired

2.2. Acquired hearing loss

This is produced by supervening pathogenic noxae not present at birth causing hearing loss. The noxae cause tonotopic reorganisation in the inferior colliculus and both unilateral and bilateral hearing loss produce the same changes, although in unilateral hearing loss, human studies show an altered interhemispheric activation pattern with almost complete disappearance of contralateral dominance (Eggermont, 2017).

Acquired hearing loss is due to trauma, infection, ototoxic drugs, autoimmune disorders or exposure to intense noise.

Of the preventable causes of childhood hearing loss, the World Health Organization attributes 31% to infections, 17% to postnatal complications around childbirth, 4% to the administration of ototoxic drugs and 8% to other causes (WHO, 2016).

Secretory otitis media is the most common cause of childhood hearing loss in developed countries. In up to 90% of children it will appear before school age and children typically have four episodes per year on average (Mandel *et al*., 2008). Permanent hearing loss related to post-otitis sequelae has a prevalence of 2 to 35 per 10,000 (Qureishi *et al*., 2014; Rosenfeld *et al.,* 2016).

Trauma can cause transmissive, sensorineural or

mixed hearing loss, depending on the location and type of damage to the temporal bone (Ishman and Friedland, 2004; Kenna, 2015; Chen *et al*., 2018).

Infectious causes that can lead to sensorineural hearing loss include mumps, measles, varicella zoster, Lyme disease, bacterial meningitis and, rarely, otitis media (Cohen *et al.*, 2014).

Late-onset or late diagnosis of hearing loss may also be due to limitations in screening technology and/or errors in the application of the recommended protocol

Ototoxic drugs can cause permanent hearing loss. Certain mitochondrial variants may confer increased susceptibility to the toxic effects of aminoglycosides (Núñez-Batalla *et al.*, 2021).

Autoimmune hearing loss may be due to a primary dysfunction in the inner ear or to a systemic disorder such as Cogan syndrome (interstitial keratitis, progressive hearing loss and vestibular dysfunction) (Maiolino *et al.*, 2017). There are several genes associated with autoinflammation (Nakanishi *et al.,* 2020).

Noise-induced hearing loss in children is underdiagnosed and there are very few studies on its prevalence. In the US, between 12% and 15% of schoolchildren have some hearing deficit attributable to noise exposure. A Scandinavian study of 538 adolescent boys revealed a hearing loss greater than 15 dB in 15% of cases. Similarly, a German review estimated that 1 in 10 adolescents had some degree of noise-induced hearing loss due to exposure during leisure and recreational activities. In China, a study of personal listening-device users found impaired hearing (loss greater than 25 dB) in 14%. A survey found hearing problems in 12% of the general population, but in a subgroup that frequently attended rock concerts or used personal music players (more than seven hours a week), this increased to 66% (Harrison, 2008).

3. LATE DETECTION AND DIAGNOSIS

Reasons for late detection or diagnosis of hearing loss include limitations in screening technology and/or errors in the application of the recommended protocol.

3.1. Limitations in screening technology

Limitations inherent in a hearing screening protocol include (Núñez-Batalla *et al.*, 2020):

- Degree or frequency of hearing loss. Hearing screening tests, both otoacoustic emissions (OAEs) and automatic auditory evoked potentials (aAEPs), are designed to detect moderate to severe hearing loss at specific frequencies. Some children with mild hearing loss or hearing loss at certain frequencies can pass the test.
- Conductive hearing loss. Some screening tests, such as aAEPs, may not detect mild conductive hearing loss. OAEs are impacted less by this limitation (Duan *et al*., 2022).
- Time of onset. Newborn hearing screening is

usually performed in the first days or weeks after birth. However, hearing loss can occur later.

- "False negative" result. This type of result means a child may have a degree of hearing loss but it is not picked up by the test. A "false negative" could be due to technical problems with the equipment, incorrect test performance or other factors. In the case of OAEs, special attention must be paid to retrocochlear hearing loss.

It is important to note that hearing screening tests are a valuable tool for identifying hearing loss but they are not infallible (Dedhia *et al*., 2013).

3.2. Errors in the application of the screening protocol. Losses in the process

Loss to follow-up refers to cases of children who do not complete the recommended follow-up testing or evaluation after an impaired hearing screening. In some published cases this is as high as one-third of initially screened newborns (Jafarzadeh *et al*., 2023). It also refers to children with identified risk factors, or not, who pass the initial screening. Both can develop late-onset postnatal hearing loss if the recommended follow-up is not performed (Núñez-Batalla *et al*., 2015; Jafarzadeh *et al*., 2023).

It is necessary to identify, prevent and solve the factors that impact losses in the follow-up of cases that fail neonatal screening and for children with risk factors

This loss to follow-up may be due to several factors that need to be understood and addressed (Fitzgibbons *et al*., 2023):

- Lack of awareness or understanding. Parents may not be fully aware of the importance of follow-up testing after an impaired hearing assessment, or may not fully understand the instructions or recommendations provided by the health professionals. In the case of at-risk children, the importance of the identified factors may not be understood. Parents may be unaware of the potential impact of untreated hearing loss on their child's development.
- Language or communication barriers. Limited command of the local language or cultural differences may make it difficult for the family to understand the need for follow-up testing after an impaired hearing assessment or the presence of hearing risk factors.
- Access barriers. Limited access to health services, including transportation difficulties, financial constraints, lack of availability of facilities/specialised paediatric audiology services, or long waiting lists may prevent the timely completion of recommended follow-up testing.
- Other responsibilities or priorities. Families may have other responsibilities, work or other family and/or health problems that make

it difficult for them to prioritise and complete follow-up testing. This may be particularly relevant in cases with other associated diseases and/or disabilities.

- Problems related to screening methods. Some hearing assessment methods can be difficult to perform or interpret accurately, requiring several evaluations. This can lead to uncertainty or confusion for families and consequent loss of trust and follow-up.
- Personal beliefs or cultural factors. Beliefs or misconceptions around hearing loss and hearing screening may influence families' decision-making regarding follow-up testing, assessments or interventions.
- Economic constraints. Costs associated with follow-up assessments, such as diagnostic hearing tests, the fitting of hearing aids or implants, or other interventions can be a barrier.
- Stigma or fear of diagnosis. Some families may experience stigma associated with hearing loss or be fearful of the diagnosis and, as a result, may be reluctant to attend or keen to avoid follow-up assessments or interventions.
- Incomplete medical history. In some cases, health professionals may not have access to the child's full medical history, including information about hearing test results, family history or exposure to possible risk factors during pregnancy or birth. They may also not have been adequately trained to identify hearing risk factors.

Regular screening for babies and young children is needed to ensure early detection and appropriate interventions

- Errors in screening data collection. Particular care must be taken in the collection and classification of screening results, since it can lead to a lack of adequate follow-up, as shown in A. MacKey's thesis where 11% of children who supposedly passed the OAE test should not have according to their OAE data. There was probably an error on the part of the assessor in mistakenly recording a normal result (Mackey, 2022).
- Other causes of loss to follow-up. In situations where neonatal screening was not performed or where children have been removed from the family home, cases must come from Primary Care to have a screening. This situation may result in the time limits set for diagnosis being exceeded or the test not being performed at all.

4. PREVENTION AND DETECTION STRATEGIES

As mentioned above, hearing screening tests are important and necessary, but they are not infallible (Dedhia *et al*., 2013). Regular hearing assessments are needed during infancy and childhood to ensure the early detection of any hearing loss and appropriate interventions, if necessary.

Additional testing and assessment should also be guaranteed in cases where hearing loss is suspected or risk factors for hearing loss are known, and in those who fail neonatal screening or subsequent hearing assessments. It is therefore important there is no loss to follow-up due to the factors described above (Yong *et al*., 2020; Chibisova *et al*., 2022).

Health professionals can take a number of measures. These include:

- Take a thorough medical history. It is necessary to ask about family history and possible risk factors during pregnancy or childbirth to help identify children at increased risk of hearing loss.
- Provide adequate training. Healthcare professionals should be trained in the identification of hearing risk factors, the proper conduct of hearing tests and the interpretation of results.
- Verify the correct recording of screening results.
- Inform parents and carers about the importance of follow-up.
- Schedule appointments before the child leaves the health facility or following discharge or attendance at the initial outpatient visit.
- Provide interpretation services or translated materials to assist families with a different language.
- Remind families of upcoming appointments by phone, app, text message and/or email.
- Offer flexible appointment scheduling options.
- Provide resources for families to attend appointments.
- Identify and address any socioeconomic barriers.

Most postnatal hearing loss appears after the age of three and in many cases there are no recognisable risk factors at birth. The prevalence of permanent hearing loss increases with age

For the early detection of postnatal hearing loss, both the Joint Committee (Joint Committee on Infant Hearing, 2019) and CODEPEH (Núñez-Batalla *et al*., 2015) propose follow-up for children with or without risk factors for hearing loss, even if they have passed neonatal screening, through to the age of 3-5 years. Hearing skills, middle ear status and developmental milestones should be assessed at each regular well-child visit. However, studies show that this is not enough, as most postnatal hearing loss occurs after the age of three and in many cases there are no recognisable risk factors at birth.

The prevalence of permanent hearing loss in childhood increases with age. Early detection programmes for neonatal hearing loss are therefore not sufficient to detect all hearing loss throughout childhood. It is thus necessary to develop further initiatives leading to the early detection of postnatal hearing loss (see figure), which should be considered a major health problem that needs to be assessed and treated appropriately and immediately upon detection.

Postnatal hearing loss should be considered a major health problem that needs to be assessed and treated appropriately and immediately upon detection

Sensory disabilities may go unnoticed in children due to their high capacity for adaptation. Hence the need and justification for postnatal screening, given that the disease to be diagnosed also meets frequency and severity criteria and benefits from early diagnosis, the technology exists to facilitate it and there are clear socioeconomic savings.

The benefits of postnatal screening are:

- Academic performance. Hearing loss in children can significantly impact their learning and social interactions. Good hearing is essential for effective communication in the classroom. School-based screening helps identify potential hearing problems early, allowing for intervention and support to minimise the impact on the child's educational and social experiences.
- Speech and language development. Early detection and intervention through school-based screening will help identify children at risk for speech and language delays and/or disorders. Early identification enables hearing-aid fitting, speech therapy intervention and other necessary support for child and family.
- Equal opportunities. School-based screening helps deliver equal opportunities. By identifying a hearing impairment early on, schools can provide the necessary support and interventions, enabling full and equal engagement in educational activities and an equal-learning experience with other students.
- Public health impact. School-based screening is also part of public health initiatives. It can help identify children with hearing loss who may not have had access to health services. Early identification enables referral to the appropriate professionals.

Postnatal screening at child health programme check-ups, at the time of starting school and at the beginning or end of each educational stage is therefore highly recommended.

Currently in Spain, in addition to monitoring children with risk factors for hearing loss, the primary-care setting has the check-ups established in the "Well Child" programme, which includes hearing assessment. These screenings are ideal to rule out postnatal hearing loss.

However, there is no state-wide school-based screening programme. Policies and practices around screening may vary according to the autonomous community and decisions made at the local level - hence the wide variation in public health and education policies regarding postnatal and/or school-based screening.

In most of the autonomous communities, hearing status assessments are carried out as part of child healthcare measures. Check-ups usually take place at certain educational levels, such as infant school or primary school, and include some form of hearing examination, although there is no objective screening. School health checks may include a family survey related to language development items and subjective perception of the child's hearing ability.

According to one study (Martínez Pacheco *et al*., 2021), until 2017 only some communities explicitly included referral to the ENT department for all children who did not pass their language tests in the periodic or spontaneous evaluations carried out in Primary Care, within the framework of the follow-up to the "Well Child" Programme.

Special mention should be made of the Balearic Islands, the only autonomous community with a universal screening programme for schoolchildren, carried out in the first year of primary school to detect bilateral or unilateral hearing loss of >30 dB by means of otoscopy, impedance audiometry and bilateral tone audiometry (Martínez Pacheco *et al*., 2021).

Postnatal screening at child health programme check-ups, at the time of starting school and at the beginning or end of each educational stage is recommended

Some European countries have adopted school-based screening as part of their health and education policies with the aim of identifying hearing problems in children at an early age and providing the necessary interventions and support. These programmes may include hearing tests, usually during infant or primary school. In addition to tone audiometry, other tests such as verbal audiometry, which assesses a child's ability to understand and repeat spoken words or phrases at different intensities, are performed at some school check-ups. Sometimes the perception of sound is tested by means of a tuning fork. Otoscopy and tympanometry are also performed. The whispered voice test has low sensitivity and is therefore not recommended as a screening test unless complemented by other, more accurate tests (Cadena *et al*., 2021; Chibisova *et al*., 2022). According to a recent study, in 17 European countries or regions, school-based screening is universally carried out at 4-6 years of age by means of tone audiometry (at frequencies of 0.5, 1, 2 and 4 kHz and at 15-20 dB), while in a further eight countries, non-universal screening is carried out with tone audiometry or whisper tests (Bussé *et al*., 2021).

Some European countries have adopted school-based screening as part of their health and education policies

Globally, a meta-analysis published by Yong *et al.* concluded that few countries or regions implement school-based screening and there is much variability in terms of the tests applied and the thresholds considered abnormal (Yong *et al.*, 2020). The most common protocols employ a suite of tests including tone audiometry (0.5, 1, 2 and 4 kHz), otoscopy and tympanometry. Region-specific prevalence estimates are often methodologically imprecise and re-screening poorly completed.

The erroneous and harmful belief that all childhood hearing loss is detected in neonatal screening is also evident, generating an excess of confidence, as has already been mentioned. Regarding the recommended age for screening at school, there is much variability, although data suggests that screening in primary school does not detect many new cases of late-onset hearing loss. It would therefore be better to extend screening to cover the entire school age (Lü *et al.*, 2011), with testing at regular intervals.

The main problem with school-based screening is poor follow-up and losses in the process of referrals to ENT departments for diagnostic confirmation of detected cases (Yong *et al.,* 2020; Chibisova *et al*., 2022).

Among the resources now available that can make screening at school more feasible are targeted questionnaires, automated audiometric screening tests and computer applications designed to perform hearing tests. Interactive apps and games on tablets or mobile devices are increasingly being developed and used to screen children for hearing impairment. These tests are presented in a recreational and attractive way to facilitate participation and results. Some systems even harness artificial intelligence and signal processing technologies to automatically detect hearing responses during tests, providing an objective assessment (Wu *et al*., 2014; D'Onofrio and Zeng, 2022).

There are now also web-based apps for hearing assessment. These apps offer advantages such as low cost, accessibility and an easy-to-use interface. One study (Rahim *et al*., 2023) found that, for detecting hearing loss, the app's 35 dB cut-off value had a sensitivity of 90.9% and a specificity of 98.9%.

Standardised guidelines and protocols for school-based screening, more accurate studies on the prevalence of childhood hearing loss and the determination of the sensitivity and specificity of screening tests are needed

Regarding the cost/benefit of postnatal screening, recent experiments in Australia featured an app that assesses the existence of hearing problems at home. The system is considered to have a 96.2% probability of being cost-effective and enables early identification and intervention, reducing disadvantages in early childhood through cumulative improvements in quality of life, education and economic outcomes over a lifetime (Gumbie *et al*., 2022).

Standardised guidelines for school-based screening protocols are needed to facilitate more accurate studies on the prevalence of childhood hearing loss and the determination of the sensitivity and specificity of screening tests. Studies would underpin the development of guidelines on screening and diagnostic services, as well as the rehabilitation and speech and educational psychology intervention services needed to reduce the impact of childhood hearing loss. These data would help clinch the political and financial commitment needed to implement early detection programmes for postnatal hearing loss (Yong *et al.*, 2020).

5. 2023 CODEPEH RECOMMENDATIONS

Postnatal hearing loss should be considered a major health problem that needs to be assessed and treated appropriately and immediately upon detection, and to which health systems must respond effectively. The prevalence of permanent hearing loss increases with age.

Regular screening for babies and young children helps to identify hearing problems early.

School-based screening is still far from being widely implemented, as is neonatal hearing screening (Bamford *et al.*, 2007).

CODEPEH therefore makes the following recommendations (see figure):

- The implementation of the programme for the early detection of childhood hearing loss should be configured as a continuous hearing prevention service throughout childhood, including new lines of application both to follow up cases that "fail" neonatal screening and for children with hearing risk factors, and to detect cases of postnatal hearing loss.

- It is necessary to provide a consensual and protocolised response from the national health system, in collaboration with the autonomous communities, with standardised guidelines for performing paediatric screening, referral and follow-up of detected cases, in order to establish universal screening for postnatal hearing loss.

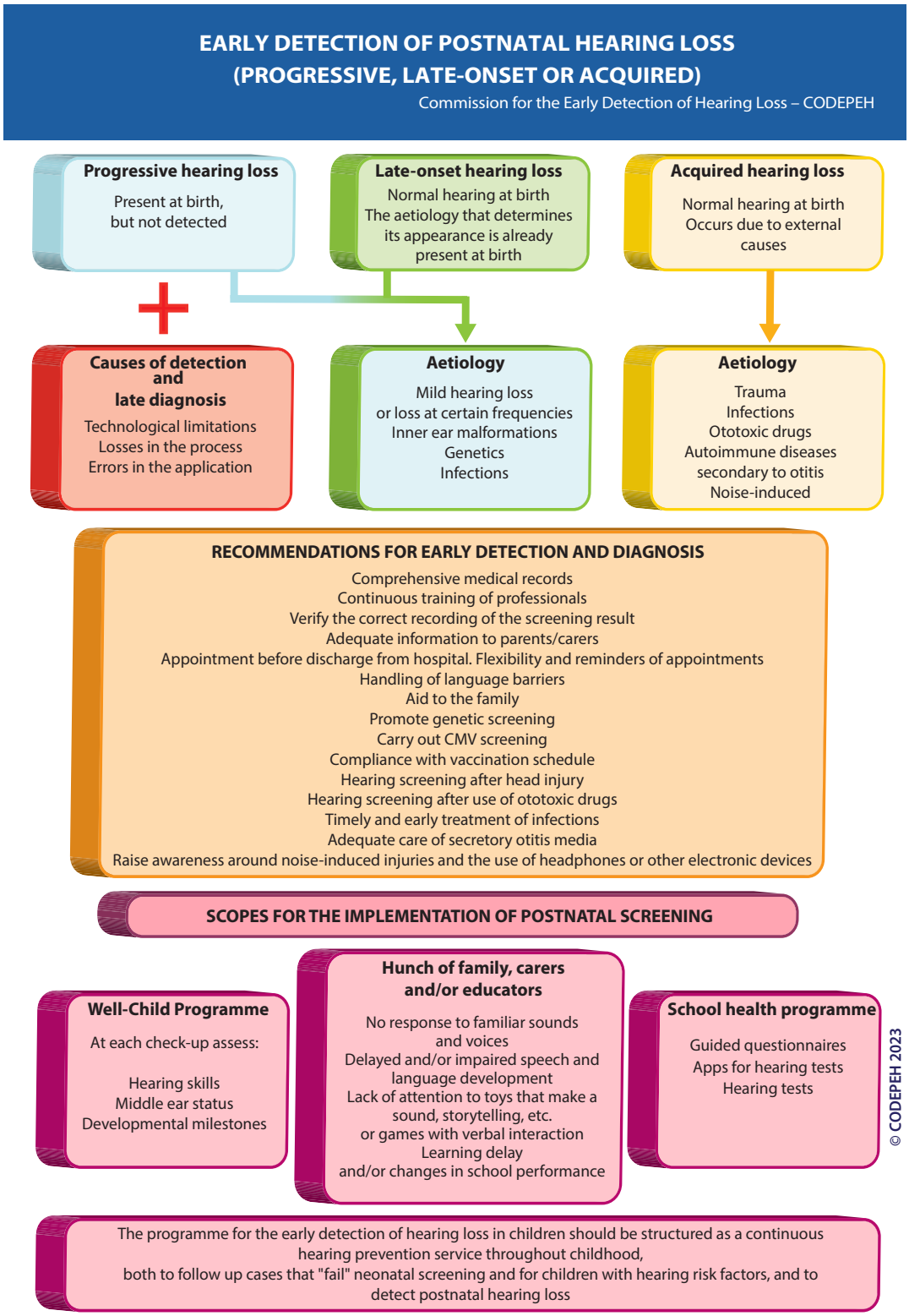
- It is advisable to carry out postnatal hearing tests, among others, during the health check-ups included in the Well Child Programme, at the time of starting school and at the beginning or end of eacheducationalstage.

- Repeated screening should be part of public health initiatives, in cross-sectoral collaboration with educational and social administrations, as it helps ensure equal opportunities for all students and provide specialised interventions and supports.

- Screening for postnatal hearing loss requires special attention to limitations in screening technology and loss to follow-up, for proper protocolisation and to ensure cost-effectiveness.

6. FIGURE

Early Detection of Postnatal Hearing Loss: progressive, late-onset and acquired



(SOURCE: own work)

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EXCELENCIA INNOVACIÓN SOSTENIBILIDAD 400 EFQM 2020 - 2023

FOMENTANDO INCLUSIÓN. APOYANDO PERSONAS. AVANZANDO SOLIDARIAMENTE.

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