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"Evaluating current clinical practices in the prescription of Softband Bone Conduction Hearing Aids for children with CHL."

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Abstract

Objectives: This study evaluated prescribing practices for non-implantable Softband Bone Conduction Hearing Aids (SBCHAs) in children with conductive hearing loss (CHL) across a single Health Board. It explored how these devices are issued in clinical settings, focusing on referral pathways, HL severity, clinical justifications, and the consistency of prescribing decisions in the absence of formal guidelines.

Methods: A retrospective service evaluation was conducted across four hospital sites, reviewing clinical records from October 2019 to October 2024. Twenty-eight children fitted with SBCHAs were included. Data collected included age at fitting, type and severity of HL, associated medical conditions, clinical reasoning, and ENT referral history. Descriptive analysis identified key trends and inconsistencies.

Results: Significant variation was found in SBCHA prescribing practices. In several cases, clinical justifications were unclear, and ENT referrals were either absent or undocumented, despite being warranted under current guidelines. For children with temporary HL, such as otitis media with effusion (OME), it was often unclear whether observation periods had been completed before device fitting. Documentation of alternative management options was inconsistent or missing.

Limitations: The retrospective design, small sample size, and variable quality of clinical records limited the scope of this evaluation. The absence of outcome data and incomplete

information on alternative treatments restricted the ability to assess the long-term effectiveness of SBCHA use.

Conclusion: SBCHA prescribing practices within the Health Board lack consistency and are not always supported by clear documentation or standardised referral pathways. Introducing local prescribing guidelines, alongside structured documentation and regular review processes, could enhance the consistency and transparency of SBCHA provision. A decision-making framework was developed from these findings to support more consistent prescribing in paediatric settings (**Appendix A**).

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List of Abbreviations

Abbreviation	Definition
ADHD	Attention Deficit/Hyperactivity Disorder
ASD	Autism Spectrum Disorder
BSA	British Society of Audiology
BTE	Behind-the-ear
BCHA	Bone Conduction Hearing Aid
CHL	Conductive Hearing Loss
CPA	Conditioned Play Audiometry
DHSC	Department of Health & Social Care
DS	Down Syndrome
ENT	Ear, Nose, and Throat
HA	Hearing aid
HCPC	Health and Care Professions Council
HL	Hearing Loss
NHS	National Health Service
NDDS	National Down Syndrome Society
NICE	National Institute for Health and Care Excellence
OME	Otitis Media with Effusion
SBCHA	Softband Bone Conduction Hearing Aid
TCS	Treacher Collins Syndrome
VRA	Visual Reinforcement Audiometry
WHO	World Health Organisation

Chapter 1: Introduction

1.1 Overview

HL affects more than 430 million people globally, including approximately 34 million children (Davis & Hoffman, 2019; World Health Organization (WHO), 2025). In the UK, an estimated 45,000 children are diagnosed with HL, which can significantly impact speech and language acquisition, cognitive development, educational outcomes, and social integration (Brown, 2020; Lieu et al., 2020). HL can be categorised as conductive, sensorineural, and mixed (Anastasiadou & Al Khalili, 2023). This study focuses specifically on CHL, which is particularly prevalent in paediatric populations (Sooriyamoorthy & De Jesus, 2023).

CHL typically results from a blockage or dysfunction in the outer or middle ear, impairing the efficient transmission of sound to the inner ear (Fattahi & Chari, 2024). Common causes include OME, microtia, or craniofacial abnormalities (Dimitrov & Gossman, 2020; Sooriyamoorthy & De Jesus, 2023). CHL can be either temporary or persistent, depending on the underlying aetiology (NICE, 2023c).

Management strategies for paediatric CHL range from monitoring and non-invasive interventions (e.g., autoinflation or grommet insertion) to hearing amplification through BTE devices or SBCHAs (NICE, 2023b; NICE, 2023c). SBCHAs, which transmit sound via vibrations through a headband device, are increasingly prescribed for children who are not candidates for surgical implants or who have anatomical contraindications to air-

conduction HAs (Ellsperman et al., 2021). However, the growing use of SBCHAs, particularly in cases where alternative treatments may have been more appropriate, has raised concerns in the absence of clear and standardised guidance (British Society of Audiology (BSA), 2024a).

1.2 Rationale of Study

This service evaluation was commissioned by a local Health Board to review current SBCHA prescribing practices in children with CHL, in response to concerns about increasing usage, high associated costs, and inconsistent documentation of clinical reasoning.

At present, no local or national guidelines exist specifically addressing for the provision of SBCHAs in this patient group (BSA, 2024a). Discussions with local clinicians highlighted that decisions around prescribing are often made on an individual basis, shaped by clinician experience, personal judgement, and available resources, rather than any shared framework or protocol (Bijani et al., 2021). This has led to noticeable variation in care, where children with similar needs may receive different interventions depending on the setting or the clinical overseeing their care. Such inconsistencies raise important concerns about fairness, quality, and accountability in service delivery.

Although SBCHAs can be highly beneficial in certain paediatric cases, they are also relatively costly compared to some other hearing support options. Without clear referral and

assessment pathways, there is a risk that these devices are used inconsistently or inefficiently, contributing to inequitable care and unnecessary spending (BSA, 2024a).

This evaluation examines current prescribing trends across the Health Board, with a focus on age at fitting, ENT referral practices, and the reasoning recorded in clinical notes. The goal is to provide evidence that can support the creation of more consistent, transparent, and equitable guidance for SBCHA use in children.

1.3 Aim & Objective

Aim:

To evaluate current prescribing practices for SBCHAs in children with CHL within a specific Health Board. The study explores how SBCHAs are being utilised in clinical settings, with a particular focus on referral patterns, clinical indications, and consistency of prescribing practices across different cases.

Objective:

To explore and describe how SBCHAs are prescribed for children with CHL, identifying trends in clinical decision-making and assessing whether current practice reflects consistent and appropriate use of this intervention.

Chapter 2: Background

2.1 CHL and Its Impact

CHL occurs when sound transmission through the outer or middle ear is disrupted, resulting in reduced stimulation of the cochlea (Fattahi & Chari, 2024). CHL is particularly prevalent in paediatric populations and can present as either a temporary or persistent condition, depending on the underlying cause (NICE,2023c).

If left untreated, CHL can significantly affect a child's developmental progress (Fabian et al., 2024). Auditory deprivation during early childhood has been linked to delays in speech and language acquisition, impaired phonological processing, and reduced cognitive and academic performance (Backous et al., 2022; Lieu et al., 2020; Shojaei et al., 2016; Sindhar & Lieu, 2021). Children with additional developmental or communication needs are particularly at risk of these adverse outcomes (MacKeith et al., 2023; Pazdro-Zastaqny & Zatoński, 2020). Evidence also suggests that even mild, untreated HL can lead to deficits in phonological memory and morphosyntactic development (Dokovic et al., 2014), underscoring the importance of early and appropriate intervention.

2.2 Causes & Management of CHL in Children

2.2.1 Common Causes of CHL

The most prevalent cause of CHL in children is OME, commonly referred to as “glue ear”, affecting approximately one in five preschool-aged children at any time (Chan & Stephenson, 2023). It is characterised by fluid accumulation in the middle ear without signs of infection (Searight et al., 2023).

Although a variety of conventional strategies exist for managing CHL, they are not always suitable for children with anatomical anomalies, congenital conditions, or complex medical needs (Sooriyamoorthy and De Jesus, 2023). In such cases, decision-making becomes more complex, requiring clinicians to weigh treatment limitations against each child’s unique developmental and clinical needs (Bijani et al., 2021).

For instance, children with DS frequently experience CHL due to structural anomalies such as narrow canals and chronic OME (Intrapiromkul et al., 2012; Kreicher et al., 2018). These features often complicate the use of BTE HAs. Additionally, autoinflation may be difficult for children with DS to use effectively, and grommet insertion, though commonly offered for persistent OME, carries greater anaesthetic risk in this group. These risks may deter some families from pursuing surgical options (Borland et al., 2004; Aboud et al., 2022). In such cases, SBCHAs often serve as the most practical and sometimes the only viable alternative for timely auditory access (Fortnum et al., 2014).

Children with microtia, Treacher Collins syndrome (TCS), or other craniofacial anomalies face similar challenges. Malformed or absent pinnae and ear canals can make both BTE HAs and grommets impractical or anatomically unfeasible (Rosa et al., 2016; Andrews and Hohman, 2022; Chandrasekar et al., 2023). Given that SBCHAs bypass the outer and middle ear, they offer a practical and reliable alternative in these cases.

Cholesteatoma presents another example where conventional approaches may be unsuitable. Following surgery, persistent otorrhoea can make ear canal-based devices uncomfortable or ineffective. Moisture retention in earmoulds may exacerbate infections or cause ongoing discomfort (Castle, 2018; Kennedy and Singh, 2020). In these cases, SBCHAs can help maintain auditory input without aggravating symptoms (Moyer et al., 2024).

2.2.2 Conventional Management Strategies

The management of CHL is influenced by its underlying cause, severity, and the individual needs of the child (NICE, 2023c). In cases of OME, NICE (2023b) recommends a three-month period of clinical observation to give the condition time to improve naturally. If HL persists after this period, treatment options should be explored in collaboration with the child, their parents, and carers (NICE, 2023a).

Treatment decisions are usually based on factors such as the child's age, stage of development, and anatomical suitability for specific devices or procedures (NICE, 2023a). A range of non-invasive and surgical options are available, each with its own benefits and limitations. These are outlined in **Table 1** below.

At present, NICE guidance focuses specifically on OME and does not provide formal recommendations for managing other causes of CHL, including those linked to craniofacial syndromes, microtia, or long-standing ear conditions.

Table 1. *Summary of Conventional CHL Management Options*

Management Strategy	Description	Effectiveness & Limitations	References
Regular Monitoring	Routine audiological assessments every three months to track OME progression.	Allows natural resolution but may delay intervention in persistent cases.	NICE, 2023b
Autoinflation (Otovent)	A non-invasive device where the child inflates a balloon through the nose to open the Eustachian tube.	It can improve middle ear pressure and avoid surgery. Requires proper technique and supervision; unsuitable for children under three.	NICE, 2016; Vennik et al., 2018; Bidarian-Moniri et al., 2021
Grommet Insertion (Ventilation Tube)	Surgical procedure placing a small tube in the tympanic membrane to facilitate fluid drainage and ventilation.	Improves hearing by an average of 9 dB within 1–3 months but may require repeated procedures due to natural extrusion within 8–18 months. Risks include general anaesthesia, infection, perforation, and tympanosclerosis.	MacKeith, 2023; NICE, 2023b; Pokorny et al., 2024; Venekamp et al., 2018; Browning et al., 2010
Air Conduction Hearing Aids (BTE HAs)	Amplifies sound directly into the ear canal to compensate for CHL.	Effective for stable CHL but less useful for fluctuating HL. It can be difficult to use in cases of recurrent otorrhoea or anatomical abnormalities.	Cook & Polgar, 2015; Dimitrov & Gossman, 2020

2.2.3 Challenges & Barriers in CHL Management

Although there are several established strategies for managing CHL, they are not always suitable, particularly for children with anatomical anomalies or complex medical needs (Sooriyamoorthy & De Jesus, 2023). In these cases, clinical decisions become more complicated, requiring a balance between treatment limitations and the child's individual developmental and medical profile (Bijani et al., 2021).

CHL affects an estimated 75 to 88% of children with DS, primarily due to structural issues like narrow ear canals, OME, and Eustachian tube dysfunction (Intrapiromkul et al., 2012; Kreicher et al., 2018). These challenges often make it difficult to fit and retain BTE HAs (NICE, 2023b). While autoinflation devices such as Otovent provide a non-invasive option, their use may be impractical for children with DS due to difficulties with technique and coordination (Williamson et al., 2015). Grommet insertion, another common treatment for persistent OME, also poses risks in this group including early extrusion, repeated procedures, and tympanic membrane complications (Hargunani et al., 2020; Venekamp et al., 2018). Some families may also be reluctant to proceed with surgery because of the higher anaesthetic risk in DS, including bradycardia, airway obstruction, and challenging intubation (Aboud et al., 2022; Borland et al., 2004; NDDS, n.d.). In these situations, SBCHAs may be the most appropriate or only viable option. Early support is critical, as delays in auditory access can further compound speech and language delays and impact broader developmental outcomes (Fortnum et al., 2014).

Similar barriers are seen in children with microtia or TCS, where the pinna or ear canal may be absent or malformed. This anatomy often rules out both traditional HAs and grommet surgery (Rosa et al., 2016; Andrews & Hohman, 2022; Orji et al., 2014; Chandrasekar et al., 2023; Dimitrov & Gossman, 2020).

Children with cholesteatoma may also experience post-surgical complications like persistent otorrhoea. This moisture-related discharge can cause discomfort and increase the risk of infection when using earmoulds (Castle, 2018; Kennedy et al., 2024; Khan et al., 2014). In such cases, SBCHAs offer a practical alternative, as they bypass the middle ear and provide consistent sound input without aggravating the condition (Moyer et al., 2024).

Table *2.* *Feasibility of CHL Management Options by Medical Condition*

Medical Condition	**BTE HAs**	**Grommets**	**Autoinflation**	**BCHA**
Down Syndrome	Dependent on ear anatomy (e.g., floppy ears, narrow canals)	Dependent on anatomy, parental influence (surgery risks) and ENT decision.	May be unsuitable due to developmental delays or nasal obstruction	Yes
Microtia	Not feasible due to absent or malformed pinna/canal	Not feasible due to anatomical abnormalities	Feasible if the canal is present and patent (open)	Yes
Cholesteatoma	Often contraindicated if active infection or otorrhoea is present.	Possible, but ENT dependent and infection status must be resolved	Generally unsuitable during active discharge	Yes

2.2.4 The Role of ENT in CHL Management and the Impact of Service Delays

ENT involvement plays a key role in the clinical management of persistent CHL (NICE, 2025). NICE (2023b) advises that children with OME lasting longer than three months and associated HL should be referred for ENT assessment to consider possible surgical intervention.

Despite the NHS's 18-week referral-to-treatment target, many children still experience considerable delays in accessing ENT care (Department of Health & Social Care (DHSC), 2022). Grommet surgery is a common and often effective treatment option, but lengthy waiting times remain a challenge (Távora-Vieira et al., 2024). For some children, these delays may result in prolonged auditory deprivation, which can negatively impact speech and language development and affect educational progress (McLaren et al., 2018)

To minimise these risks, audiologists may fit SBCHAs as a temporary measure to maintain auditory access while children await ENT review or surgery (Easto et al., 2016). While this strategy can be helpful in the short term, it may also result in children continuing to use SBCHAs longer than necessary, particularly if their OME resolves naturally over time and no formal reassessment occurs (NICE, 2023b; Searight et al., 2023). This could lead to unnecessary use of NHS resources, delayed discharge from audiology services, and children wearing devices they no longer require, potentially impacting their comfort and self-esteem (Maynard, 2017).

These findings highlight inconsistencies in referral practices and gaps in follow-up care, particularly when SBCHAs are used as a temporary solution rather than as part of a planned and regularly reviewed treatment approach.

2.3 The Role of BCHAs in Complex Cases

SBCHAs play an important role in the management of CHL, particularly in paediatric cases where conventional BTE HAs may not be appropriate (Ellsperman et al., 2021). Unlike BTE HAs, which rely on a clear and functional ear canal, SBCHAs transmit sound through the bones of the skull, bypassing the outer and middle ear to reach the cochlea directly (Brown et al., 2019; Moyer et al., 2024).

As non-surgical devices worn on an adjustable elastic headband, SBCHAs offer immediate access to sound. This makes them especially useful for young children or those with anatomical differences that make traditional devices difficult to fit or tolerate (NICE, 2023b; Nicholson et al., 2011; Wang et al., 2018).

SBCHAs are particularly effective for children with fluctuating or chronic CHL, where BTE HAs may be unsuitable due to persistent ear discharge (otorrhoea) (Cook & Polgar, 2015). Since they do not block the ear canal, SBCHAs help reduce the risk of infection and remove the need for regular earmould replacements, easing the burden on both families and audiology services (NICE, 2023b).

Research has shown positive outcomes for children fitted with SBCHAs, particularly those with craniofacial conditions like microtia (National Deaf Children's Society (NDCS), 2023). Fan et al. (2020) found that children with microtia who used SBCHAs developed speech and auditory skills similar to their hearing peers. Other studies have reported improvements in

communication, learning, and social participation, reinforcing the value of SBCHAs in early intervention (NDCS, 2023; Lazzerini et al., 2023).

Table 3. *Clinical Indications for SBCHA Use in Paediatric Populations*

Indication	Rationale for BAHA Use	Reference
Anatomical Challenges	Suitable for children with microtia, atresia, or craniofacial syndromes where conventional BTE HAs are difficult to fit.	(Brotto et al., 2023)
Middle Ear Conditions	Used in cases of OME, cholesteatoma, or chronic ear infections where BTE HAs may exacerbate symptoms or be poorly tolerated.	(NICE, 2023b; Khan et al., 2014)
Congenital Syndromes	Preferred for children with Down syndrome or Treacher Collins syndrome who experience chronic CHL and anatomical limitations.	(National Deaf Children's Society, 2023)
Unilateral or Single-Sided Deafness (SSD)	Allows sound transmission from the affected side to the better-hearing ear, improving spatial awareness and speech recognition.	(NICE, 2023b)

Table 3 summarises the clinical justifications for SBCHA use in complex paediatric cases and the evidence base supporting these practices.

2.4 Gaps in Clinical Guidance and Local Practice

SBCHAs are becoming more commonly used in paediatric audiology. However, their use currently lies beyond the framework of formal national guidance. In contrast, implantable BCHAs are supported by well-established service specifications. These include clear referral criteria, required trial periods, structured outcome evaluations, and the involvement of multidisciplinary teams including ENT consultants, audiologists, and speech and language therapists (NHS, 2024). Such protocols help ensure that care is delivered consistently, with clear accountability and to a recognised standard across services.

Implantable BCHA pathways also provide detailed guidance on device maintenance, procedures for lost or damaged equipment, and ongoing responsibilities for monitoring and support (NHS, 2024). These protocols are not currently in place for non-implantable SBCHAs. Instead, decisions are often based on individual clinician judgement, which has led to noticeable variation in how children are assessed, referred, and managed across departments within the health board.

To address these issues, the BSA is developing national guidance that will outline referral criteria, documentation standards, and clarify the roles of key professionals involved in SBCHA provision (BSA, 2024a). By analysing local practice, this evaluation supports that process and reinforces the need for clear, equitable, and sustainable protocols for SBCHA use in children.

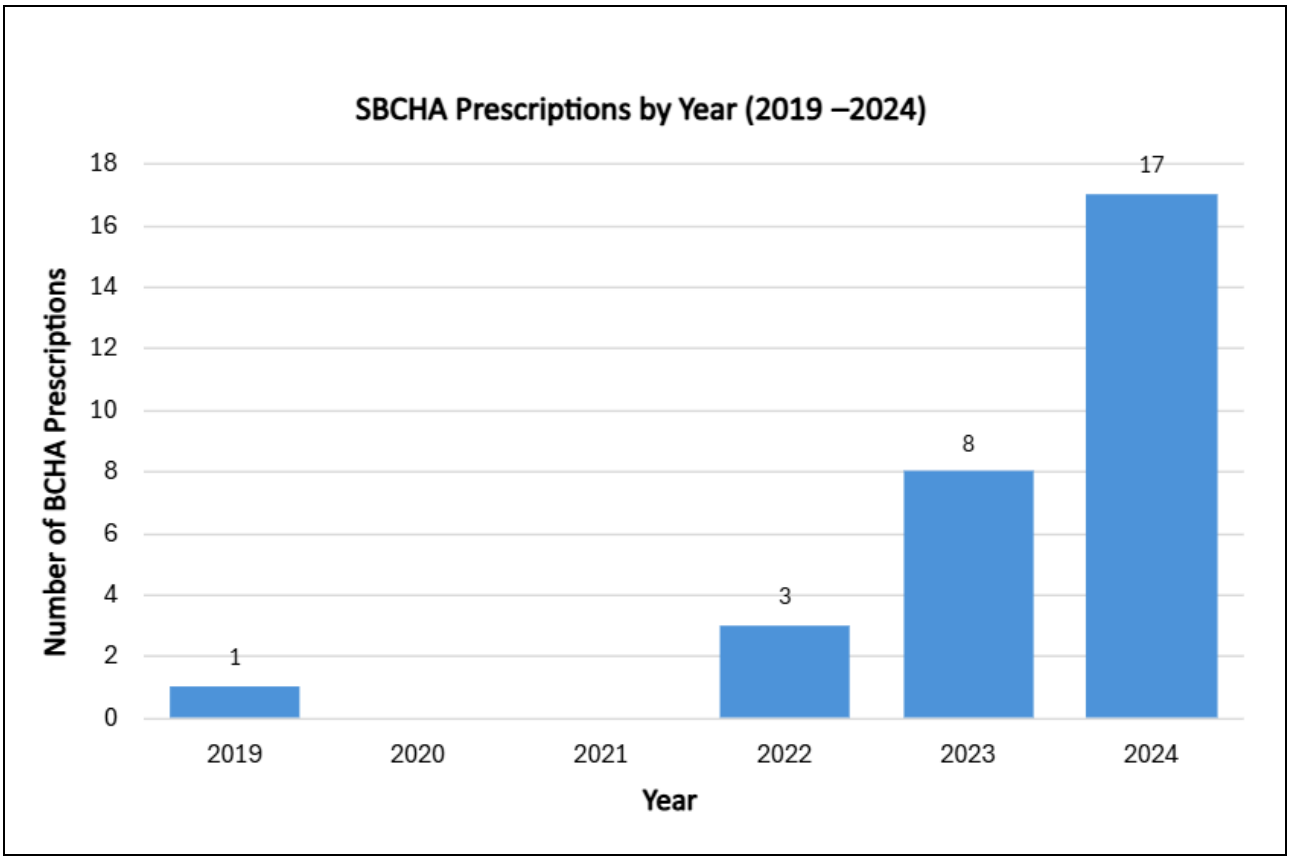
Chapter 3: Methodology

3.1 Study Design

This project was designed as a retrospective, quantitative cohort service evaluation exploring current prescribing practices for SBCHAs in children with CHL within a specific health board (James & Meertens, 2025). Service evaluations are intended to assess the quality and consistency of care within existing services by systematically analysing clinical data (Gibbard et al., 2017). As a retrospective design, this evaluation could not control for how or why SBCHAs were prescribed, limiting causal interpretations (Talari & Goyal, 2020).

The preliminary review observed an increase in SBCHA prescriptions between 2019 and 2024. This trend prompted a new focus on examining the clinical decision-making behind SBCHA recommendations and the extent to which these devices are being used consistently and appropriately.

Figure 1. *SBCHA Prescriptions by Year (2019 – 2024)*



Note. SBCHA prescriptions increased annually between 2019 and 2024, rising from 1 to 17 over the five-year period. Notably, no SBCHAs were prescribed in 2020 or 2021, likely due to service disruptions caused by the COVID-19 pandemic (WHO,2022).

As shown in **Figure 1**, there was a steady rise in SBCHA prescriptions between 2019 and 2024, with the number increasing significantly year on year and reaching a peak of 17 prescriptions in 2024.

3.2 Participants

The study included children who were fitted with SBCHAs between October 2019 and October 2024. Data were collected from four audiology departments within the same NHS health board. This five-year period was chosen to capture current and up-to-date clinical practice while keeping the number of cases manageable. Although the sample size was relatively small (n = 28), it reflects what is commonly seen in local service evaluations, especially within specialist areas like paediatric audiology (Gibbard et al., 2017).

In total, 29 children were identified. One case was excluded due to a diagnosis of mixed hearing loss, as the evaluation focused specifically on CHL. This left a final sample of 28 children who met the inclusion criteria and had a confirmed diagnosis of CHL.

3.3 Inclusion and Exclusion Criteria

The inclusion criteria were chosen to ensure the study population matched the purpose of the evaluation (Patino & Ferreira, 2018). Children were included if they had a confirmed diagnosis of CHL, were under 18 years old at the time of fitting, had been seen during the evaluation period, and had received a SBCHA at one of the four hospital sites involved.

Children were excluded if they had sensorineural HL or normal hearing levels, had been fitted with a different type of HA (such as BTE), were over 18 at the time of fitting, or were seen outside of the evaluation timeframe or at other hospital sites. These criteria helped maintain the focus and relevance of the evaluation (Koym, 2022).

Table 4. *Inclusion and Exclusion Criteria for Participant Selection*

Inclusion Criteria	Exclusion Criteria
Children diagnosed with CHL	Children with sensorineural HL or normal hearing thresholds
Children seen between 4th October 2019 to the 8th October 2024	Children seen before the 4th October 2019 and after the 8th October 2024
Children at the time of fitting	Individuals aged 18 years or older
Children fitted with SBCHAs during the study period	Children fitted with BTE HAs
Children treated at one of the four participating hospital sites	Children not treated at one of the four participating hospitals

3.4 Data Collection

The data was collected between 20th January 2025 and 20th February 2025. Clinical records were accessed through AuditBase, the secure electronic system used to store audiological information across the hospital sites (Auditdata, n.d.). While AuditBase allowed access to a centralised database, inconsistencies in documentation across sites may have affected data completeness and reliability (Talari & Goyal, 2020). The focus was on collecting information relevant to SBCHA use and the clinical decisions behind their prescription.

Key variables included the child's age and gender, the type and severity of HL, and any associated medical conditions. Additional details captured included whether the HL was temporary, persistent, or unclear, the diagnostic methods used, ENT referral status, and

SBCHA maintenance costs. Where available, notes on alternative management options were also recorded, although this information was often missing or incomplete in the clinical documentation.

3.5 Data Analysis

The data was entered into Microsoft Excel for analysis. Descriptive statistics were used to summarise sample characteristics and explore key trends (Kaliyadan & Kulkarni, 2019). Descriptive statistics were calculated using Excel (Version 2502), including frequencies, proportions, and central tendency (mean, range). Comparative analysis was also used to examine variations in SBCHA prescriptions by age, hearing loss type and severity, associated medical conditions, and maintenance costs (Noyes & Holloway, 2004).

In addition to the quantitative data, clinical notes were reviewed to provide context around prescribing decisions, referral patterns, and documentation practices. While this was not a formal thematic analysis, it offered a descriptive qualitative element that added insight into undocumented or discretionary factors influencing clinical decision-making (Evans, 2024). This mixed-methods approach allowed for a more comprehensive understanding of how SBCHAs are used within local paediatric audiology services.

3.6 Ethical Considerations

As this project was classified as a service evaluation, formal ethical approval from a research ethics committee was not required. Permission to carry out the evaluation was granted by the Head of Audiology Services covering the four hospital sites involved.

All data were anonymised before analysis in line with UK Government guidance (2018). Patient identifiers were removed, and only essential clinical details were retained. Data were stored securely within NHS systems and accessed only by authorised personnel, in accordance with the Data Protection Act (2018).

3.7 Quality Assurance

To ensure the accuracy and reliability of the data, several quality assurance procedures were followed. Clinical records were compared with Auditbase entries to resolve any differences, and data extraction was carried out with the input of experienced audiologists to help ensure consistency and correct interpretation. During the analysis stage, entries were double-checked to identify and correct any errors. In cases where the reasoning behind clinical decisions wasn't clear, these were discussed with a supervisor. While senior audiologists supported the data extraction process, the primary reviewer's prior knowledge of local services may have introduced observer bias, where familiarity influences how information is interpreted (Mahtani et al., 2018). To reduce this risk, findings were cross-checked and discussed collaboratively to promote objectivity (Talari & Goyal, 2020).

Although the evaluator had limited experience in service evaluation, these steps helped reduce the risk of bias and support the overall trustworthiness of the findings (NICE, 2022).

3.8 Limitations

The retrospective design of this project and the relatively small sample size created some limitations, particularly in relation to inconsistent documentation and the absence of outcome data. These challenges are discussed in more detail in Chapter 5, Section 5.3.

Chapter 4: Results

4.1 Study Population and Data Selection

4.1.1 Inclusion and Exclusion Criteria

Table 5. *Summary of Initial Cases, Exclusions and Final Sample*

Initial Cases	Excluded (Mixed HL)	Final Sample
29	1	28

One participant was excluded due to a diagnosis of mixed HL, as the study focused exclusively on cases of CHL.

4.1.2 Demographic Characteristics

Table 6. *Average Gender and Age of Children in the Study*

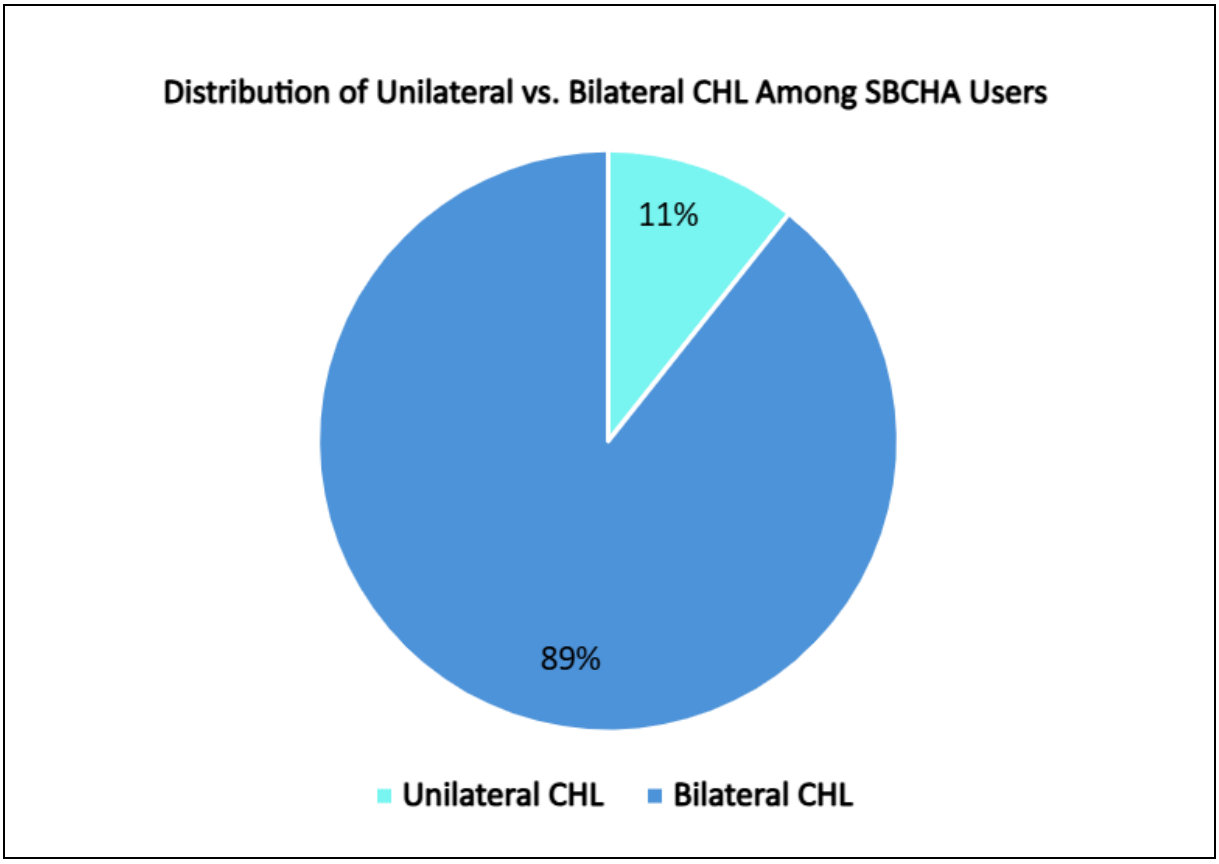
Gender	Number of Participants (n)	Percentage (%)	Mean Age (Years)	Age Range (Years)
Male	6	21%	4.85	1.83- 9.00
Female	22	79%	5.52	1.58-15.00
Total	28	100%	5.19	1.58-15.00

Table 6 presents the demographic profile of the final sample. Most children fitted with SBCHAs were female (79%). The mean age at fitting was 4.85 years for males and 5.52 years for females, with an overall age range of 1 year 7 months to 15 years.

4.2 Types and Severity of CHL

4.2.1 Unilateral vs. Bilateral CHL

Figure 2. *Distribution of Unilateral and Bilateral CHL Before SBCHA Fitting*

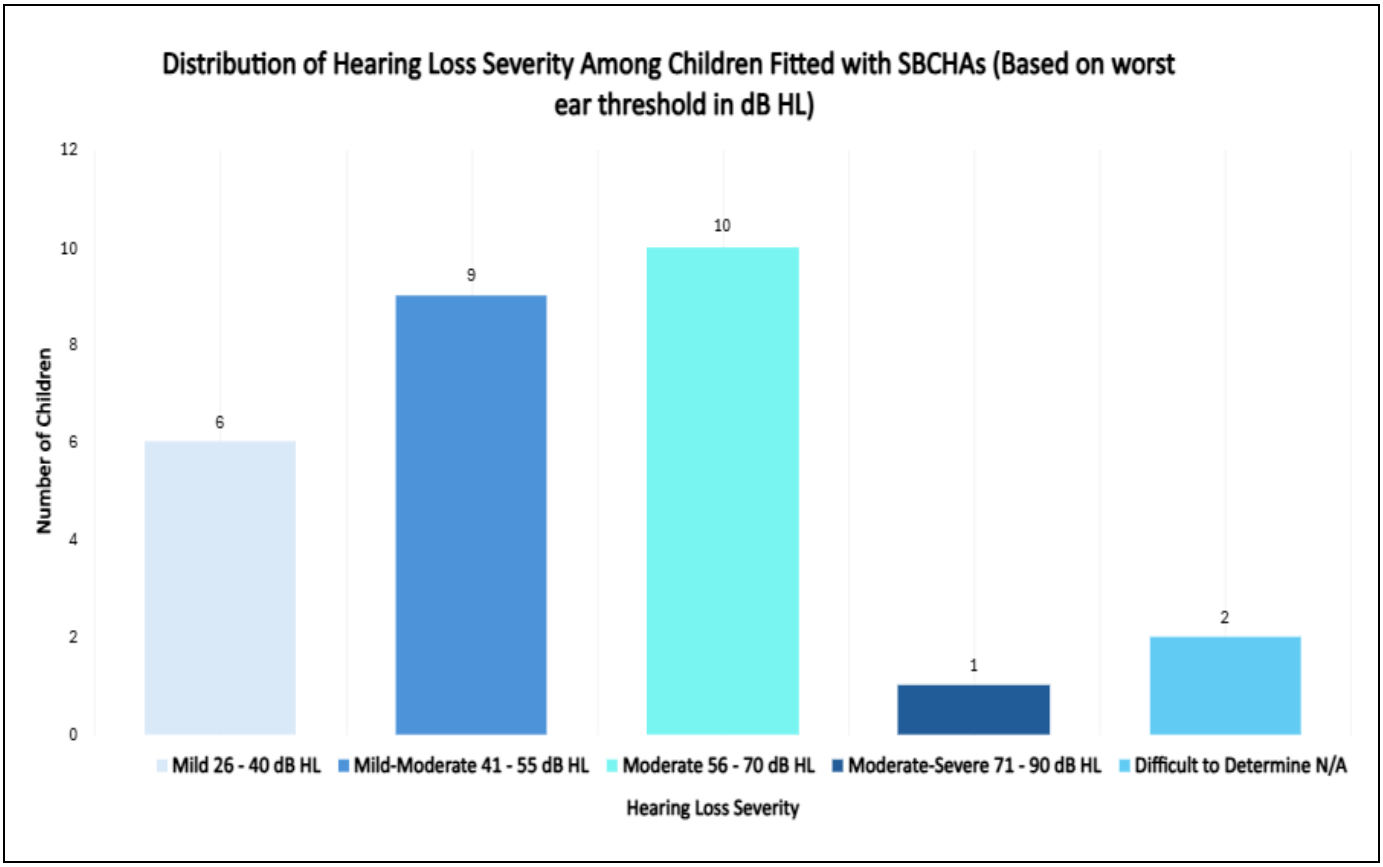


Note. *Most children (n = 25, 89%) presented with bilateral CHL. Only three children (11%) had unilateral CHL, all of whom had a diagnosis of microtia*.

Most children fitted with SBCHAs had bilateral CHL, accounting for 89% (n = 25) of the sample. A smaller proportion (11%, n = 3) had unilateral CHL, and each of these cases was associated with microtia.

4.2.2 Degree of HL

Figure 3. *Distribution of HL Severity Among Children Fitted with SBCHAs*

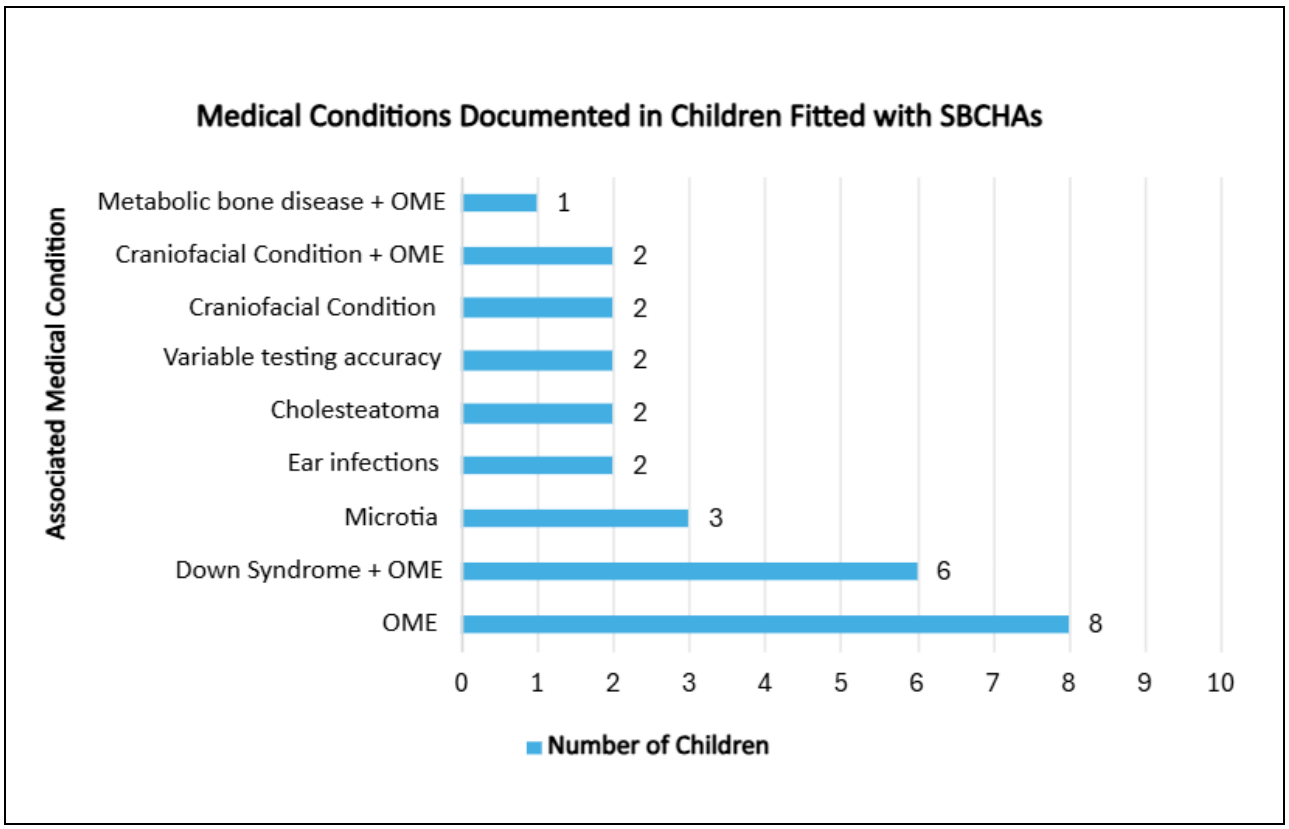


Note. *HL classification is based on worst-ear thresholds. Hearing levels could not be determined for two children due to testing challenges.*

Figure 3 shows that most children fitted with SBCHAs had either moderate (n = 10) or mild-moderate (n = 9) HL. Mild HL was recorded in 6 cases, while only one child had a moderate-severe loss. In two cases, hearing thresholds could not be reliably determined due to limitations in audiometric testing.

4.3 Medical Conditions Associated with SBCHA Fittings

Figure 4. *Medical Conditions Associated with SBCHA Fittings*



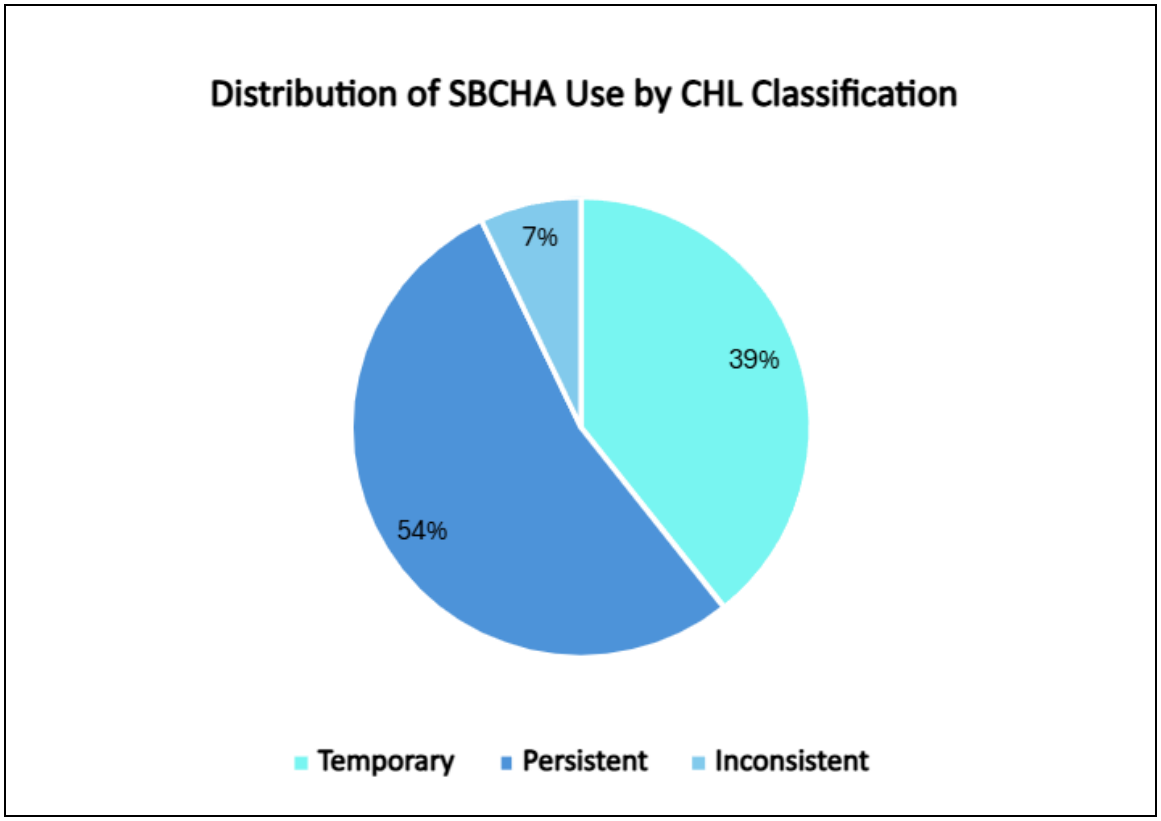
Note. *Each child is counted once under their primary associated medical condition. Some cases involved overlapping diagnoses (e.g., OME with syndromes or anatomical anomalies).*

Figure 4 presents the distribution of medical conditions among children fitted with SBCHAs. The most frequently recorded conditions were OME alone (n = 8), DS with OME (n = 6), and microtia (n = 3). Less commonly observed were cholesteatoma, variable testing accuracy, and ear infections (n = 2 each), as well as isolated cases of craniofacial anomalies and metabolic bone disease with OME (n = 1 each).

4.4 CHL characteristics and impact on SBCHA prescription

4.4.1 Temporary vs. Persistent CHL in SBCHA Users

Figure 5. *Distribution of SBCHA Use Across Temporary, Persistent, and Inconsistent CHL Categories*

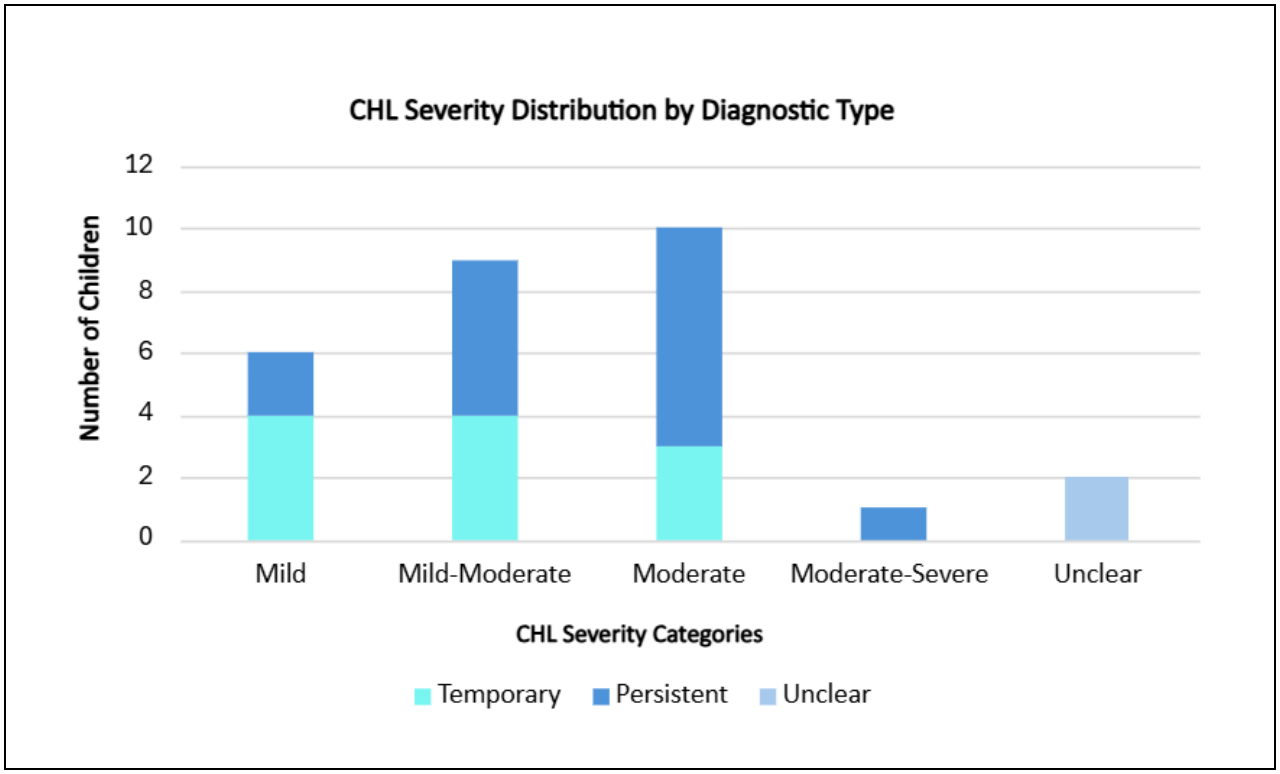


Note. *CHL was classified as temporary in 11 children (39%), persistent in 15 (54%), and inconsistent in 2 (7%) due to insufficient documentation of diagnosis or progression.*

Figure 5 shows that SBCHAs were most prescribed for children with persistent CHL (n = 15, 54%). Temporary CHL accounted for 39% of cases (n = 11), while the remaining 7% (n = 2) had unclear or inconsistent diagnostic classifications due to incomplete documentation.

4.4.2 The Relationship between CHL Severity and Type

Figure 6. *CHL Severity Levels Categorised by Type of HL Diagnosis*



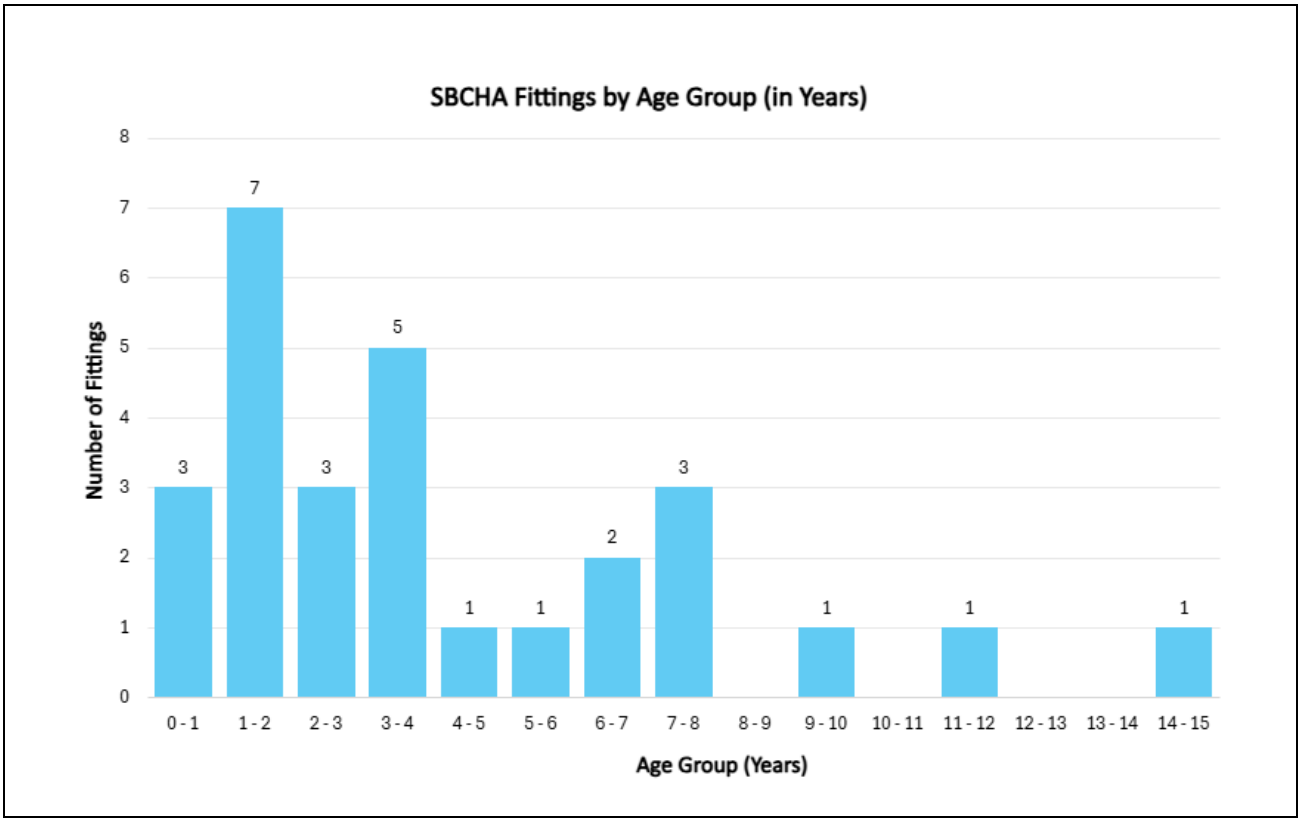
Note. *CHL severity varied by diagnostic type. Temporary CHL was primarily mild to moderate, while persistent CHL ranged from mild to moderate-severe. Severity could not be determined in two cases due to incomplete diagnostic information.*

Figure 6 illustrates differences in CHL severity across diagnostic classifications. Temporary CHL was predominantly mild or mild-moderate, with no cases of moderate-severe loss. In contrast, persistent CHL exhibited broader variability, including one case of moderate-severe HL. For the two children with unclear diagnoses, HL severity could not be established due to insufficient data.

4.5 Age Trends in SBCHA Fitting

4.5.1 Overall Age Distribution

Figure 7. *Age Distribution of Children Fitted with SBCHAs*

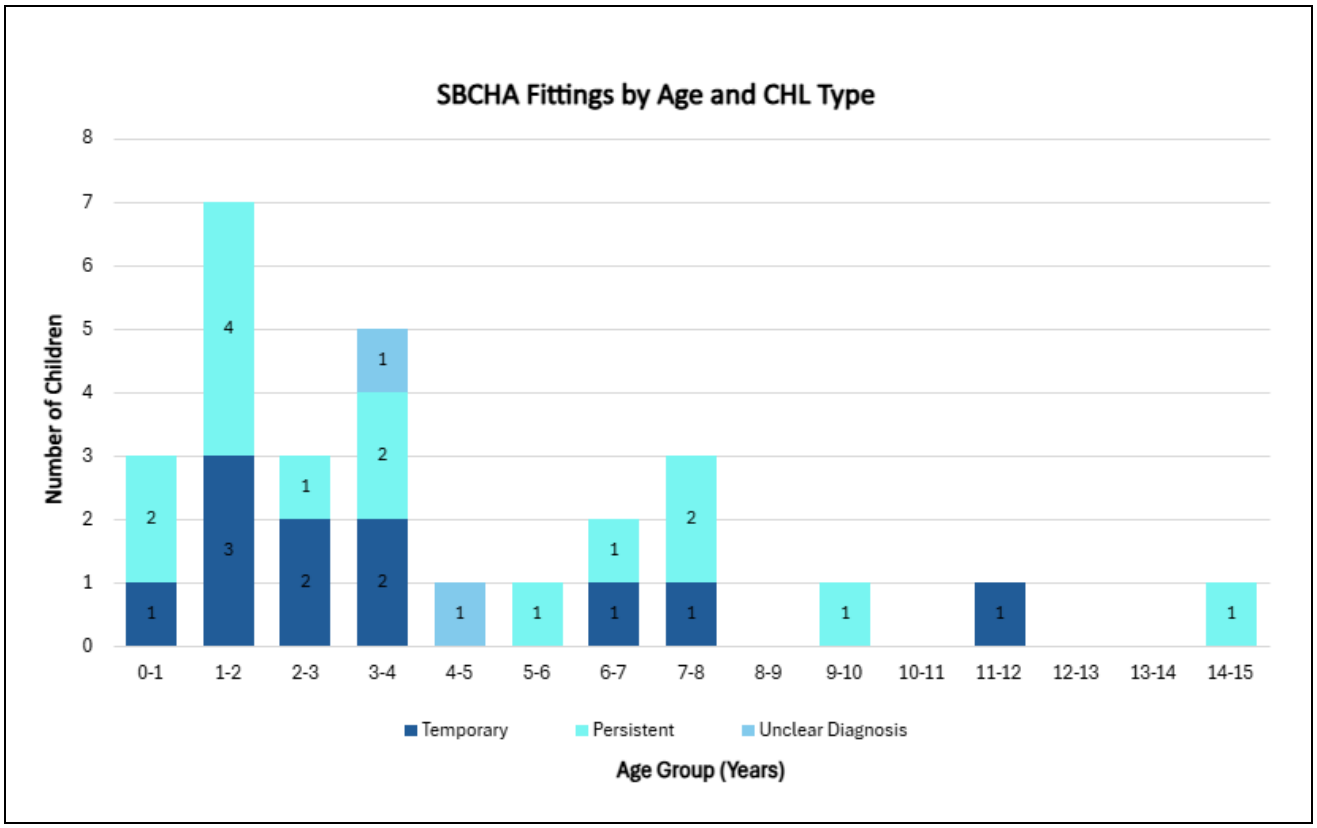


Note. *The highest number of fittings occurred in children aged 1–2 years (n = 7), followed by those aged 3–4 years (n = 5). Fittings became progressively less common with increasing age, with only one child fitted in each age band beyond 9 years.*

Figure 7 shows that SBCHA fittings were most common among children aged 1–2 years, with frequency declining progressively in older age groups. The 3–4 year group represented the next most frequent age range for fittings.

4.5.2 Age Trends by CHL Type

Figure 8. *Age Distribution of SBCHA Fittings by CHL Type*



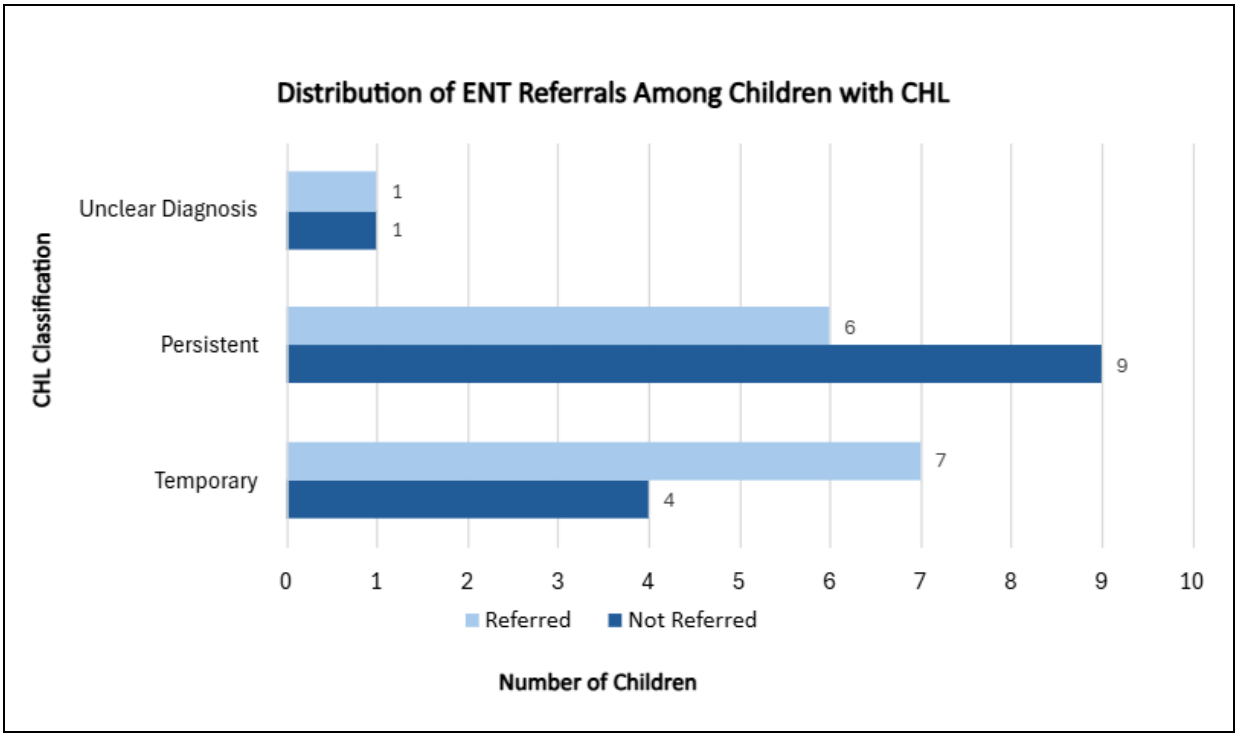
Note. *SBCHA fittings are shown by age group and CHL classification. Temporary and persistent CHL were observed across a wide age range, while unclear diagnoses were limited to younger children. Most fittings occurred between ages 1–4 years.*

Figure 8 demonstrates that SBCHA fittings were most frequent in younger age groups, particularly among children aged 1–2 and 3–4 years. Temporary and persistent CHL were present across multiple age categories, whereas unclear diagnoses were confined to younger children.

4.6 ENT Referrals and Alternative Treatments Consideration

4.6.1 ENT Referrals: All Groups

Figure 9. *Distribution of ENT Referrals by HL Category*

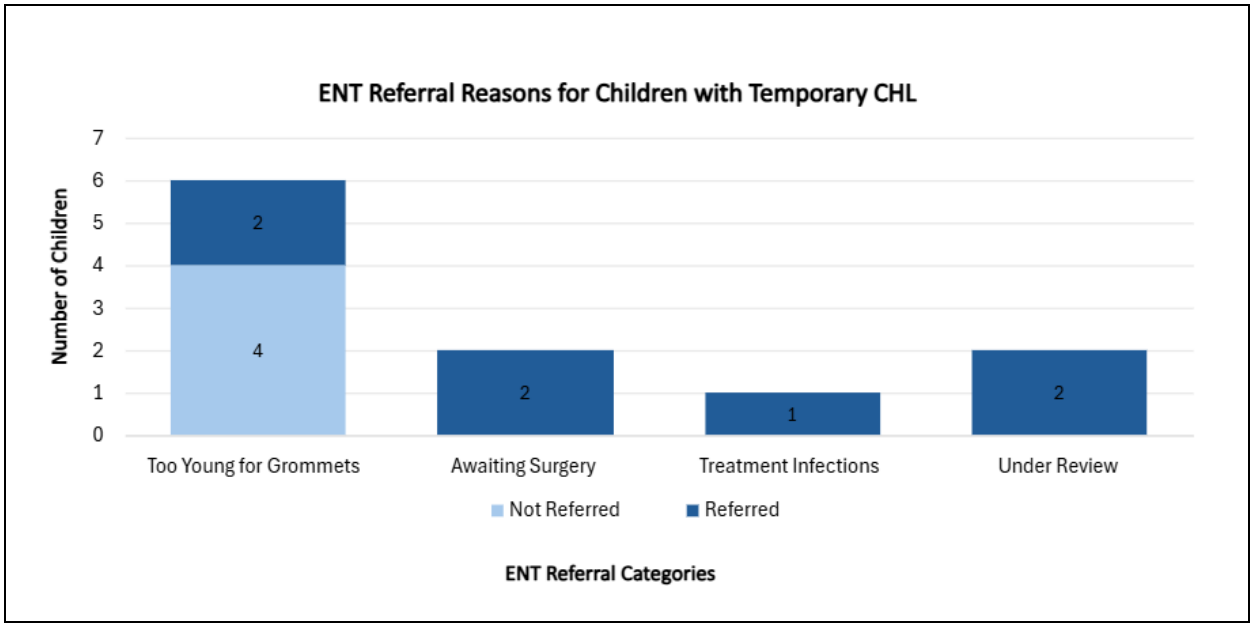


Note. *Of the 28 children, 14 were referred to ENT services. Referrals outnumbered non-referrals in the temporary CHL group (n = 7 vs. 4), while the reverse was true for persistent CHL (n = 9 vs. 6). For children with unclear diagnoses, referrals and non-referrals were evenly split (n = 1 each).*

Figure 9 illustrates that ENT referral patterns varied across CHL categories. Children with temporary CHL were more frequently referred than those with persistent CHL. For those with unclear diagnostic information, referrals were evenly divided.

4.6.2 ENT Referrals: Temporary CHL

Figure 10. *ENT Referral Reasons for Children with Temporary CHL*

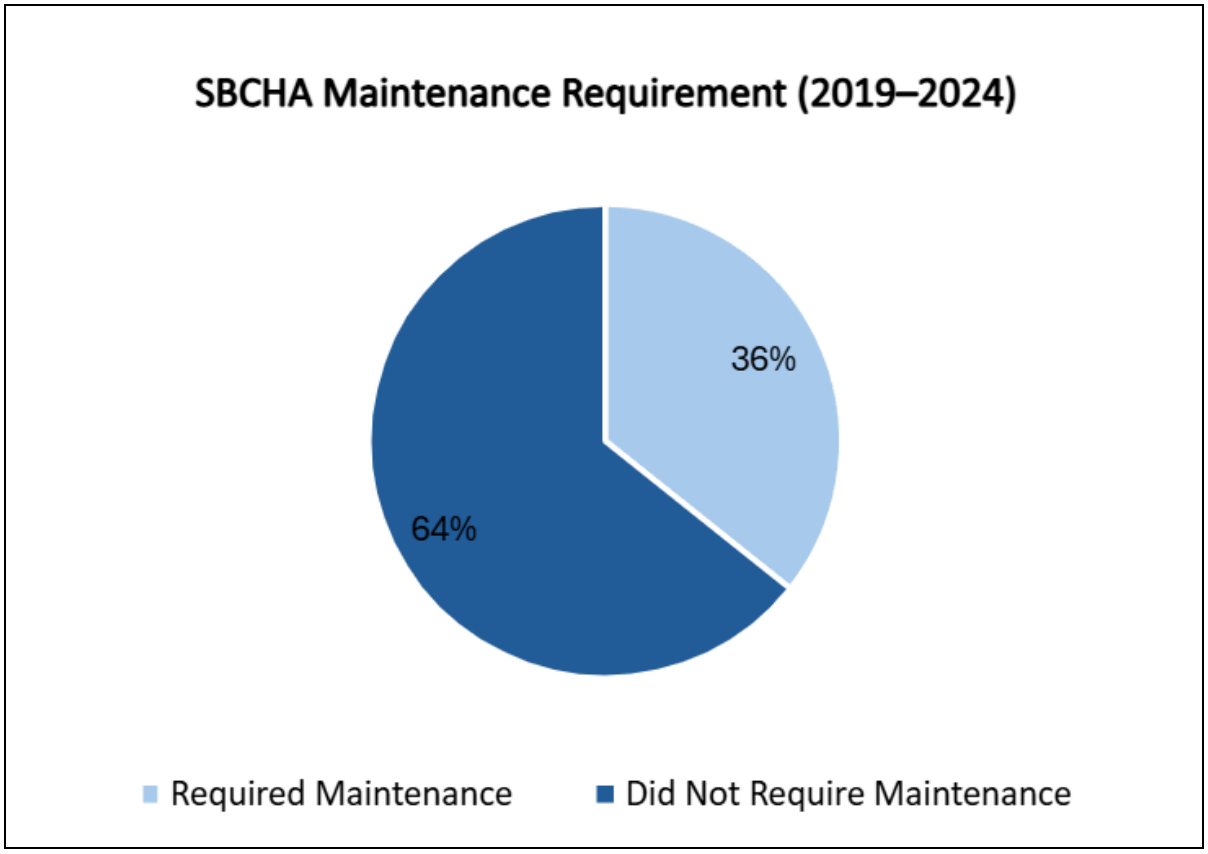


Note. *Of the 11 children with temporary CHL, 64% were referred to ENT. The most common reason was that the child was considered too young for grommet insertion (n = 6). Other documented reasons included being on a surgical waiting list (n = 2), undergoing treatment for infections (n = 1), or currently under ENT review (n = 2).*

As shown in **Figure 10**, most children with temporary CHL were referred to ENT, predominantly due to age-related contraindications to immediate grommet insertion. Additional referrals were related to ongoing medical management, such as pending surgery, infection treatment, or continued ENT monitoring.

4.7 Maintenance Costs of SBCHAs by Age Group (2019–2024)

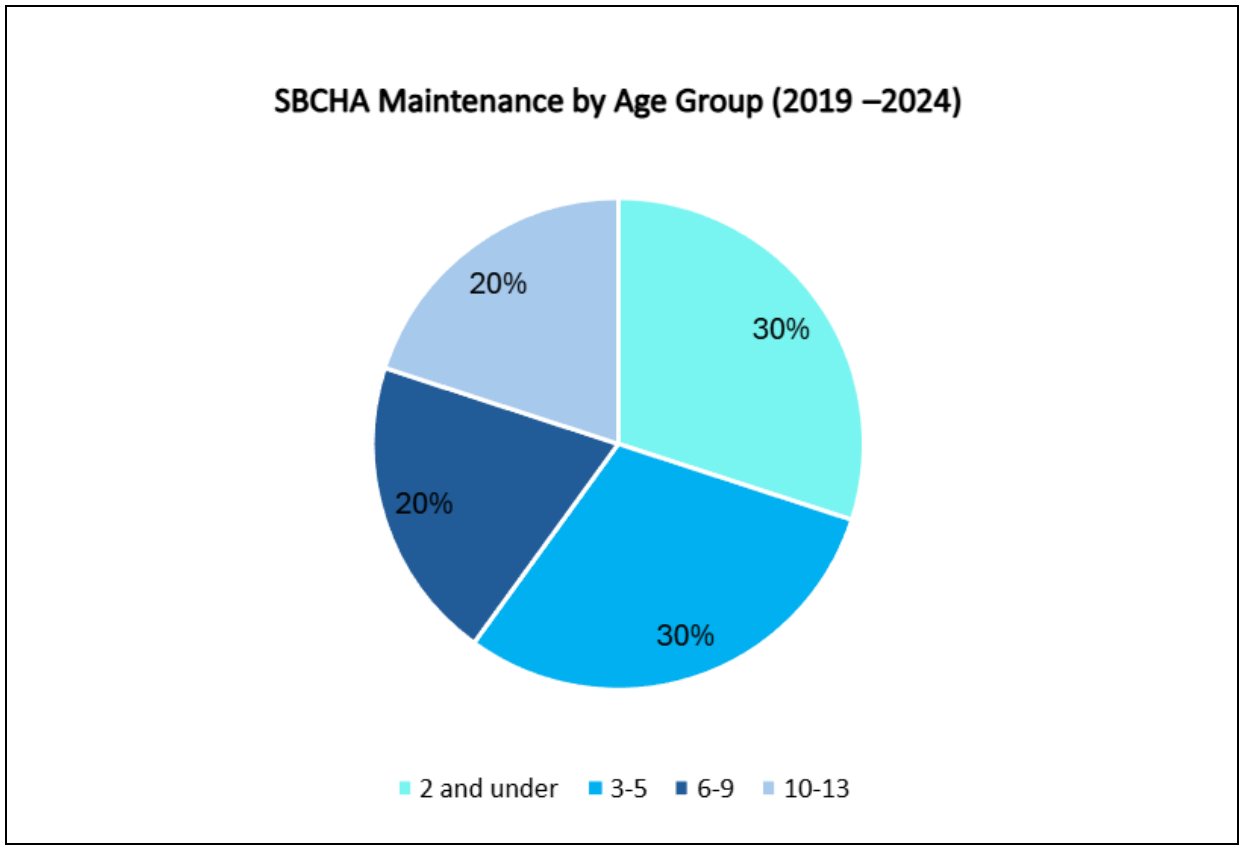
Figure 11. *SBCHA Maintenance Requirements Among Children (2019–2024)*



Note. *More than one-third of SBCHA users (36%, n = 10) required device maintenance during the study period, compared to 64% (n = 18) who did not.*

As illustrated in **Figure 11**, just over one-third of the children fitted with SBCHAs required maintenance support between 2019 and 2024. In contrast, nearly two-thirds experienced no documented maintenance needs during this timeframe.

Figure 12. *Age Distribution of Children Requiring SBCHA Maintenance (2019–2024)*



Note. *Of the children requiring SBCHA maintenance, 30% were aged 2 years and under, 30% were 3–5 years, 20% were 6–9 years, and 20% were 10–13 years. No maintenance was reported for children aged 14 and over.*

As shown in **Figure 12**, the majority of SBCHA maintenance requirements occurred in younger children, particularly those aged 5 and under. In contrast, no maintenance was recorded for children aged 14 and over during the review period.

Table 7. *Total and Average SBCHA Maintenance Costs by Age Group (2019–2024)*

Age Group (Years)	Total Maintenance Cost (£)	Average Maintenance Cost (£)
2 and under	596.61	197.20
3- 5	2,988.44	996.15
6-9	572.00	286.00
10-13	894.27	447.14
14 and over	0.00	0.00
Total	5,051.32	385.30

Table 7 presents SBCHA maintenance costs by age group from 2019 to 2024. The highest costs were seen in the 3–5 year group (£2,988.44 total; £996.15 average), followed by those aged 10–13 (£894.27 total; £447.14 average). Children aged 2 and under incurred £596.61, while the 6–9 group recorded £572.00. No maintenance costs were recorded for children aged 14 and over. The total expenditure across all age groups was £5,051.32, with an overall average of £385.30.

Chapter 5: Discussion

5.1 Overview

This study explored the clinical decision-making process behind SBCHA prescriptions for children with CHL. The results revealed variation in how devices are used, especially in cases of temporary CHL, unclear diagnoses, and differences in ENT referral patterns. This discussion critically evaluates these findings and their implications for audiological practice, clinical judgement, and departmental resource allocation.

Table 8. *Key Findings from the Study*

Section	Key Finding	Implications
5.2.1 Age at SBCHA Fitting	Most fittings occurred in children aged 1–2, followed by 3–4 years. This aligns with critical periods of neural plasticity and early speech and language development. Safety concerns related to BTE HAs in younger children may also influence this trend.	Early fitting reflects evidence-based prioritisation of auditory input during early development. Clinicians appear to be acting by developmental guidelines and safety considerations (e.g., choking risk from BTE components). Continued focus on early access to sound is justified but requires monitoring of diagnostic certainty.
5.2.2 Diagnostic Limitations	7% of children (mostly aged 3–5) were fitted without a confirmed HL diagnosis. Assessments may be particularly challenging in this age group due to attention, comprehension, and behavioural variability. These challenges may be compounded in children with neurodevelopmental conditions such as DS, ASD, and ADHD.	Risk of inappropriate device use when diagnostic certainty is lacking. Highlights the need for developmentally appropriate testing methods (e.g., VRA over CPA in certain cases). Better diagnostic documentation and interdisciplinary input are needed to support accurate, timely decisions.
5.2.3 Unilateral vs. Bilateral CHL	All unilateral CHL cases were linked to microtia and presented with moderate (not profound) HL. No evidence of speech/language delay or parental concern was recorded. Most SBCHAs were prescribed for bilateral CHL, which aligns better with NICE guidance.	SBCHA use in unilateral, moderate CHL cases was poorly justified and lacked supporting documentation. Clearer criteria are needed for unilateral fittings. In contrast, bilateral CHL cases appear more appropriate. Supports the development of specific local protocols and thresholds to ensure transparent, needs-based intervention.
5.2.4 ENT Referrals	Only 50% of children were referred to ENT, including 5 children with OME who met NICE referral criteria. Temporary CHL cases were more likely to be referred than persistent ones. Documentation of referral decisions was often missing or unclear.	Inconsistent referral practices risk delaying appropriate surgical or medical treatment. Standardised ENT referral protocols and better documentation are needed to ensure all management options are explored before SBCHA prescription.
5.2.5 Maintenance Costs	Children aged 3–5 years had the highest maintenance costs (£2,988.44 total; £996.15 average), followed by those under 2 years. Older children had minimal or no recorded maintenance. Behavioural factors such as tantrums, device removal, and sensory challenges were more common in younger children.	Younger children may require more support to maintain devices effectively. Early SBCHA use in cases of unclear diagnosis or temporary CHL may lead to avoidable costs. Greater emphasis should be placed on parental education, proactive follow-up, and ensuring diagnostic clarity before fitting to reduce service burden and improve device outcomes.

5.2 Key Findings and Critical Analysis

5.2.1 Age at SBCHA Fitting

Most SBCHAs were fitted in children aged 1 to 2 years, followed by those aged 3 to 4. This pattern likely reflects the importance of early brain development, as this is a key stage when neural plasticity supports the rapid growth of auditory pathways and language skills (Persic et al., 2020; NIDCD, 2022). Fabian et al. (2024) highlights that consistent auditory input during this time plays a crucial role in supporting language development.

Delayed access to sound during these early years increases the risk of delayed speech and language, difficulties at school, and challenges with social interaction (Backous et al., 2022). The data suggest that clinicians are fitting SBCHAs early to support children's communication and learning. While this early approach has potential benefits, it should be guided by a clear and confirmed diagnosis. If assessments are incomplete or uncertain, devices may be fitted unnecessarily, which can contribute to parental anxiety. This stress has been linked to developmental difficulties in children (Chapman et al., 2022). Inaccurate or premature device provision may also undermine trust between families and clinicians, potentially affecting engagement with future interventions (Pagel et al., 2019). Ensuring diagnostic certainty before device fitting supports both effective clinical management and parental wellbeing.

Practical reasons may also affect early fitting decisions. According to NICE (2023a), BTE HAs carry a higher choking risk than SBCHAs due to their smaller detachable parts. While these

safety considerations are important, other factors may also influence the decision not to choose BTE HAs, and such decisions must be guided by accurate diagnosis and appropriate long-term management, especially given the cost implications discussed in Section 5.2.5.

5.2.2 Diagnostic Limitations

In this evaluation, 7% of children aged three to five were fitted with SBCHAs without a confirmed HL diagnosis. This demonstrates some of the practical challenges in paediatric audiology, where developmental differences can affect the accuracy and consistency of standard hearing assessments (Fabian et al., 2024). As discussed in Section 5.2.1, early amplification can be beneficial for language development, but starting intervention without a clear diagnosis raises important clinical and resource-related concerns (Brown, 2020; Lieu et al., 2020).

In a few cases, the principle of "*do no harm*" was used by clinicians to support early fitting of SBCHAs in children. SBCHAs are considered safer than BTE HAs in terms of over-amplification risk (NICE, 2023c), which may explain their use as a temporary or cautious measure. However, offering a device without a clear diagnostic justification is especially concerning in a resource-limited health system. As Maynard (2017) outlines, ongoing financial pressures on the NHS make it essential that all interventions are well-justified and cost-effective.

The tools used to assess hearing in this age group also present limitations. Conditioned Play Audiometry (CPA), often used with children aged two to five, relies on attention, understanding of the task, and willingness to cooperate (Sabo, 1999; Yeung et al., 2013). These requirements can be harder to meet for children with neurodevelopmental conditions such as DS, autism spectrum disorder (ASD), or attention deficit hyperactivity disorder (ADHD), all of which may impact engagement and test accuracy (Cervin, 2022). In such cases, clinicians may have to make fitting decisions based on incomplete or inconsistent information.

To improve the accuracy and usefulness of assessment outcomes, hearing tests should be matched to a child's developmental stage rather than their chronological age. For instance, Nightingale et al. (2020) found that children with DS were able to complete Visual Reinforcement Audiometry (VRA) at around 3.2 years of age. While VRA is typically used with younger children, these findings suggest it can be a viable alternative when CPA is not suitable. Adopting more flexible and developmentally appropriate assessment approaches could improve diagnostic accuracy and help ensure that SBCHA prescriptions are grounded in reliable clinical evidence (BSA, 2024b).

5.2.3 Unilateral vs. Bilateral CHL

In this evaluation, all children with unilateral CHL had microtia, whereas most SBCHA prescriptions were given to children with bilateral CHL. Although unilateral HL is sometimes perceived as less impactful, research shows it can affect speech and language

development, academic performance, and social interaction (Firszt et al., 2017; Snapp and Ausili, 2020). Huttunen et al. (2019) support the use of amplification in more severe unilateral cases, emphasising that aiding the affected ear improves binaural hearing, essential for sound localisation and following speech in noisy environments. For young children, sound localisation supports attention, safety awareness, and the ability to engage effectively in learning environments (Lieu et al., 2020).

In this study, however, no children with unilateral CHL had severe or profound HL; all had moderate levels. While this raises considerations about the extent of benefit SBCHAs may provide in such cases, research suggests that even moderate unilateral HL can impact sound localisation and speech perception in noise, which are critical for children's development, learning, and safety (Huttunen et al., 2019; Lieu et al., 2020).

Although microtia can make it difficult to use standard BTE HAs or consider grommets (Chandrasekar et al., 2023; Dimitrov & Gossman, 2020), decisions should also reflect the severity and functional impact of the HL on the child, not just anatomical barriers. However, in many cases, there was little to no documentation regarding whether factors like parental concerns, speech or language delays, or developmental risks influenced the decision to fit a device. Without this information, it is difficult to fully understand the clinical reasoning, highlighting the need for more transparent and well-documented decision-making.

According to the BSA (2024a), such decisions should be made collaboratively, involving audiologists, ENT specialists, speech and language therapists, and caregivers, to ensure the

approach is both appropriate and aligned with the child's individual needs (Rosa et al., 2016; Andrews & Hohman, 2022).

Most of the children fitted with SBCHA for bilateral CHL, had moderate or long-term HL, which aligns more clearly with NICE (2023b) recommendations. These guidelines suggest intervention is appropriate when HL in both ears is likely to affect a child's development. In such cases, SBCHAs can provide continuous auditory support, especially when conventional HAs are not suitable due to anatomical or medical issues (Dimitrov & Gossman, 2020; Khan et al., 2014).

These findings suggest that clearer local protocols are needed when considering SBCHAs for unilateral CHL, especially in children with microtia. Such guidance should help clarify when these devices are appropriate and ensure decisions are based on documented clinical need, observed outcomes, and input from a coordinated team of professionals.

5.2.4 ENT Referrals

The evaluation found that clinicians referred only half of the children fitted with SBCHA (n = 14) to ENT services. Five of the 14 children who were not referred had a confirmed diagnosis of OME, despite meeting the NICE (2023b) criteria for ENT assessment. As OME is one of the most common causes of CHL in children and is addressed directly in national clinical guidelines (NICE, 2023c; Rosenfeld, 2016; Searight et al., 2023; Simon et al., 2022), the lack

of referral in these cases may reflect missed opportunities for timely intervention, such as grommet insertion.

SBCHAs may sometimes be used as a default management strategy rather than as part of a planned, evidence-based treatment approach. This concern is heightened by poor documentation, as clinical records often lacked clear reasoning behind referral decisions. Good clinical notes are essential for continuity of care and for supporting safe and informed choices (Mathioudakis, 2016). The Health and Care Professions Council (HCPC, 2024) also states that clinicians must maintain full, clear and accurate records (Standard 10.1). Incomplete or inconsistent documentation not only affects individual patient care but also limits service evaluation.

Interestingly, children with temporary CHL were referred to ENT more frequently than those with persistent CHL. While this might seem unexpected, it could be influenced by how referral guidance is interpreted, practical service constraints such as limited ENT clinic availability or long waiting lists, or family preferences (DHSC, 2022). These constraints may lead clinicians to prioritise referrals for cases perceived as more likely to resolve or where parental concern is high. However, in the absence of thorough documentation, the rationale behind these decisions remains unclear.

In several cases, SBCHAs were prescribed as a temporary measure while children waited for ENT assessment or when grommet surgery was not immediately available. While this may provide short-term benefit, it can also result in prolonged device use without addressing the underlying cause, especially if no reassessment plans are in place (Wang et

al., 2018). This evaluation found little consistent evidence of follow-up plans or review protocols, raising concerns about whether device use is regularly reviewed.

These patterns may also reflect a wider systems issue, specifically the lack of coordinated pathways between audiology and ENT services. When referrals are inconsistently made or poorly recorded, children can fall into a clinical grey area without a clear plan for further care. In such situations, SBCHAs may inadvertently be used to bridge service gaps rather than as part of a structured care strategy. This highlights the need for better communication across multidisciplinary teams. According to the HCPC (2024), clinicians must work collaboratively with colleagues and share relevant information to ensure safe and effective care. Establishing shared protocols and improving interprofessional communication could help ensure decisions are well justified, transparent and in the best interest of the child.

Altogether, these findings point to the need for clear and locally agreed ENT referral protocols that align with national guidance. Standardised pathways, supported by thorough and consistent documentation, would help ensure equitable access to care, reduce unnecessary or prolonged SBCHA use and support more effective management of children with potentially self-limiting conditions.

5.2.5 Maintenance Costs

Children between the ages of three and five years were associated with the highest SBCHA maintenance costs, with an average of £996.15 per child over a five-year period. This likely reflects developmental and behavioural challenges in early childhood, such as tantrums

and resistance to wearing HAs, which can increase the likelihood of devices being lost or damaged (Sisterhen and Soman-Faulkner, 2019; Löytömäki et al., 2022). These difficulties may be even more pronounced in children with neurodevelopmental conditions. See **Appendices C** and **D** for detailed participant and cost summaries.

Although this age range is a critical period for speech and language development, HA use among children under three remains relatively low (Kelly et al., 2024). These developmental realities highlight the need for additional support when prescribing SBCHAs to very young children, particularly in cases where HL is mild or fluctuating. Studies show that regular support for parents, such as practical guidance and follow-up, can help improve device maintenance and reduce pressure on audiology services (Muñoz, 2021). On the other hand, limited support can result in more frequent repairs and inconsistent auditory access.

The associated cost also raises questions about the clinical value of early fittings, especially when decisions are based on unclear diagnostic information. As mentioned in earlier sections, some children were fitted with SBCHAs without strong clinical justification. This can increase the burden on families who must manage the devices, and it also places further strain on an NHS already facing economic challenges (Maynard, 2017).

For children with mild or fluctuating HL, where speech and language development are not significantly impacted, low-cost alternatives such as the HearGlueEar kit may be worth considering. The kit includes a BC headset (approximately £50), and a free app designed to support children with OME (Brown, 2021; Fordington & Brown, 2020). Although not typically provided through the NHS, the HearGlueEar kit is available for private purchase by families.

Research by Brown et al. (2021) found that around 20% of children avoided grommet surgery by using the device either as an alternative or to maintain hearing until the OME resolved naturally. Providing families with an affordable, accessible option may help reassure concerned parents and reduce unnecessary reliance on NHS-funded interventions.

Finally, the absence of follow-up data such as improvements in hearing, communication outcomes, or parental satisfaction limits the ability to assess whether these fittings delivered sustained benefit. To ensure both clinical effectiveness and financial sustainability, SBCHA provision should be supported by clear diagnostic criteria, regular reassessment, and structured parental support.

5.2.6 Summary of Key Themes

The discussion outlined three central concerns: unclear documentation, uncertainty around diagnosis, and a lack of follow-up to monitor outcomes. These problems arose in several areas, including cases where SBCHAs were fitted without confirmed HL, ENT referrals were not recorded, and the reasons for keeping devices in use were not always explained. When records do not clearly show why decisions were made, it becomes more difficult to determine whether the care was necessary, effective, or in line with good clinical practice. It also makes it more difficult to review and improve services fairly across teams.

To help address this, improved documentation, along with regular reassessment and consistent outcome tracking, should be embedded into everyday practice. This could include the use of structured templates or standardised forms for recording referral decisions, clinical reasoning, and parental concerns (e.g., SBCHA Justification Form – see **Appendix B**), as well as incorporating prompts within AuditBase to ensure consistent recording of key clinical information (HCPC,2024).

In some situations, such as mild or fluctuating HL, families might also benefit from lower-cost options like the HearGlueEar kit (Brown, 2021). While not provided by the NHS, it may offer a useful alternative for families looking for short-term support and could ease pressure on NHS services when used appropriately.

5.3 Limitations

This evaluation presents several limitations that may affect how the findings are interpreted. As a retrospective service review, it relied on the quality and completeness of clinical records, which were often inconsistent or incomplete. Documentation frequently lacked key details, including the rationale for SBCHA fitting, the use of observation periods, and whether alternative management strategies had been considered. In some cases, audiological data were incomplete or unclear; for example, two children were fitted with SBCHAs without a documented classification of hearing loss, raising questions about the clinical basis for these decisions.

To address these gaps, introducing structured documentation templates, similar to those used in Direct Referrals and Reassessments, could ensure that key decision-making elements such as clinical rationale, HL classification, ENT involvement, and alternative management options considered are consistently recorded. The SBCHA Justification Form (**Appendix B**) could serve as a foundation for this standardised approach (BSA, 2024a; HCPC, 2023).

The lack of outcome measures such as hearing benefit, family satisfaction, or information about device use further limited the ability to assess how effective or impactful these interventions were in the longer term (Muñoz et al., 2011; BSA, 2024a). Without adequate follow-up data and clear documentation, it becomes challenging to determine whether prescribing decisions reflected best practice.

The small sample size of 28 children also limits the generalisability of the findings, meaning that no formal statistical analysis was able to be conducted (Faber and Fonseca, 2014; Tipton et al., 2016). Although some patterns were observed across different CHL types, age groups, and associated diagnoses, the overall diversity of the cohort reduces the applicability of the findings to wider populations (Andrade, 2020; McDermott, 2023; Linden and Hönekopp, 2021). Additionally, the sample was predominantly female (79%), which may introduce gender bias, especially given existing evidence of gender disparities in access to healthcare (Heidari et al., 2016).

There is also the possibility of gatekeeper bias, as participants were selected by a single clinician. This method of recruitment may have unintentionally excluded other eligible cases, potentially limiting the breadth of the findings (Torelli et al., 2020; CASP, 2025).

Finally, although maintenance costs were considered, other relevant economic factors such as clinician time, the frequency of follow-up appointments, and how SBCHA compares in cost to other treatment options were not explored. Future evaluations would benefit from a more comprehensive economic analysis to help assess the overall value and long-term sustainability of SBCHA provision (Weber et al., 2024).

Chapter 6: Future Recommendations

This evaluation reveals several opportunities to improve the consistency, transparency, and appropriateness of SBCHA use in children with CHL.

Currently, the local Health Board lacks a formal protocol for prescribing non-implantable SBCHAs. Prescription decisions are often made on a case-by-case basis, relying heavily on individual clinician judgement. This contributes to variation in practice. Clear local guidelines should be developed to define eligibility criteria based on HL type, severity, and anatomical considerations. These should align with national guidance and include structured review processes to ensure devices are used appropriately over time (BSA, 2024a). The proposed decision-making framework (see **Appendix A**) and justification form (see **Appendix B**) may assist in improving prescribing consistency and documentation.

Referral pathways also require standardisation. ENT involvement was inconsistent, even in cases where national guidelines recommend referral, such as persistent OME (NICE, 2023b). Establishing a clear referral process would support timely ENT assessment, helping to reduce unnecessary fittings and promote more effective care planning.

The quality of clinical documentation was a consistent issue throughout the evaluation. Missing or incomplete records limited the ability to determine whether the SBCHA provision was justified. Introducing structured templates or minimum documentation standards could help ensure clinicians record key information such as HL classification, alternative options considered, ENT involvement, and reasons for device provision. As Morrissey et al.

(2021) mentions, standardised record-keeping not only supports continuity of care but also improves service evaluation by ensuring critical data is routinely captured and accessible (HCPC, 2024).

Greater caution is also needed when considering SBCHAs for children with mild or temporary HL. In cases where speech and language development are progressing well, and observation periods have not been trialled, SBCHA use may be premature. Alternative strategies, such as autoinflation or temporary BTE HAs, may offer effective management without the same long-term resource implications (Backous et al., 2022; Persic et al., 2020).

Support for younger children should be strengthened. Those under five were associated with higher device maintenance needs, likely due to behavioural challenges, sensory sensitivities, and increased likelihood of damage or loss. Targeted interventions such as parental training, more robust accessories, and scheduled device checks may help improve outcomes while reducing service strain (Muñoz et al., 2021; Watermeyer et al., 2012).

In selected cases, families could also be informed about self-funded options such as the HearGlueEar headset (Brown et al., 2021). While not appropriate for every child, particularly those with complex needs or more severe HL, this low-cost possibility may provide temporary support during observation periods, diagnostic uncertainty, or ENT waiting times (Fordington & Brown, 2020). Offering this information may reassure concerned parents and help reduce unnecessary reliance on NHS-funded hearing devices. The parent-facing poster developed as part of this evaluation (see **Appendix E**) may also help support informed family involvement.

It is recommended that the proposed decision-making framework be piloted within clinical teams to assess its usability and impact on prescribing consistency. Incorporating feedback from audiologists, ENT professionals, and families will be crucial to refining the tool and ensuring its integration into routine practice. See **Appendix G** for the clinical audit tool designed to monitor framework use.

Finally, multidisciplinary collaboration should be prioritised, particularly for children with complex medical conditions such as DS, microtia, or TCS. Formalising collaborative decision-making processes between audiologists, ENT specialists, speech and language therapists, and paediatricians can support more holistic care. According to Epstein (2014), such approaches improve both decision quality and family satisfaction. Embedding multidisciplinary input into the SBCHA prescription process would help ensure that decisions reflect the full spectrum of each child's clinical and developmental needs (BSA, 2024a). See **Appendix F** for a summary of medical conditions that may influence SBCHA candidacy.

Chapter 7: Conclusion

This evaluation explored how SBCHAs are currently prescribed for children with CHL across a single Health Board. The results showed significant variation in how clinical decisions are made, particularly around ENT referrals, the confirmation of HL, and the suitability of SBCHAs for children with mild or temporary conditions.

Although many fittings were in line with current guidance, particularly for children with bilateral and longer-term CHL, some devices were prescribed without a confirmed diagnosis or clear documentation. In several cases, children who appeared to meet referral criteria were not referred to ENT. Poor documentation made it hard to understand the reasoning behind some decisions or to evaluate whether the devices were used appropriately.

There were also broader concerns around the sustainability and impact of current prescribing practices. Children under five had the highest maintenance costs, which may reflect the behavioural and developmental difficulties of using hearing devices at this age. There was also no consistent follow-up or outcome monitoring, meaning it was unclear whether the SBCHAs made a lasting difference.

Altogether, the findings point to a need for more structured and transparent processes. Locally agreed prescribing guidelines, standardised referral procedures, and more consistent record-keeping could help improve the quality and consistency of care.

Strengthening communication and collaboration between audiology and ENT services is also essential to ensure that care is appropriately planned and reviewed.

Based on the findings, a structured decision-making framework (see **Appendix A**) is proposed to guide equitable and consistent SBCHA prescribing. See **Appendix B** for the form supporting documentation, and **Appendix G** for the audit tool that may facilitate ongoing quality assurance.

This evaluation offers insight that may support the development of formal national guidance for SBCHA use in paediatric settings. Future research should focus on evaluating long-term outcomes, service costs, and family experiences to build a stronger case for when and how these devices are most effectively used. At the same time, alternative options such as the HearGlueEar headset should be explored further, particularly for children with mild or fluctuating CHL (Brown, 2021). Offering families lower-cost, accessible solutions may help reduce unnecessary NHS expenditure while providing early support and reassurance during the diagnostic or treatment process.

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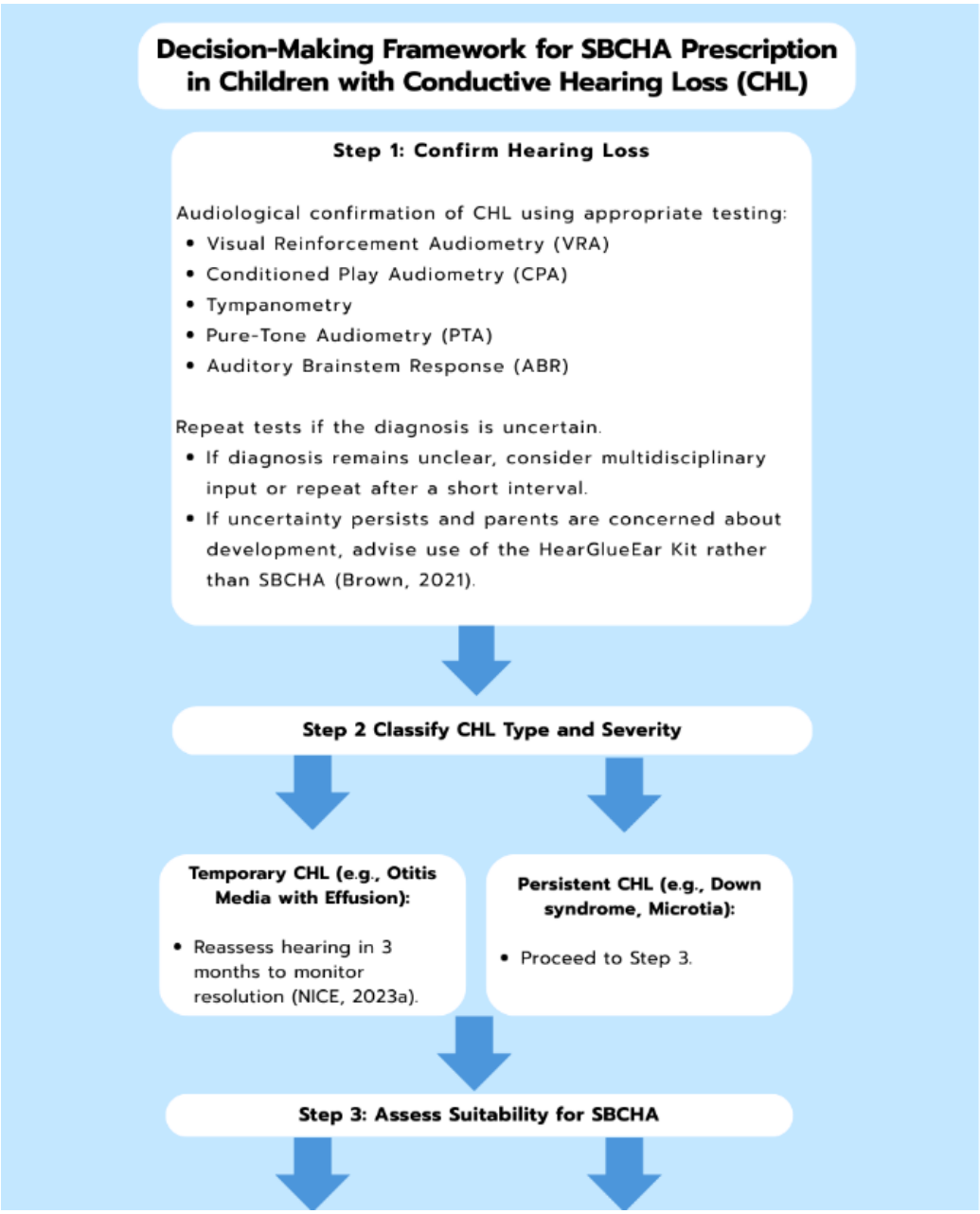
Appendix A

Decision-Making Framework for SBCHA Prescription

Figure 13. *Comprehensive Decision-Making Framework for SBCHA Use in Children with CHL*



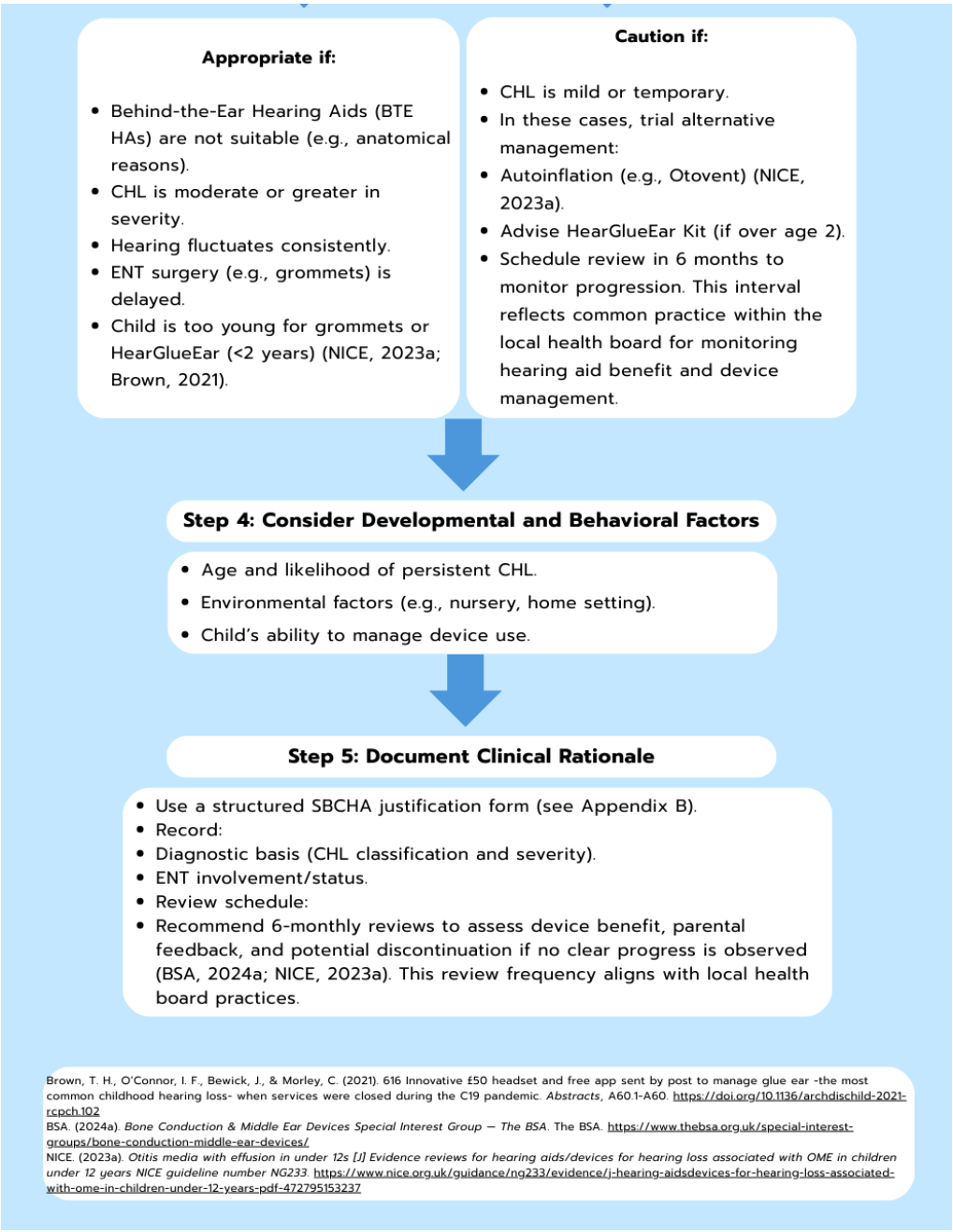


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Figure 13 presents the decision-making framework developed to address inconsistencies identified in SBCHA prescribing practices for children with CHL. In the absence of formal local or national guidelines, this framework aims to standardise the clinical pathway within paediatric audiology services. It offers a step-by-step process, guiding clinicians from confirming diagnosis through to assessing device suitability, while factoring in developmental, behavioural, and clinical considerations. The framework promotes diagnostic certainty, appropriate ENT referrals, consideration of alternative management options, and clear documentation of clinical reasoning. Its purpose is to improve consistency, transparency, and accountability in SBCHA provision, and it could be adapted into local policy or piloted as part of a quality improvement initiative.

Case Example. *Application of the SBCHA Decision-Making Framework in a Paediatric Patient with CHL*

Patient:

- Child aged 3 years 2 months, female.
- History of recurrent otitis media with effusion (OME) for approximately 6 months.
- Presenting with bilateral mild-moderate CHL (30–40 dB HL) confirmed through Visual Reinforcement Audiometry (VRA) and tympanometry.

Step 1: Confirm HL

- CHL confirmed via VRA and tympanometry.
- Repeat testing conducted after a 3-month observation period showed persistent CHL with no significant improvement (aligned with NICE, 2023b).

Step 2: Classify CHL Type and Severity

- Persistent bilateral CHL.
- Degree: Mild-moderate, fluctuating across testing periods.

Step 3: Assess Suitability for SBCHA

- ENT referral made due to persistence beyond 3 months; child placed on grommet surgery waiting list (current wait time: 5 months).
- Parents report concern over speech and language delays; early intervention is sought.
- Air-conduction hearing aids (BTE) considered but deemed unsuitable due to ongoing ear discharge (otorrhoea) causing discomfort with earmoulds.
- Decision: SBCHA provision appropriate as a temporary measure to maintain auditory access during the ENT waiting period, given the documented developmental risk.

Step 4: Consider Developmental and Behavioural Factors

- Child is in a critical period for language development.
- Able to tolerate headband wear during trial fitting; parental feedback positive.
- No significant behavioural barriers noted.

Step 5: Document Clinical Rationale

- Justification for SBCHA provision recorded, including:
    - Persistent CHL diagnosis (bilateral, mild-moderate).
    - ENT referral status and surgical waiting time.
    - Risk of speech and language delay due to prolonged auditory deprivation.
    - Unsuitability of BTE aids due to otorrhoea.
    - Plan for regular review every 3 months, with a view to discontinuing SBCHA use post-surgery or if CHL resolves.

This case example demonstrates how the SBCHA decision-making framework can be applied in practice to guide clinical decision-making for a child with persistent CHL. It illustrates the step-by-step process from diagnosis through to device provision, incorporating key factors such as ENT involvement, developmental risk, and documentation of clinical rationale. The scenario demonstrates the framework's role in supporting consistent, evidence-based prescribing decisions.

Appendix B

SBCHA Justification Form Template

Table 9. *SBCHA Prescription Justification Form – Child and Clinical Assessment Details*

Section 1: Child and Clinician Information

Child's Name	
Date of Birth	
Assessment Date	
Assessor Name & Role	

Section 2: Hearing Assessment

- CHL confirmed by audiologist? ☐ Yes ☐ No ☐ Inconclusive – Retest needed

- CHL Type: ☐ OME ☐ Microtia ☐ DS ☐ Craniofacial Condition ☐ Other: _____

- Degree of HL: ☐ Mild ☐ Mild-Moderate ☐ Moderate ☐ Severe ☐ Profound

☐ Fluctuating

- Audiology Tests Completed: ☐ VRA ☐ CPA ☐ Tympanometry ☐ ABR ☐ PTA

☐ Other: _____ Date: _____

- Is diagnosis confirmed? ☐ Yes ☐ No

- If no: planned reassessment date: _____

Section 3: ENT and Alternative Management

- ENT Referral Indicated? (e.g. persistent OME >3 months) ☐ Yes ☐ No

- ENT Status: ☐ Referral made ☐ Under ENT care ☐ Not referred

- ENT Comments / Plan:

_____

- Trial of other management options:

☐ Autoinflation ☐ Monitoring Period Completed ☐ Grommets considered
☐ Not appropriate

- HearGlueEar discussed? ☐ Yes ☐ No ☐ Not suitable
- HearGlueEar advised (if diagnosis unclear)? ☐ Yes ☐ No ☐ Not appropriate (e.g., under age 2)

Section 4: SBCHA Suitability & Clinical Rationale

- Standard BTE unsuitable due to: ☐ Anatomy ☐ Recurrent otorrhoea ☐ Age/safety
☐ Other: _____

- HL ≥ Moderate? ☐ Yes ☐ No

- CHL persistent/fluctuating for >3 months? ☐ Yes ☐ No

- Surgery delayed or declined? ☐ Yes ☐ No

- Family concern about development or access to sound? ☐ Yes ☐ No

- Clinical rationale for SBCHA:

_____

_____

Section 5: Developmental / Behavioural Considerations

- Sensory sensitivities / neurodiversity noted? ☐ Yes ☐ No

- Expected ability to tolerate/manage device? ☐ Good ☐ Variable ☐ Poor

- Family ability to support use? ☐ Strong ☐ Needs training ☐ Limited

Section 6: Decision Summary & Follow-Up

- SBCHA prescribed today? ☐ Yes ☐ No ☐ Deferred – Reason: _____

- Trial duration planned (if applicable): _____

- Family informed of next steps? ☐ Yes ☐ No

- Initial outcome measure planned: ☐ Parent feedback ☐ Use tracking
☐ Speech/language review

Follow-Up Plan

Review Point	Date	Key Outcome Areas	Clinician Notes
3-Month Review		☐ Usage ☐ Benefit ☐ ENT update ☐ Tolerance ☐ Speech ☐ Hearing Benefit (with and without aid)	
6-Month Review		☐ Continue ☐ Discontinue ☐ Transition to BTE	

Assessor Signature: _____ Date: _____

Table 9 presents the SBCHA Justification and Assessment Form, developed to support the practical application of the decision-making framework outlined in Appendix A. It offers a clear structure for clinicians to record key details when considering SBCHA prescription for children with CHL. The form captures important areas such as hearing assessments, ENT involvement, alternative management options, and developmental or behavioural factors. By documenting the reasoning behind each decision, the form helps ensure that prescribing is consistent, transparent, and in line with national guidelines and local service needs. It's designed to support clinical decision-making and can be adapted for use across different Health Boards.

Appendix C

Parent Information Poster – Understanding OME (Glue Ear) and SBCHA Options

Figure 14. *Parent Information Poster: Understanding Glue Ear, Conductive Hearing Loss, and SBCHA Options*

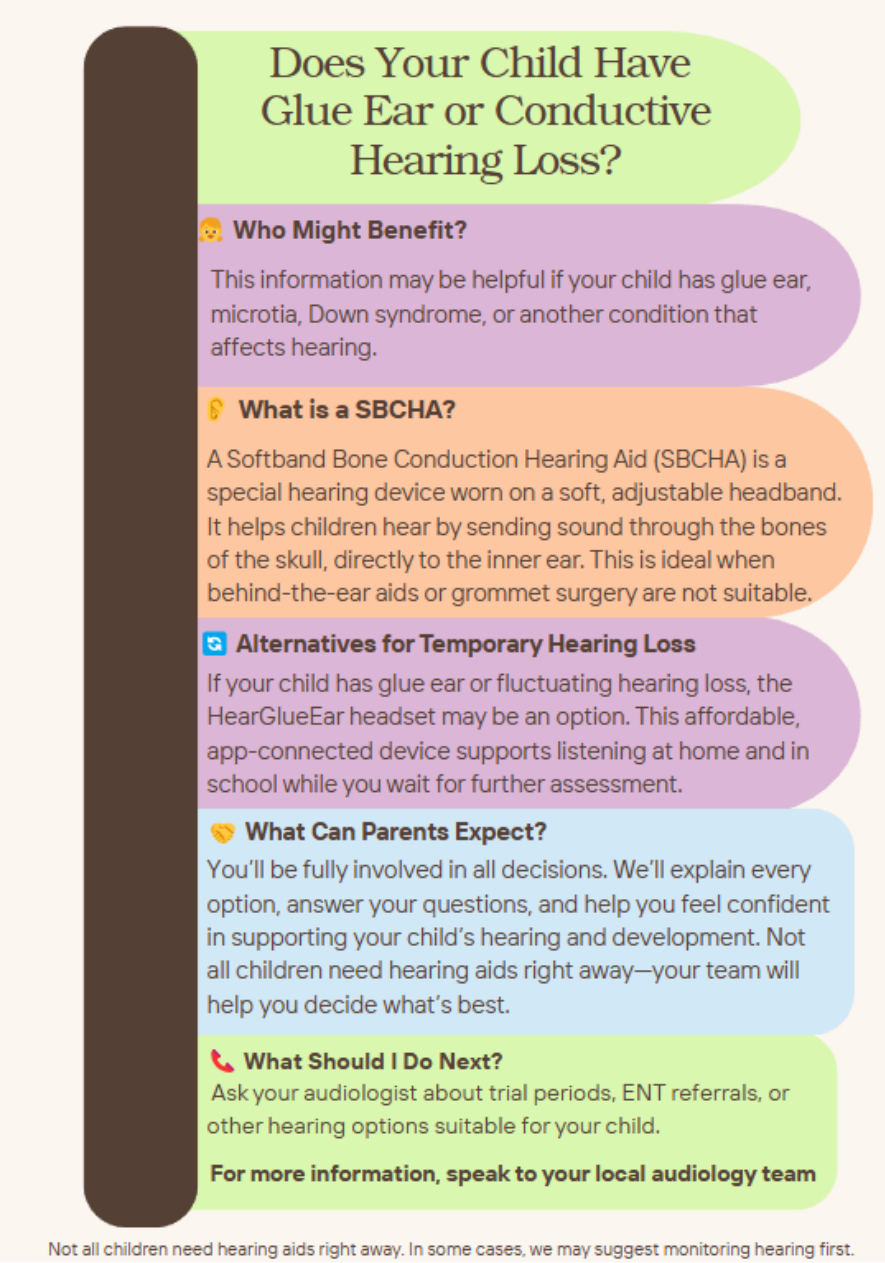

Figure 14 presents a parent information poster developed as a visually engaging, easy-to-read resource for parents and caregivers of children with CHL or OME (glue ear). The poster introduces SBCHAs, outlines alternative hearing support options such as the HearGlueEar headset, and emphasises the importance of shared decision-making between families and clinicians (Brown, 2021). Designed in an A4 format, it can be displayed in clinics, schools, or included in parent information packs to help families make informed choices about their child's hearing care.

Appendix D

Summary of Medical Conditions Affecting SBCHA Candidacy

Table 10. *Medical Conditions Relevant to SBCHA Use*

Medical Condition / Presentation	Description	Relevance to SBCHA Use
Down Syndrome (Trisomy 21)	Genetic condition often associated with narrow canals, persistent OME, and delayed speech development (Intrapiromkul et al., 2012; Kreicher et al., 2018).	Increases CHL risk and makes BTE HA fitting difficult; SBCHA used for early auditory access.
Microtia	Underdevelopment or absence of the outer ear (Andrews and Hohman, 2022).	Prevents BTE HA use; SBCHA provides an effective non-surgical solution.
Craniofacial Conditions (e.g., Treacher Collins, Pierre Robin, Goldenhar)	Syndromic anomalies affecting skull and facial structures, including the ears (Rosa et al., 2016).	Causes persistent OME and make BTE use or tympanometry challenging.
Metabolic Bone Disease of Prematurity	Affects bone growth, including structures in the middle ear, due to inadequate calcium and phosphate intake (Chinoy et al., 2019).	Can contribute to CHL; ABR confirms conductive loss suitable for SBCHA.
Cholesteatoma	Skin growth in the middle ear causes erosion and chronic discharge (Castle, 2018; Kennedy and Singh, 2020).	BTEs are contraindicated due to risk of infection; SBCHA offers a safer alternative.
Cleidocranial Dysplasia	Rare condition affecting bone formation, including cranial structures (Bharti & Goswami, 2016).	Causes fluctuating CHL; SBCHA preferred when conventional options are not viable.
Recurrent Otitis Media / Glue Ear (OME)	Fluid build-up in the middle ear leading to fluctuating or persistent CHL (Searight et al., 2023).	Common CHL cause; SBCHA often used while awaiting resolution or ENT intervention.
Global Developmental Delay	Delayed cognitive, speech and language and motor milestones (Khan & Leventhal, 2023).	Complicates reliable hearing testing and device tolerance; SBCHA offers accessible support
Cleft Palate / Pierre Robin Sequence	Craniofacial condition affecting Eustachian tube function.	Strongly associated with chronic OME; SBCHAs used when grommets are delayed or contraindicated.
Learning Difficulties	Behavioural or cognitive factors affecting test cooperation or accuracy (Fletcher & Miciak, 2017).	SBCHA may be trialled in cases of diagnostic uncertainty to ensure auditory stimulation.

Table 10 provides a summary of the medical conditions and presentations that affect SBCHA candidacy in children with CHL. It outlines how specific diagnoses such as DS, microtia, and craniofacial conditions can complicate the use of conventional HAs, making SBCHAs a more practical option. The table illustrates the relevance of each condition to SBCHA use, offering a quick reference for clinicians when considering alternative hearing support strategies. By bringing together this information, the table supports clearer and evidence-based decision-making in complex cases.

Appendix E

Patient Summary Table (2019-2024)

Table 11. *Overview of SBCHA Fittings: Participant Demographics, CHL Type, and ENT Referral Status (2019–2024)*

Participant	Age at Fitting	Gender	CHL Type	HL Severity	Associated Conditions	ENT Referred
1	1 yr 7 m	F	Temporary	Mild-Moderate	OME	No
2	1 yr 8 m	M	Temporary	Mild-Moderate	OME	No
3	1 yr 9 m	F	Persistent	Mild-Moderate	DS + OME	No
4	1 yr 7 m	F	Persistent	Mild-Moderate	DS + OME	No
5	3 yr 10 m	F	Temporary	Moderate	OME	Yes
6	3 yr 11 m	M	Temporary	Mild-Moderate	OME	No
7	3 yr 10 m	F	Persistent	Moderate	DS + OME	No
8	9 m	F	Temporary	Moderate	Metabolic Bone Disease + OME	No
9	7 yr 9 m	F	Temporary	Mild	Chronic Ear Infections	Yes
10	3 yr 10 m	M	Persistent	Moderate	DS + OME	No
11	2 yr 2 m	F	Temporary	Mild	OME	Yes
12	2 yr	F	Unknown	Unknown	Variable Testing Accuracy	Yes
13	6 yr 7 m	F	Persistent	Moderate	DS + OME	No
14	7 yr 11 m	F	Persistent	Moderate	Craniofacial Condition	No
15	2 yr 10 m	F	Temporary	Mild	OME	Yes
16	9 yr 3 m	M	Persistent	Moderate-Severe	Microtia	Yes
17	7 yr 9 m	F	Persistent	Moderate	Cholesteatoma	Yes
18	11 yr 10 m	F	Temporary	Mild- Moderate	Chronic Ear Infections	Yes
19	1 yr 6 m	F	Persistent	Mild	Craniofacial Condition + OME	Yes
20	5 yr 2 m	F	Persistent	Moderate	Microtia	Yes
21	11 m	F	Persistent	Moderate	Microtia	Yes
22	2 yr 9 m	F	Persistent	Mild-Moderate	DS + OME	No
23	4 yr 1 m	M	Unknown	Unknown	Variable Testing Accuracy	No
24	6 yr 2 m	F	Temporary	Mild	OME	No
25	1 yr 7 m	F	Temporary	Mild	OME	No
26	14 yr 5 m	F	Persistent	Mild-Moderate	Cholesteatoma	Yes
27	3 yr 5 m	M	Persistent	Moderate	Craniofacial Condition	Yes
28	4 m	F	Persistent	Mild-Moderate	Craniofacial Condition + OME	Yes

Table 11 provides a detailed summary of all participants fitted with SBCHAs between 2019 and 2024, capturing key demographic and clinical characteristics. The table includes age at fitting, gender, type and severity of CHL, associated medical conditions, and ENT referral status. This data demonstrates the diversity of cases seen within the service, with participants ranging from four months to over fourteen years old, and a variety of underlying conditions influencing prescribing decisions. It also illustrates variability in ENT referral patterns, with some children meeting referral criteria but not referred, underscoring the need for clearer protocols. By presenting this information in one place, the table supports a broader understanding of local prescribing trends and the clinical profiles of children receiving SBCHAs.

Appendix F

SBCHA Maintenance and Cost Summary by Participant (2019-2024)

Table 12. *SBCHA Initial and Maintenance Costs per Participant (2019–2024)*

Participant	Age (Years & Months)	Initial Cost (£)	Maintenance Cost (£)	Total Cost (£)
1	2yr	552.00	0	552.00
2	1yr 10m	552.00	552.00	1,104.00
3	2yr 2m	552.00	44.61	596.61
4	1yr 9m	552.00	44.61	596.61
5	4yr 6m	552.00	0	552.00
6	4yr 4m	552.00	0	552.00
7	4yr 3m	552.00	0	552.00
8	1yr 7m	552.00	0	552.00
9	9yr	552.00	562.00	1,114.00
10	4yr 9m	552.00	616.61	1,168.61
11	2yr 5m	552.00	0	552.00
12	2yr 3m	552.00	0	552.00
13	7yr	552.00	0	552.00
14	9yr	552.00	0	552.00
15	3yr 10m	552.00	0	552.00
16	12yr	552.00	0	552.00
17	13yr	552.00	740.44	1,292.44
18	13yr	552.00	153.83	705.83
19	1yr 9m	552.00	0	552.00
20	7yr	552.00	10	562.00
21	2yr 9m	552.00	0	552.00
22	5yr	552.00	10	562.00
23	2 yr 11m	552.00	0	552.00
24	4yr 5m	552.00	0	552.00
25	7yr	552.00	0	552.00
26	15yr	552.00	0	552.00
27	5yr	552.00	2,317.22	2,869.22
28	1yr 8m	552.00	0	552.00
		TOTAL: £15,456	TOTAL: £5,051.32	TOTAL: £20,507.32

Table 12 provides a detailed breakdown of the initial and maintenance costs associated with SBCHA provision for each participant between 2019 and 2024, based on clinical service records. The table outlines the upfront cost of device provision alongside any additional maintenance expenses, offering a clear view of the financial impact across individual cases. Maintenance costs varied significantly, with some children requiring extensive support and repairs. This variation highlights the additional service demands associated with younger children or those with behavioural or developmental challenges, reinforcing the importance of considering long-term cost implications when prescribing SBCHAs. The total expenditure across the cohort amounted to £20,507.32, with maintenance costs contributing over £5,000 to this figure.

Cost Summary Statistics for SBCHA Provision (2019–2024)

Table 13. *Summary of SBCHA Provision Costs: Key Statistics and Itemised Maintenance Expenses (2019–2024)*

Metric	Value (£)
Average Maintenance Cost over 1 Year	1,010.26
Average Cost of 1 Hearing Aid over a Year	4,211.86
Total Average Maintenance Cost per Child	174.18
Total Average Cost of 1 Hearing Aid	726.18

Maintenance Cost Itemisation

Item	Cost (£)
SBCHA with Accessories	552.00
Softband (Headband)	44.61
Wire	10.00

Table 13 presents a summary of key cost statistics for SBCHA provision and maintenance during the evaluation period from 2019 to 2024. The upper section of the table outlines average costs, showing that the total average maintenance cost per child was £174.18, while the total average cost of a single HA, including the device and associated expenses, was £726.18. Additionally, it compares the average maintenance cost of SBCHAs over one year (£1,010.26) with the average annual cost of a conventional HA (£4,211.86), highlighting the relative affordability of SBCHAs in this context. The lower section provides an itemised breakdown of maintenance costs, detailing the standard price of an SBCHA with accessories (£552.00), along with common replacement items such as the softband (£44.61) and wire (£10.00). This breakdown helps illustrate the specific components contributing to overall maintenance expenses.

Appendix G

SBCHA Clinical Audit Tool

Table 14. *SBCHA Clinical Audit Tool for Evaluating Prescribing Practices and Documentation*

Audit Criterion	Met? (✓/✗)	Notes / Action Needed
SBCHA justification form completed and stored in patient record		
Diagnostic confirmation recorded before SBCHA fitting (or valid justification if not)		
ENT referral completed (if criteria met, e.g. persistent OME >3 months)		
Alternative management options considered and documented (e.g., autoinflation, HearGlueEar)		
Developmental and behavioural considerations assessed (e.g., tolerance, sensory needs)		
Parental discussion documented (including consent and explanation of options)		
Follow-up review scheduled (e.g., 3–6 months)		
Outcome measures identified (e.g., device usage, speech progress, family feedback)		

This audit tool may be adapted for local use or incorporated into electronic health record systems.

Table 14 presents the SBCHA Clinical Audit Tool, developed to support the effective implementation and ongoing quality assurance of the SBCHA decision-making framework. This tool is intended for use in service evaluations, clinical audits, or governance reviews to assess whether prescribing practices align with best practice standards. It focuses on key areas such as documentation of clinical reasoning, diagnostic confirmation, ENT referral processes, consideration of alternative management options, and family communication. By systematically reviewing these criteria, the tool helps identify gaps in practice and areas for improvement, ensuring that SBCHA provision remains consistent, transparent, and patient-centered. The audit tool can be adapted for local use or integrated into electronic health record systems to streamline compliance monitoring and support continuous service development.