



# Dutch Position Statement Children with Listening Difficulties

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Listening difficulties in children are also known as auditory processing disorders (APD) or (central) auditory processing disorders (C)APD.

Translated version of the original Dutch version (October 2017)

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Colophon: Dutch Position Statement Children with Listening Difficulties.

This is a translated version of the Dutch Position Statement 'Kinderen met Luisterproblemen'.

We want to thank Jae Evans for correcting our translation.

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## Summary

(Inter)nationally there is discussion about whether auditory processing disorders (APD) should be seen as a unique clinical diagnosis and what is the most appropriate diagnosis and referral of children in this target group. In this context, the Dutch Audiological Centres (AC) have different care pathways for children with so-called unexplained listening difficulties.

The purpose of the current document is to provide professionals with tools to identify, diagnose and treat children with listening difficulties. The Dutch Position Statement Children with Listening Difficulties has been developed based on current scientific evidence of listening difficulties, and based on meetings held with professionals. Professionals in the Dutch Audiological Centres have reached a consensus with the following 9 statements:

### Definition:

- (1) The target group 'Children with listening difficulties' is not a unique and demonstrable clinical entity.
- (2) The problems of children with listening difficulties are multimodal.
- (3) The symptoms of children with listening difficulties may also occur in children with other developmental disorders such as AD(H)D, DLD, dyslexia and learning disorders.

### Detection and referral:

- (4) After detection of listening difficulties, children can be referred to a multidisciplinary centre.

### Diagnostics:

- (5) When diagnosing a child with listening difficulties, an audiologist, a speech language therapist and a behavioral scientist must be involved.
- (6) Listening difficulties are initially mapped using patient history (with client-centred focus) and, if available, a validated questionnaire.
- (7) In the case of children with listening difficulties, a speech-in-noise test is always carried out in addition to the pure tone and speech audiometry
- (8) The diagnostic procedure for listening difficulties starts from a broad perspective on development.

### Therapy:

- (9) For children with listening difficulties, intervention is focused on the client's needs and focuses on action-oriented practice.

This document informs professionals in the Netherlands, who are working with children who are referred because of listening difficulties in the absence of hearing loss, about the current evidence available and about the consensus in the Netherlands.

# Dutch Position Statement Children with Listening Difficulties

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## Introduction

### Rationale

There are children who seem to have difficulty in hearing and understanding despite having normal hearing thresholds. For them, listening is difficult in complex listening situations: where there is background noise, or when a speaker speaks very quickly and/or the sound quality is poor. There is not always a clear explanation for the listening difficulties. Such problems in hearing, understanding and listening are known among professionals and also in the (scientific) literature as auditory processing disorders (APD) or (central) auditory processing disorders ((C)APD).

(Inter)nationally there is discussion about whether APD should be seen as a unique clinical diagnosis. Also under discussion is the most appropriate diagnosis and referral of children in this target group. In this context, the Dutch Audiological Centres (AC) deal with children with listening difficulties differently. For both professionals and (parents of) clients, these differences are not desirable. There is a need for an unambiguous and appropriate approach to this target group. In some countries, this need has been met by drawing up a consensus document, or a so-called Position Statement (American Academy of Audiology (AAA), 2010; American Speech-Language-Hearing Association (ASHA); 2005; British Society of Audiology (BSA), 2011; 2017). These documents have gathered the current state of science and practice and established consensus statements in the field of diagnostics and counselling in children with listening difficulties. In 2010, the Multidisciplinary Diagnostics Guideline appeared in the Netherlands for children with auditory processing difficulties (FENAC, 2010). However, the recommendations of this guideline have not been implemented in clinical practice. In the Netherlands, there is currently no consensus document or position statement available at national level. The Dutch Position Statement Children with Listening Difficulties, can meet this need.

### Terminology: APD and Listening Difficulties

In the Dutch Position Statement we use the term APD when we refer to the literature, where the terms APD or suspected APD are usually used. As there is no evidence at present that APD can be seen as a separate clinical entity, and therefore not as a diagnosis, this document has chosen to use as much as possible the term "listening difficulties<sup>1</sup>". This term refers to the target group of children who, in practice, have problems with functioning in (complex) listening situations, despite normal hearing thresholds. These are listening difficulties for which no clear explanation has been found and for which there are restrictions on participation in daily life (for example during classroom work). The term 'listening difficulties' has been chosen to align with international developments which increasingly refer to 'listening difficulties' instead of 'auditory processing disorders'.

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<sup>1</sup> With listening difficulties, the unexplained listening difficulties are meant. For the readability, in this document the term 'listening difficulties' will be used instead of 'unexplained listening difficulties'.

## Aim of the Dutch Position Statement

The current document provides professionals with the tools for identifying, diagnosing and treating children with listening difficulties. It aims to inform professionals in the Netherlands who are dealing with children (who are referred for hearing difficulties despite having good hearing) about the current evidence available, and about the joint position in the Netherlands. The ultimate goal is to establish a standardised method for detecting listening difficulties and for assessing children who are referred to an Audiological Centre.

## Target Group

The Dutch Position Statement Children with Listening Difficulties is intended for professionals working in the Dutch Audiological Centres and who are involved in detection, diagnosing and counselling/supervising children who have listening difficulties, despite normal tone thresholds. In addition, the information contained in this document is informative for professionals from other workplaces related to the detection of children with listening difficulties (e.g., Otorhinolaryngologists, teachers, speech therapists).

## Development

The Dutch Position Statement has been developed on the basis of current scientific evidence of listening difficulties and on the basis of meetings held with professionals of the Research Group Child, Language & Development at Hanze University of Groningen and the Research Centre Innovations in Care at Rotterdam University of applied sciences, in collaboration with the Foundation for Audiological Training (SAO) of the Federation of Dutch Audiological Centres (FENAC). In addition to the available scientific literature, the Dutch Position Statement uses the following sources:

- Focus group research on current experiences, knowledge and bottlenecks, held on the study day "Diagnostics of Auditory Processing Issues (APD)" of May 21, 2014 (Neijenhuis, De Wit, & Luinge, 2017);
- Systematic review of the definition and symptomatology of auditory processing disorders (De Wit et al., 2016);
- Systematic review on the co-morbidity of auditory processing disorders (De Wit et al., 2017);
- Delphi research on consensus of experts regarding difficulties in auditory processing (De Wit, Luinge & Neijenhuis, in preparation);
- Survey data during a meeting with speech language platform (n = 12) and study day "Recent developments around APD" (n = 29) of June the 1<sup>st</sup> and 8<sup>th</sup> 2016.

The draft version of this document was presented to the Dutch ACs affiliated with the FENAC for their comments and feedback in January to March 2017. Fifteen AC's provided feedback on the draft version of this document during the commentary round. After processing the comments, a final version was adopted by the working group and offered to FENAC on July 3, 2017. More information on the creation of this document can also be found on the website: [www.Rotterdamuas.nl/dutchpositionstatement](http://www.Rotterdamuas.nl/dutchpositionstatement)

There is no international consensus on the definition, description, diagnosis and treatment. The reader must be aware of the controversy surrounding the subject. The Dutch Position Statement will therefore have to be reviewed regularly.

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During the development of this document, Dr Rob Drullman and Dr. Nic van Son were involved in the Federation of Dutch Audiological Centres (FENAC).

### Reading Guide

The Dutch Position Statement begins with Part I - Dutch Position Statement Children with Listening difficulties. This chapter contains the statements on which consensus has been reached among Dutch Audiological Centres. These statements were based on the focus group research, the two systematic reviews, the Delphi research and finally, a survey among professionals, working in the audiological field. This survey was conducted during two FENAC meetings (meeting speech language platform (n = 12) and study day "Recent developments around APD" (n = 29) on June 1<sup>st</sup> and 8<sup>th</sup> 2016).

In Part II – Evidence Base and Background - the statements are further substantiated from the various studies that serve as a basis for the Dutch Position Statement.

## Part I Dutch Position Statement Children with Listening Difficulties

### Definition

**(1) The target group 'Children with listening difficulties' is not a unique and demonstrable clinical entity.**

The term "Auditory Processing Disorder" is no longer used as a diagnostic label. There is currently insufficient evidence to consider APD as a unique clinical disorder. The difficulties that children have with listening are instead called (unexplained) listening difficulties, and are described in terms of ICF (functions, activities, participation, environmental factors, personal factors). The target group "Children with listening difficulties" seen in the AC are children who experience constraints in the participation due to listening difficulties.

Despite the disapproval of the term APD as a diagnostic label, the term 'listening difficulties' has not been adopted in consensus. Nevertheless, the working group has used this term, aiming at problems in functioning in (complex) listening situations and restrictions on participation due to these problems.

**(2) The problems of children with listening difficulties are multimodal.**

Listening difficulties can be caused by both disturbed bottom-up processes (sensory processing auditory signal) and disturbed top-down processes (including cognition and language). Moreover, children with listening difficulties, usually have problems in other areas (for example: language, attention, concentration, reading). Because of this multimodal nature of listening difficulties, the client's needs and action-oriented practice are of great importance for this target group.

**(3) The symptoms of children with listening difficulties may also occur in children with developmental disorders such as AD(H)D, DLD, dyslexia and learning disorders.**

The listening difficulties of children may be part of AD(H)D, developmental language disorders (DLD), dyslexia or other learning and developmental disorders. In the aforementioned developmental disorders, there is also a great deal of mutual overlap of symptoms.

## Detection and Referral

**(4) After detection of listening difficulties, children can be referred to a multidisciplinary centre.**

In case of listening difficulties (problems with understanding speech, despite a good peripheral hearing and not explained by an already known disorder), children should always be referred to a multidisciplinary audiological centre for diagnostics and counselling.

## Diagnostics

**(5) When diagnosing a child with listening difficulties, an audiologist, a speech language therapist and a behavioral scientist must be involved.**

The following disciplines are minimally involved in the diagnostic procedure for children with listening difficulties:

- Audiologist
- Speech Language Therapist/Linguist/Speech Language Pathologist
- Behavioral Scientist

**(6) Listening difficulties are initially mapped using patient history (with client-centred focus) and, if available, a validated questionnaire.**

An action-oriented approach and a broad overview of the problems are important in the diagnostics of children with listening difficulties. As an initial step, an inventory of (medical) history and the client's needs should be registered during an anamnesis (interview).

If a child has listening difficulties, the problems present should be mapped using validated questionnaires (if available). According to Moore (2016) and DeBonis (2015), a questionnaire focusing on the executive functions and a questionnaire for mapping the communication skills must be administered. At the moment, no validated questionnaire is available for mapping the listening difficulties. In the absence of well-validated questionnaires, the teacher questionnaire CHAPPS-NL and SIFTER, and the questionnaire LIFE-NL for students, are available as an alternative. These questionnaires can map the listening skills of a child (Neijenhuis & van Herel-de Frel, 2010).

**(7) In the case of children with listening difficulties, a speech-in-noise test is always carried out in addition to the pure tone and speech audiometry.**

The diagnostic procedure always starts with a standard hearing assessment (audiometry). An overview of the available speech-in-noise tests, which can be used in children, can be found in the article by Hammer, Coene and Govaerts (2013) and Drullman (2015). The speech-in-noise testing, is a challenge to measure speech recognition and not language ability (Drullman, 2015). The Digits-In-Noise (DIN) test appears to be the most suitable in the Netherlands for use in children with suspicion of listening difficulties as a speech-in-noise test. According to the BSA (2017), however, all speech perception tests involve the influence of language, attention and work memory.

**(8) The diagnostic procedure for listening difficulties starts from a broad perspective on development.**

In addition to the anamneses, the questionnaire(s), and the hearing examination, the following tests are carried out in the diagnostic examination of children with listening difficulties:

- Intelligence test, including standardized tests of attention and memory
- Speech and language assessment

There is no consensus about the use of the Dutch auditory processing (AP) tests. The AP test batteries currently nationally and internationally available, are insufficiently valid and seem to mainly measure language and auditory attention (BSA, 2017). On the basis of information about current available tests, combined with own expertise, client's needs and capabilities of the organization, the professional will make a well-informed choice on a case by case basis .

## Therapy

**(9) For children with listening difficulties, intervention<sup>2</sup> is focused on the client's needs and focuses on action-oriented practice.**

The intervention is tailored to the individual client and his or her daily functioning in all ICF domains (functions, activities, participation, environmental factors and personal factors). In children with listening difficulties, the intervention focuses on environmental adjustments and compensation possibilities.

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<sup>2</sup> Intervention may be a diagnostic intervention, a therapeutic intervention, postponing treatment, or giving advice (Wouters, van Zaalen & Bruijning, 2015)

## Part II Evidence Base and Background

### Dutch Position Statement Children with Listening Difficulties

#### Definition

**(1) The target group ‘Children with listening difficulties’ is not a unique and demonstrable clinical entity.**

From the literature, no evidence has been found that APD can be seen as a separate clinical entity (De Wit et al., 2016; 2017). According to Cacace & McFarland (2009; 2013), the term APD should only be used if modality specificity can be demonstrated and that misdiagnosis can be prevented. Without the modality specificity, the concept of APD has little power and meaning (McFarland & Cacace, 2009). To date, no study is known in which modality specificity has been demonstrated.

As there is still a lot of discussion about the definition and diagnosis of APD, Bamiou (2009) believes it is better not to talk about an auditory processing disorder but instead use ‘a disturbed auditory processing’. Kamhi (2011) and DeBonis (2015) also suggest that it may be better not to see APD as a separate clinical entity, but as a processing defect that may occur due to various developmental disorders such as Specific Language Impairment (SLI), dyslexia and AD(H)D. The Dutch professionals who participated in the Delphi study (De Wit, Luinge, & Neijenhuis, in preparation) also reached consensus that APD cannot be seen as a separate disorder. They assume that listening difficulties are seen as part of dyslexia, AD(H)D, developmental language disorders (DLD), autism spectrum disorders (ASS) or other learning and developmental disorders.

All test results of children who, have difficulty listening, despite a normal threshold, should be analyzed and discussed multidisciplinary. Professionals should use a holistic approach. Instead of labeling a person with APD, it is desirable to thoroughly describe the listening difficulties involved and to use an action-oriented approach (BSA, 2017; Beck, Clarke, & Moore, 2016).

One possibility of mapping the clinical problem and representation of the problem in daily life is with the commonly used ICF model, see Figure 1 (International Classification of Functioning, Disability and Health of the World Health Organisation, WHO, 2001; Dutch translation appeared in 2002). The ICF provides a scientific basis and common language to describe the functioning of people and the possible problems that limit people in the functioning (RIVM, n.d.). In 2006, an ICF developed specifically for children and adolescents up to 18 years, the ICF-CY (International Classification of Functioning, Disability and Health for Children and Youth, WHO, 2007). From the three different perspectives (anatomical properties of the body, activity and participation), the ICF-CY model can describe functioning and all what relates to it. In addition, ICF-CY also contains a classification of external factors, such as the direct and broader living environment of the child (RIVM, n.d.).

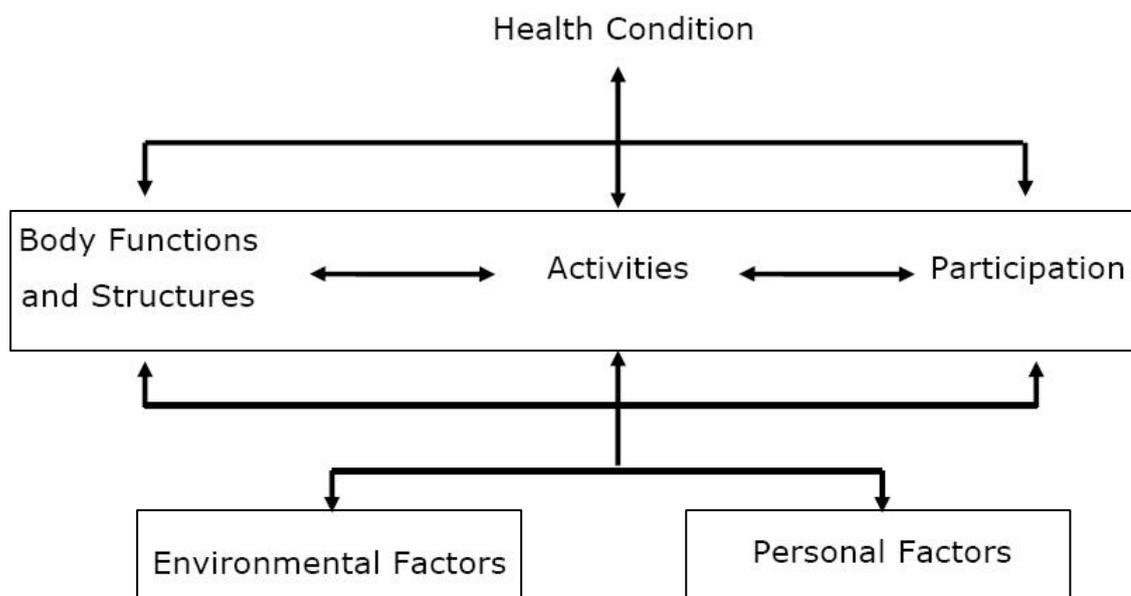


Figure 1: Model of functioning and disability illustrating the interactions of different health aspects according to the International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2002b, p. 9).

The ICF model appears to be a suitable model to map the functioning of children with listening difficulties (Baas, 2011). The child's listening difficulties can be described in the ICF domain 'Activities and Participation'. Auditory processing problems fit better to the ICF domain 'Functioning' in this context. An extensive explanation can be found in the article by Neijenhuis, Dekelver & van Herel-de Frel (2016).

## **(2) The problems of children with listening difficulties are multimodal.**

To date, there is no unique symptom that can solely be attributed to problems in auditory processing. According to Moore et al. (2012), the most common reason for referral of children with APD, is listening difficulties associated with a wide range of symptoms such as difficulties of understanding speech in a noisy environment, unable to follow conversations, speech problems, hearing in classroom and inattention. A systematic review (De Wit et al., 2016) showed that the problems of children who were referred because of listening difficulties are not specific to the auditory modality. Various studies reveal that children with listening difficulties have difficulty with auditory, visual, cognitive, oral and written language tasks. Several processes play a role in listening. Problems with language processing are not always explained by an underlying problem. It has become clear that cognition, language and attention are interwoven and integrated with auditory perception (Beck, Clarke, & Moore, 2016). Figure 2 shows the characteristics of the child with listening difficulties.

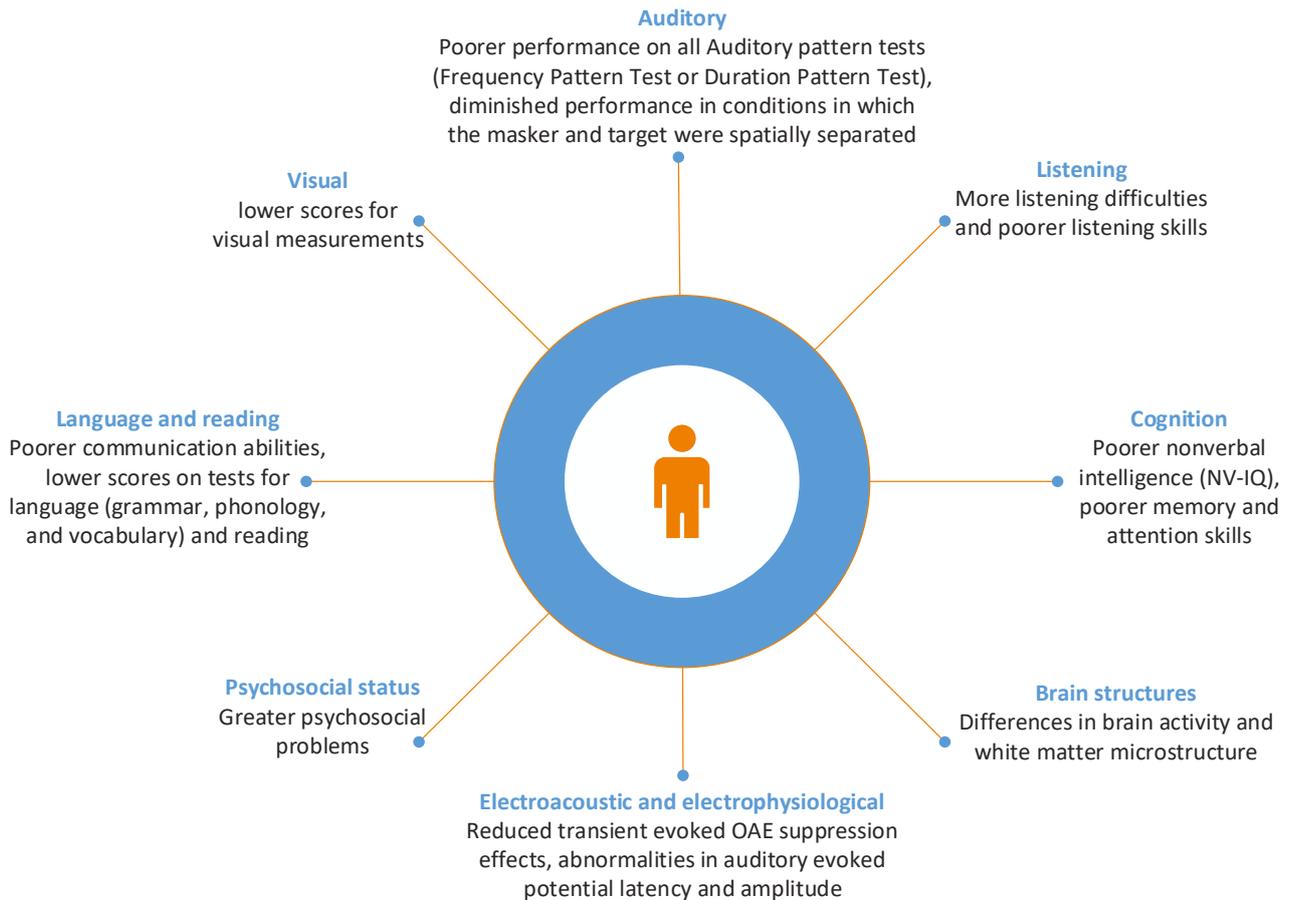


Figure 2: Characteristics of a child with listening difficulties. Children with listening difficulties perform compared to typically developing children weaker in multiple domains (De Wit et al., 2016)

One of the most reported features in the literature is having speech recognition problems in the presence of background noise (Jerger & Muziek, 2000; ASHA, 2005). According to the respondents who participated in the Delphi study (De Wit, Luinge, & Neijenhuis, in preparation), the following symptoms are characteristic in children with listening difficulties:

- Difficulty hearing in noise,
- Auditory attention problems,
- Better understanding in one on one situations,
- Difficulties in noise localisation, and
- Difficulties in remembering oral information.

These features do not say anything about the possible cause of listening difficulties. All mentioned symptoms also occur in other developmental disorders, such as developmental language disorder (DLD), Dyslexia, AD(H)D and ASS. As can be seen in Figure 2, the characteristics of children with listening difficulties are diverse and these children perform in several areas weaker compared to normally developing children. The current available evidence suggests that the problems of these children are related to language skills and cognitive processing beyond the traditional auditory system (BSA, 2017; Beck, Clarke, & Moore, 2016).

**(3) The symptoms of children with listening difficulties may also occur in children with other developmental disorders such as AD(H)D, DLD, dyslexia and learning disorders.**

Recent research shows that difficulties in auditory processing usually coincide with language, reading, attention and/or cognitive problems (Bishop & Dawes, 2009; Dawes & Bishop, 2010; Kahmi, 2011; Ferguson et al., 2011; Moore, 2010; De Wit et al, 2017). The high degree of comorbidity of problems in auditory processing with other disorders, such as DLD, dyslexia and autism spectrum disorders, is recognised internationally (BSA, 2017).

For listening to auditory stimuli, not only hearing and processing of the auditory stimulus are necessary as skills, but before hearing and processing, attention must be paid to the auditory stimuli. In addition, one must remember, analyse, and understand speech sounds (Moore, 2013). According to Bellis (2003) even the simplest auditory signals are influenced by higher cognitive factors, such as memory, attention and learning.

The systematic review about the overlap between children with APD and children diagnosed with another developmental disorder showed that children with listening difficulties perform the same on many tests as children diagnosed with DLD, dyslexia or ADHD. There are no differences with cognitive and language tasks between children with listening difficulties and children with a different diagnosis. Children with DLD also score the same as children with APD on reading tasks. Only minor differences have been found between children with listening difficulties and children diagnosed with another disorder. Children with listening difficulties score weaker in comparison with children with ADHD on auditory and visual pattern recognition tests. Compared to children with learning problems, children with listening difficulties have more difficulty with directional hearing. However, it should be noted that there are only a small number of studies included with in most cases, small research groups (see Figure 3). The parents of children with listening difficulties assess the children's listening skills as weaker than the parents of children with a DLD or dyslexia (measured with the CHAPPS questionnaire). The question is, how reliable is this result. Information about the validity and reliability of CHAPPS (Smoski, Brunt, & Tannahill, 1998) is missing. In addition, the CHAPPS is completed by parents, but were originally designed to be completed by the child's teacher (Smoski, Brunt, & Tannahill, 1992). The teacher answers the questions by comparing the listening skills of the individual child with the listening skills of other children of the same age group and background. The similarities and differences between children with the various disorders are visually shown in Figure 3.

The Delphi study and the focus group study show the same picture. In the Delphi study, a majority of experts (> 80%) indicate that listening difficulties usually coincide with ADHD, ADD, dyslexia or language disorders. Some believe that listening difficulties are also part of a disturbance in the autistic spectrum. The professionals agree that problems in auditory processing usually coincide with language, reading, attention and cognitive problems and that listening difficulties should be seen as part of a broader developmental problem.



Figure 3: Overlap and difference between children with listening difficulties and children with another developmental disorder (SLI, dyslexia, ADHD and learning problems); De Wit et al., 2017.

The performance of children diagnosed with APD on various tests is compared with the performance of children diagnosed with another developmental disorder. The area of the circles is equal to the number of subjects included in the studies (*n*). The bold and outlined numbers shows the overlap (no significant differences) on the outcome of the used measurement instruments. Italic numbers illustrates the significant differences between children diagnosed with APD and children diagnosed with other disorders. The encircled italic numbers shows the number of measurement instruments (test and subtest level) whereupon children diagnosed with APD perform significant poorer in comparison with children diagnosed with other developmental disorders.

ADHD: attention deficit hyperactivity disorder; APD: auditory processing disorder; CHAPPS: Children's Auditory Processing Scale (Smoski et al. 1998); DPT: Duration Pattern test; LD: learning disorder, LiSN-S: Listening in Spatialized Noise Test-sentences (Cameron & Dillon 2007; 2008); SLI: specific language impairment; SRT: speech reception threshold.

## Detection and Referral

### **(4) After detection of listening difficulties, children can be referred to a multidisciplinary centre .**

Professionals who participated in the focus group study (Neijenhuis, De Wit, & Luinge, 2017) agreed on the multidisciplinary approach of children with complaints regarding listening. The high degree of coherence of listening difficulties with language, attention, memory and executive problems in both children and adults underlines the importance of a multidisciplinary approach (BSA, 2017). In case of listening difficulties, a referral to a multidisciplinary audiological centre is necessary.

There may be listening difficulties if a child has one or more of the following symptoms:

- Problems in understanding speech in noise;
- Better understanding in one on one situations;
- Auditory attention problems;
- Localisation problems;
- Difficulties in perception and remembering oral information.

It is good to realise that the above symptoms are not symptoms of APD, but according to the professionals who participated in the Delphi study, the children with listening difficulties often show the above symptoms, irrespective of possible associated problems.

## Diagnostics

### **(5) When diagnosing a child with listening difficulties, an audiologist, a speech language therapist and a behavioral scientist must be involved.**

The current evidence indicates that problems in auditory processing are mainly due to language or other cognitive processes beyond the traditional auditory system. This underlines the importance of a multidisciplinary approach (BSA, 2017).

More than 90% of Delphi's experts report that research involving children with listening difficulties needs to be conducted by a multidisciplinary team. In any case, an audiologist, a speech language therapist and a behavioral scientist (psychologist/orthopedagogue) should be part of a multidisciplinary team. In addition, the following disciplines could be added to the team: clinical linguist, a speech language pathologist, or social worker.

### **(6) Listening difficulties are initially mapped using patient history (with client-centred focus) and, if available, a validated questionnaire.**

All experts who participated in the focus group study agreed on the starting point of the diagnostic procedure: intake/history and audiometry. An action-oriented approach and the broad mapping of the problems are important. As an initial step, an inventory of (medical) history and the help question should be mapped during an anamnesis (interview).

If a child has listening difficulties, the problems present should be mapped using validated questionnaires (if available). In addition, missing information should be requested. Understanding the difficulties that exist and its impact on education, social interactions and other achievements must be central in diagnostics (BSA, 2017). If hearing problems have been identified, professionals can map the listening difficulties of

the children at the beginning of the diagnostic procedure using a validated questionnaire, if available. The questionnaire should provide insight into the listening situations and the problems experienced. It is up to the multidisciplinary team to decide, partly based on the questionnaire, which tests should be administered and what care pathway is the best for the child.

In addition, the ASHA (2005) and the AAA (2010) stated that mapping problems that the child experiences and disease history is a first step before further diagnostics should take place. This information should be obtained through the anamnesis, observations and questionnaires for parents or for example teachers. Since it is usually not clear what the precise cause of the listening difficulties is, it is important to focus on the clinical representation of the problems; daily listening behaviour is then mapped using an observation or validated questionnaire (BSA, 2011; Moore, 2016; Moore et al., 2013). At the moment, no validated questionnaire is available for mapping the listening difficulties. According to Moore (2016) and DeBonis (2015), a questionnaire focusing on the executive functions and a questionnaire for mapping the communication skills should at least be used. Validated questionnaires are available for the screening language and attention abilities (for example, CCC-2-NL, BRIEF, CBCL). There are Dutch questionnaires available that can be filled in by children themselves, their parents or their teacher to map listening difficulties (see Table 1). These questionnaires often provide useful information, but are not well-standardised and/or validated (BSA, 2017). They are not suitable for diagnostics (Wilson et al., 2011).

Name of Questionnaire	Original version	Reference	Filled in by:	Standardization available	Clinical research
Vragenlijst voor luistervaardigheden van kinderen (CHAPPS-NL)	Children's Auditory processing Performance Checklist (CHAPPS)	Smoski et al., 1998; Neijenhuis & Nijland, 2005; manual and questionnaire available through <a href="https://www.ned-ver-audiologie.nl/download-s-en-publicaties/">https://www.ned-ver-audiologie.nl/download-s-en-publicaties/</a>	Teacher	no	n=64 (Smoski et al, 1992)
Checklist voor kinderen met auditieve verwerkingsproblemen (naar Keith, 2000)	checklist for auditory processing disorders in children	Keith, 2000; Neijenhuis & Stollman, 2003; available through: <a href="https://www.phonakpro.com/content/dam/phonak/gc_nl/FM/checklist%20AVP.pdf">https://www.phonakpro.com/content/dam/phonak/gc_nl/FM/checklist%20AVP.pdf</a>	Teacher/parent/professional	no	Limited, n=63 (Neijenhuis & van Herel-de Frel, 2010)
Vragenlijsten naar effect van geluidsapparatuur (LIFE-NL)	Listening Inventories For Education (LIFE)	Anderson & Smaldino, 1998. See also <a href="http://successforkidswithhearingloss.com/tests">http://successforkidswithhearingloss.com/tests</a> . Neijenhuis & Nijland, 2005; manual available through <a href="http://www.simea.nl/vereniging/materialensite/handleiding-life-nl.pdf">http://www.simea.nl/vereniging/materialensite/handleiding-life-nl.pdf</a> . Adapted version: <a href="http://www.kentalissoloapparatuur.nl">www.kentalissoloapparatuur.nl</a>	Student (student version), teacher	no	Limited, n=7 (Neijenhuis, 2009)
Schoolvragen-lijst voor kinderen met (mogelijke) gehoorproblemen	Screening Identification For Targeting Educational Risk (SIFTER).	Anderson, 1989. Neijenhuis & Wiltingh, 2002. Available through <a href="http://www.kentalissoloapparatuur.nl/file/tgthplx2f-f-/SIFTER.pdf">http://www.kentalissoloapparatuur.nl/file/tgthplx2f-f-/SIFTER.pdf</a>	Teacher	Yes	Yes, n=530 controls vs. 50 children with HL (Anderson, 1989)

Table 1: Dutch questionnaires available for mapping listening difficulties.

There is an urgent need for validated and standardised questionnaires for mapping listening difficulties in children under 6 years, teenagers and adults (BSA, 2017). In 2015, a new questionnaire was developed by Barry et al. (the Evaluation of Children's Listening and Processing Skills (ECLiPS)). This questionnaire is to be completed by parents and consists of 38 statements with a 5-point scale. The ECLiPS has been validated in 49 children with suspected auditory processing problems, and unlike many other questionnaires, the psychometric features are known in this list and the comprehensibility for parents is sufficient. Further research is required to determine which role the questionnaire can have in the diagnostic procedure. At the Catholic University of Leuven a translation of the ECLiPS has been made in French and Dutch, and a standardisation study is ongoing (Van Wieringen, personal information June 2017).

**(7) In the case of children with listening difficulties, a speech-in-noise test is always carried out in addition to the pure tone and speech audiometry.**

The diagnostic examination of children with complaints in the field of listening always starts with a standard hearing examination (audiometry). According to Moore (2016) and DeBonis (2015), in addition to the use of questionnaires (at least one aimed at executive functions and one for mapping the communication skills), two speech-in-noise tests should be added to the diagnostic procedure. In countries outside the Netherlands, the Words-in-Noise Test (WIN) and the Bamford-Kowal-Bench Speech in Noise Test (BKB sentences) are available. In speech-in-class testing, the challenge is to measure only speech perception and not language proficiency (Drullman, 2015). According to the BSA (2017), however, all speech perception tests involve the influence of language, attention and work memory.

In the Netherlands, the Plomp test (Plomp & Mimpen, 1979) can be used for example. The Plomp test is considered as "gold standard" for measuring speech in speech in adults or older children (Drullman, 2015). The Plomp test uses short sentences offered against a background of stationary noise. This Plomp test consists of lingual stimuli and language and cognitive processes play a role in the administration of the Plomp test. The Digits-In-Noise (DIN) test (Smits et al., 2016; 2013; Kaandorp et al., 2015) can be used in children from 4; 0 years for whom the Plomp test is too difficult. Standard age data is available for each age group (Drullman, 2015). Using numbers (0 through 9) offered in background noise minimizes the involvement of language abilities and/or auditory memory.

Research (Kaandorp et al., 2015) has shown that the DIN test is a reliable and valid test for measuring the intelligibility of speech in hearing aid and cochlear implant users with high hearing loss. The reliability and validity of the DIN test is not (yet) investigated. In practice, the DIN test seems to be a good test for use in the Netherlands as a speech-in-noise test.

An overview of all available Dutch speech-in-noise tests for children, can be found in the article by Hammer, Coene and Govaerts (2013) and Drullman (2015).

## **(8) The diagnostic procedure for listening difficulties starts from a broad perspective on development.**

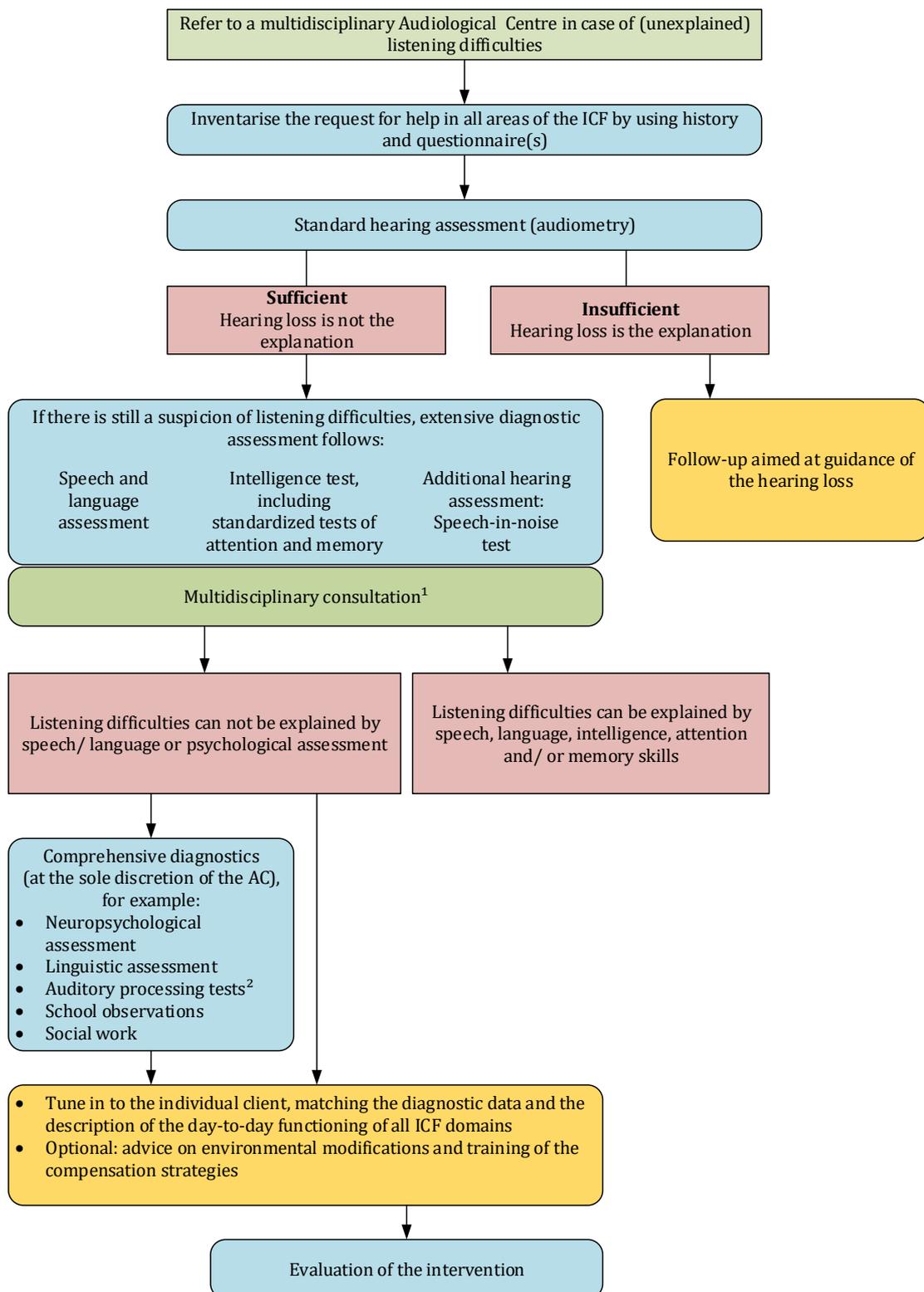
In addition to the anamneses, the questionnaire(s), and the hearing examination, the following tests are carried out at least in the diagnostic examination of children with listening difficulties:

- Intelligence test, including standardised tests of attention and memory
- Speech and language assessment

Further examination can follow different pathways. The variation in further care pathways for children with listening difficulties are: either or not using auditory processing tests, the extent of the auditory test battery (speech-in-noise only or more) and the starting point in diagnostics: first narrow or first wide. A wish to customise or tailor the approach is often mentioned.

There is no consensus on the use of the Dutch auditory processing (AP) tests. The validity of AP-test batteries currently available nationally and internationally has not been proven sufficiently. Most AP- tests seem to measure language and auditory attention (BSA, 2017). Current AP-test batteries cannot be used for diagnosis and should not be used for this purpose. There is no scientific evidence to justify the choice for AP-tests (De Wit et al., 2017). However, audiological centre is free to use sub-tests of the AP-test battery to obtain additional information. In practice, the administration of a test may be justified on the basis of experience and expertise or from the specific help question. On the basis of information about current available tests, combined with own expertise, client's wishes and capabilities of the organisation, the professional will make a well-informed choice per case. More information on current test batteries can be found in the article by Neijenhuis & van Herel-de Frel from 2010 and in the Dutch Learning Book Audiology (Neijenhuis, 2014).

For the Dutch Position Statement, a flow chart for the diagnostic study has been made (Figure 4).



Figuur 4. Diagnostic flowchart for children with listening difficulties.

This flow chart has been developed based on the literature (BSA, 2017; Moore, 2016; DeBonis, 2015); existing documents of Dutch audiological centres (Royal Auris Group, 2016; Pento, 2016) and research among the Dutch professionals of Audiological Centres.

<sup>1</sup> The multidisciplinary consultation is variable in terms of composition, timing and content. It depends on the diagnostic procedure of each centre where in the process this occurs.

<sup>2</sup> Everyone is free to use sub-tests of the AP test battery to obtain additional information. However, There is no scientific evidence to justify the choice for AP-tests.

## Therapy

### **(9) In children with listening difficulties, intervention <sup>3</sup> is focused on the client's needs and focuses on action-oriented practice.**

The Delphi-study (De Wit et al., In preparation) showed that the experts had different opinions about the intervention to be conducted in children with listening difficulties. Some experts think it does not make sense to start treatment if there are only listening difficulties. However, targeted advice should be given to parents and teachers. The advice should be directed towards the utilisation of the child's capacities, so that other difficulties can be compensated.

According to Moore (2016), there are only a few interventions that currently provide some scientific support. These include environmental and behavioral adjustments, such as improving acoustics in the classroom, the listener's location relative to the speaker, and the use of an external microphone. There is no clarity in the literature regarding the meaning and effectiveness of auditory training. A systematic review was published in 2011 evaluating the effectiveness of interventions for schoolchildren with APD (Fey et al., 2011). In this systematic review, no convincing evidence has been found that auditory interventions have an effect.

Existing auditory interventions do not affect the auditory, language and academic skills of children diagnosed with APD or language impairment. Loo and colleagues (2016) have recently investigated the effect of auditory training on the listening skills of children with an APD diagnosis. They found an improved test performance of children with APD, who had followed a 12-week intensive speech-based auditory training, on a speech-in-noise test. A similar result was found in the study by Cameron and Dillon (2011). The question is whether the improved test performance also has an effect on the daily functioning and listening. A comprehensive systematic review (Simons et al., 2016) proves that practicing a particular cognitive task will improve performance on that task and closely related tasks. However, the current available evidence does not prove that such training is also generalisable to other tasks or the daily functioning.

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<sup>3</sup> Intervention may be a diagnostic intervention, a therapeutic intervention, postponing treatment, or giving advice (Wouters, van Zaalen & Bruijning, 2015)

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