A study investigating the use of a teachers' questionnaire and a hearing history questionnaire to rate pupil's skills in auditory comprehension, attentive listening and speech discrimination.

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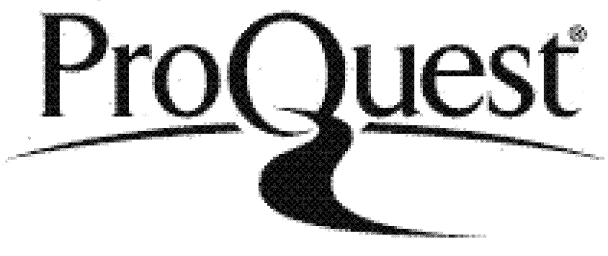

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Abstract

The purpose of this study was to investigate whether teachers could accurately rate children's auditory comprehension, attentive listening and speech discrimination skills over a 12 month period using a questionnaire. A hearing history questionnaire was also used to investigate whether a significant history of hearing difficulties would affect scores of auditory comprehension and speech perception and whether the teachers' ratings would reflect any hearing difficulties.

56 children from a cohort of 307 pupils aged from 4.4 – 5.5 years were selected as they had the weakest profile across assessments of verbal comprehension and speech discrimination. The children were followed over a 12 month period. Assessments of auditory comprehension and speech discrimination and teachers questionnaires took place at three points during this period. The hearing history questionnaire was completed at the beginning of the program by the children's parents.

We found that teachers' ratings of auditory comprehension and attentive listening skills significantly correlated with standardised test scores at the first and last period of testing but not at the middle period. No correlation was found between the teachers ratings of speech discrimination and formal tests of speech discrimination.

Significant negative correlation was found between scores on the hearing history questionnaire and scores obtained on the formal test of speech discrimination. No other significant correlation was found with the hearing history questionnaire.

Explanations for these findings are discussed and the implications of this study are considered for both Speech and Language Therapists and Teachers.

This study supports the use of the hearing history questionnaire in conjunction with the teachers' questionnaire in order get a comprehensive picture of the child's skills in auditory comprehension, attentive listening and speech discrimination.

Contents

Introduction

Much research has been carried out to investigate causal relationships for speech, language and literacy difficulties. Researchers have for some time tried to identify patterns in children's development that put them at greater risk of developing these types of difficulties; family history, socioeconomic status and television viewing habits are examples of some of the potential factors that Hollis (1989) investigated.

Speech and language difficulties can impact on a child's life in many ways. Poor language has been associated with emotional and behavioural problems (Goodyer 2000) and poor social relationships (Rice 1993 cited in Williams 2006). Research has indicated that children with language difficulties are at increased risk of developing later literacy, reading and writing difficulties (Bishop & Adams, 1990, Bishop and Edmundson, 1987, cited in Boudreau 2005 p. 1). Catts et al (2002) carried out a longitudinal study following children with language impairments from kindergarten to fourth grade and studied their reading abilities. The study concluded that the presence of a developmental language impairment should be taken as an important sign of a child being at risk of reading disability.

The importance of early identification of children at risk of reading failure has been a major area of concern for many researchers as "prevention is easier than remediation" (Snow et al 1998 cited in William 2006 p 2). Catts et al (2001) explain if children can be identified as being at risk early, optimally preschool, and provided with the necessary intervention, then future literacy difficulties may be prevented or at least significantly reduced. Heath and Hogben (2004) add that early identification may prevent associated negative outcomes such as impaired social and emotional development that may impact on both society and the individual.

It is clear from this research that early identification is crucial. However in order to develop successful identification methods and preventative intervention programmes, it is essential that we understand more fully the causes of these language and literacy difficulties.

It is widely accepted that early speech discrimination skills and in turn phonological awareness skills are key requirements to developing sound literacy and language skills

(Bird, Bishop & Freeman 1995). In fact, phonological awareness, "the explicit awareness of and access to the sounds of spoken language"(Wagner & Torgessen 1987 cited in Heath et al 2004 p.2) has been accepted as accounting for as much of the variance in reading outcomes than any other predictor (Felton & Brown 1991, Mann 1984, Share et al 1984 cited in Heath and Hogben 2004). It is therefore crucial to understand phonological awareness in more detail and try to account for some of the variation amongst children. Rvachew and Grawburg (2006) investigated potential variables that may affect phonological awareness (PA) skills in 4 and 5 year-old children with speech sound disorders. They found half the children had difficulties with speech perception and PA despite having language levels within the average range. They found that speech perception has a direct effect on PA and early literacy skills were predicted by PA abilities. They concluded that "children with speech sound disorders are at greatest risk of delayed PA if they have poor speech perception abilities and/or relatively poor receptive vocabulary skills" (p.74). This finding supports the view that speech perception skills play a crucial role in the normal development of PA. Early speech perception skills have also been found to be predictive of later language abilities. Tsao, Liu & Kuhl (2004) carried out a longitudinal study that investigated speech perception skills amongst a group of children in the first two years of life. At 6 months they used a standard method – conditioned head turn - to test speech perception and found that it predicted language development at 13, 16 and 24 months of age. They argued that good phonetic discrimination is essential to identify lexical information from the speech stream a child who has a greater ability to do this is likely to have a more developed lexicon by two years of age. This supports the view that phonetic perception plays a critical role in the early phases of language acquisition. They suggest that an early measure of speech discrimination may provide information helpful to the early detection of infants at risk of language difficulties.

In contrast to phonetic perception which is particularly concerned with the discrimination of speech sounds, other researchers have argued that a core sensory deficit affecting both speech and non speech sounds is responsible for difficulties in language and literacy development. Tallal's (1980) Auditory Model argues that a core sensory deficit in

auditory processing would make it difficult for children to process rapidly changing sounds; this has been argued to result in Specific Reading Disability (SRD) and Specific Language Impairment (SLI). However commentators are still undecided whether auditory temporal processing deficits are responsible for SRD and SLI. Experiments to investigate and test this hypothesis remain inconclusive (McArthur et al 2001). In Share et al's (2002) study, auditory temporal processing (ATP) deficits in children who went on to develop reading difficulties were found but this relationship was not found to be causal.

Heath and Hogben (2004) also attempted to investigate this relationship further by incorporating an ATP assessment into their screening tool which aimed to identify those children at risk of developing future literacy difficulties. This screening tool was originally made up of assessments of phonological awareness (PA), phonological short term memory and demographic variables. They found that these assessments identified 80% of children with poor PA who were at risk of reading problems. When they incorporated an ATP assessment into their screening tool they found no evidence that this assessment yielded better results than screens based on phonological and oral language. These studies do not currently support the use of ATP assessments as a means to identify children at risk of literacy and language difficulties, although speech discrimination is a skill which has been linked to future language skills (Tsao et al 2004).

In addition to the importance of auditory discrimination described above, Morgan-Barrie (1994) states there are four other principle components of the complex auditory process that must be considered; auditory acuity, auditory attention, auditory discrimination (described above) and auditory memory.

Auditory acuity – the sensory response to sound - is the most peripheral to the system but is essential to developing language. Any disruption to the hearing mechanism will impact at this level and disrupt the process. Otitis Media with effusion (OME) is a common condition particularly amongst young children that results in intermittent conductive hearing loss. Research has identified a general relationship between an early history of OME and language deficits particularly in toddlers and pre-school children (Petinou et al

2001). Some additional effects associated with OME are impaired linguistic and cognitive development and reduced educational attainment (Schilder et al 1994). OME often makes it difficult for children to perceive the ends of words. Petinou et al (2001) found that children with histories of otitis media with effusion (OME) performed less well on a perception task of morphophonological and phonological /s/ and /z/. Mody et al (1999) studied a group of 9 year olds with and without histories of OME in the first year of life. They found that children with a history of OME performed less well on speech discrimination and phonological short term memory tasks. This study provided evidence that a history of OME in the first year of life may result in some persistent and subtle effects on phonological representations and working memory. Petinou et al (2001) conclude that children prone to OME need to be closely observed to ensure that their language development follows a normal course.

Auditory attention is the ability for the listener to attend to sounds. The listener must first hear the sound – auditory acuity - and then be alerted to the salience of the sound. As Morgan-Barrie (1994) explains many factors will impact on the degree of auditory attention an individual demonstrates; the interest of the sound, is it a new sound, the degree of background noise, the physical state of the listener for example, tiredness and motivation to listen. Young children have varying levels of attention and some children will only be able to attend to a speaker for a very short space of time even with very motivating sounds. An inability to attend to sounds will disrupt the whole auditory process as Geffner et al (1996) found. Children with attention deficit disorder (ADD) were poorer at speech discrimination in noise but performed as well as controls in quiet. When distracted their auditory system broke down resulting in poor speech discrimination. Therefore it is crucial to observe closely those children with a reduced ability to attend to sounds and ensure conditions are kept optimal for listening.

Teachers as assessors of language ability:

Teachers rely heavily on being able to accurately judge their pupils performance in order to plan lessons and pitch them at the right level. Borko et al (1979 cited in Hoge et al 1989) found that teachers base their 'instructional decisions' on judgments of their

student's level of comprehension. These judgements are also important whilst delivering lessons; teachers will make alterations to their plan if they perceive their students do not comprehend (McNair 1978-1979, cited in Hoge et al 1989). In addition to this, teachers must be able to identify those children that are having difficulties in this area and that are not functioning at a level that is age appropriate. Salvia and Ysseldyke (1981) explain that "teachers judgements are the primary source of information used in educational decision making and in particular identifying children with special needs"(p.185 cited in Bates and Nettelbeck 2001) They have a professional obligation to refer children on for specialist support when children need it. The revised special educational needs (SEN) code of practise (2001 DFES) has shown a move towards inclusion with increasing pressure on teachers to identify and manage children with speech and language impairments including seeking specialist advice or treatment when appropriate. It is therefore crucial that teachers make accurate judgments about their pupils.However there is some disagreement in the literature about how successfully teachers are able to do this. Bates and Nettlebeck (2001) compared the reading accuracy and comprehension scores of children aged 6-8 years with teachers' predictions of their reading achievement. They found predictions about relative individual differences in reading achievements were moderately correlated with accuracy (0.77) and comprehension (0.62) scores. However when they applied an acceptable band of error for each score, based on age, they found that 75% of teachers judgments were inaccurate. These teachers had misjudged reading age by 6-7 months. There was a tendency to over-estimate the reading skills of low achieving students and underestimate the achievements of capable readers. However other studies have found evidence to support mainstream teachers abilities to judge their pupil's skills accurately.

Hoge and Coladarci (1989) reviewed 16 studies that focused on teacher–based judgements of academic achievement. In general they found high levels of agreement between the teachers' judgements of ability and standardised test scores. They commented that there was quite broad variation amongst the teachers' ratings although reasons behind this variation were not discussed in detail. The studies in this review focused around core curriculum subjects - reading, maths and science, a small number focused also on social studies and language arts. This review provides evidence to

support teachers' ability to make accurate judgments about their student's achievements in core subjects. However it does not look specifically at speech and language impairments and other impairments that may put children at risk of future literacy difficulties, for example, phonological awareness and speech perception.
Therefore it is still unclear how well teachers are equipped to identify and manage speech, language and communication impairments.

Sadler (2005) used a questionnaire to investigate issues such as training, specialist knowledge and attitudes towards inclusion of children with speech and language impairments. The study focused on teachers from reception, year 1 and year 2. Many teachers reported having little or no training on speech and language impairment with knowledge acquired mainly through hands on learning. Levels of confidence in their ability to meet the educational needs of such pupils were low. This offers little optimism for teachers' ability to accurately identify and manage those children at risk of speech, language or literacy difficulties. Boynton, Hauerwas, and Addison Stone (2000), investigated whether parents were accurate estimators of their child's language skills. They involved parents of children aged 5-7 with and without language impairments. They compared parents ratings with standardised test scores and teachers judgments of their language skills. They found parents of normally developing children and teachers of children with SLI to be most accurate in rating children's language skills. In fact the teachers of the SLI children were speech and language pathologists, so had therefore received specific training in language skills. However this study found that parents, who had received no training, were better judges of their child's language skills than mainstream teachers. This is an unnerving discovery; however other studies reveal more optimistic results.
Botting et al (1997) looked specifically at the concordance between scores on language assessments and teacher/therapist opinion of a pupil's ability. Their study assumed that the teacher/therapist's clinical judgement was accurate and investigated how closely the standardised assessments reflected this judgement. They found that for 'less complex' impairments - articulation/ phonology and syntax/phonology difficulties, teacher/ SLT opinion related strongly with results from standardised tests – 66% agreement or higher.

However for 'more complex' impairments, semantic/pragmatic difficulties, agreement between professional judgement and test scores diminished. The children with semantic/pragmatic difficulties performed relatively well on standardised tests. The difficulties identified by the teachers were not revealed or reflected in standardised test scores. This study provides evidence that clinical judgment for less complex impairments e.g. articulation, is reflected accurately in standardised test scores. Botting et al (1997) used informal interviews to collect information from the teachers and/or Speech and Language Therapist's regarding their clinical opinion of each pupil and support staff would often be present at these sessions. Unfortunately, clinical judgements were not made by teachers alone as Speech and Language Therapists with specialist knowledge in these areas would have influenced teacher's judgements and vice versa. It is therefore still unclear whether teachers alone can accurately judge children's language skills. This method of collecting data is suitable for research but is impractical as a means to assess or screen children on a day to day basis due to the time constraints and logistical difficulties of arranging meetings for a number of busy professionals.

Williams (2006) carried out a similar study to Botting et al (1997) but set out explicitly to distinguish mainstream teachers' ability to identify language impairment from specialists such as Speech and Language Therapists. The rationale behind the importance of this is cost – by maximising on teachers' knowledge, specialist resources can be targeted at those children who need it quickly and efficiently without the need for explicit widespread screening programmes.

Williams (2006) identified teachers from kindergarten, pre-primary and year 1 from a cluster of 5 primary schools in the Perth area. The teachers attended three professional development sessions over the course of the project and worked with final year Speech and Language Therapy students. They were asked to identify children whose speech and language skills placed them at risk of developing future literacy difficulties. They were also asked to identify one or two children whose speech and language was developing normally. The study found that teachers were able to identify a large number of children for whom testing revealed language/phonological awareness skills that may place them at risk of literacy difficulties (sensitivity 86% and specificity 68.2%). Interestingly they found that when kindergarten children were excluded, teacher judgments resulted in

higher sensitivity and specificity rates (92% and 85.7%). Two possible explanations for this finding were that, firstly, teachers had spent less time with this year group due to the fewer days they attended school and therefore knew the pupils less well. Secondly, teachers had received less training on language development for this age group and therefore were less equipped to make judgements about their abilities. In contrast to Sadler (2005), this study found that 80% of teachers judged their knowledge of language components as average or above and 85% of them reported that they were moderately confident in their ability in identifying children with language impairments. It also reported that the factors teachers considered when identifying children at risk were factors that were considered to be important by Speech and Language Therapists.
This study appears to provide clear evidence of the competence of teachers to identify those children who appear to be at risk of future literacy difficulties.
It is possible that this cluster of schools in Australia are particularly well equipped to deal with language and literacy difficulties: Schools and training in England may vary considerably from this model. There is however one major confounding factor in this study. Despite the fact that the teachers were asked about their knowledge and confidence in identifying children with speech and language impairment prior to the first professional development session, they were asked to identify children at risk after they had attended this initial session. This session gave training on potential indicators of language and literacy difficulties. Although it is clear from the questionnaires that the teachers felt well equipped to identify these children, it is impossible to tease apart the knowledge gained from training from prior knowledge. Would these teachers have identified the same children and considered the same factors having not received this training? As Williams (2006) highlighted the study may have been better evaluated if teachers had identified children prior to receiving any specific training from this project or if a control group of teachers had been included who had not received any training.

Training for teachers was an integral part of Flynn and Rahbar's (1998) study which developed a rating scale for teachers to use to identify children at risk of reading failure. The tool included research-validated precursors to reading achievement. Behavioural descriptions were given to help focus teachers' observations and compare the pupils

behaviour to typical behaviours expected at both low and high levels of ability. They found that these descriptions improved teachers' ability to identify children at risk of reading failure. They commented that additional training, particularly for areas such as phonological awareness, is likely to improve prediction rates even more. This study shows that with the right level of support and training, teachers can effectively identify a high percentage of children at risk of reading failure.

Questionnaires:

Questionnaires or rating scales as described by Flynn et al (1998) can be an effective method to obtain crude measures of ability in a timely and efficient manner. As Flynn et al (1998) found, by giving examples of behaviours for high and low performance of a particular skill, teachers had a reference point to base their judgments on and greater accuracy was achieved. In a busy school environment it is often unrealistic to arrange meetings with the teacher to discuss individual pupils at length. However, as has been described above, teachers have an essential role in identifying children who are at risk of developing language and literacy difficulties. If we can use the knowledge they have of their pupils and focus their observations to identify particular skills, we have a cost-effective way to identify at risk pupils and can target intervention to those pupils who need it most.

Questionnaires or rating scales can be used to screen for language difficulties that may place children at risk of developing future literacy difficulties. They could also be used to identify any changes made in these skills for example gains made in therapy.

Often questionnaires ask the teacher to make judgments about their pupils in relation to their peers e.g. below average, average or above average. It is therefore important that any gains made in therapy exceed average changes made in the class as a whole in order for them to be represented using this scale.

Like all assessments, questionnaires and ratings scales must be sensitive enough to identify those items you are investigating. The questionnaires used in this study are a teacher questionnaire developed by Gilmore (2005) and a hearing history questionnaire adapted from Hind et al (1999). Although as Botting et al (1997) demonstrated, interviews often yield more comprehensive information, but they require a large

investment of time which may not be available in a school setting. Therefore questionnaires, that are quick and easy to complete, are more likely to be incorporated into a school working day.

This project is an extension/follow up of a previous project by Gilmore, J (2005) that examined the use of a teacher questionnaire to identify children's level of comprehension, attentive listening skills and in particular speech discrimination skills. As has been described above, comprehension, attentive listening and speech perception skills are crucial to the normal development of language and literacy and are therefore important skills for teachers to be able to identify. Teachers will need to make accurate judgements of these skills over a 12 month period and the questionnaire itself will need to be sensitive enough to reflect any changes made in these skill areas over the given time period. These ratings will then be compared to standardised test scores to see whether any correlation is found.

Gilmore (2005) found that teacher scores on the questionnaire for comprehension and attentive listening correlated positively with formal test scores, but found no correlation between teachers' ratings and the pupils' scores of speech discrimination.

Due to the importance placed on the auditory process in the research and the commonality of OME amongst young children, this study has also incorporated a hearing history questionnaire to investigate whether a significant history of hearing difficulties is reflected in teachers' ratings or formal test scores.

This study proposes to investigate whether the pattern seen by Gilmore (2005) is echoed over the period of a year and proposes to answer three key questions.

1. Using a questionnaire, will teachers rate children's auditory comprehension, attentive listening and speech discrimination skills significantly higher at each interval in testing over a 12 month period?
2. Will teachers' ratings of these skills correlate with children's scores obtained from standardised tests at all three testing points over a 12 month period?

3. Will the hearing history questionnaire correlate with the teachers' ratings of their abilities and the children's scores on the standardised assessments of auditory comprehension and speech discrimination?

The literature leads us to predict that teachers will rate their pupil's skills in comprehension, attentive listening and speech discrimination significantly higher at each period in testing. As, time passes these pupils will be getting more used to the routine of school and will be maturing generally, it is likely that the teachers will be able to identify and record these changes.

The teachers will also be able to accurately rate their pupils' skills for comprehension and attentive listening but, as Gilmore (2005) found, may not be able to judge speech discrimination skills accurately.

We would also expect to see some correlation between the hearing history questionnaire and teacher ratings and standardised test scores particularly for the speech discrimination assessment.

Method

Design

This study employed a within subjects design. Speech and language assessment data was collected from participants at three points in time T1 – January 2005, T2 – September 2005 and T3 – January 2006 and compared to teachers' ratings of their abilities at the same periods in time. A hearing history questionnaire was completed by the parents of all the children assessed at T1. This was collected and compared to the children's test scores at T1.

Participants

Participants were selected from an initial cohort of 307 pupils taken from 17 reception classes of 10 mainstream primary schools. Information packs about the project along with consent forms were sent to the families of every pupil in all 17 reception classes. For every pupil for whom consent was gained, a thorough battery of speech and language

assessments was undertaken. The battery was designed to identify any auditory, speech and language difficulties that the pupils may have. Groups of four or eight pupils were selected, depending on the size of the school, to take part in a pilot intervention study to improve speech discrimination skills. The pupils selected had the weakest profile across assessments of verbal comprehension and speech discrimination. They had performed at chance level on an assessment of speech discrimination skills and/or had a standard score of 4 or less on a published test of verbal comprehension. In total 56 pupils were selected to participate. At the time of selection their ages ranged from 4 years 4 months – 5 years 5 months, with the mean age of 4.81 years.

Teacher questionnaires were given to the class teachers of the 56 participants and there were 17 teachers at all three periods of testing. The questionnaire at T1 was completed by each child's reception teacher, whereas at T2 and T3 these were completed by a different year 1 class teacher.

Materials

Speech and Language Assessments:

Two assessments were used for this study, testing auditory comprehension and speech discrimination.

Auditory comprehension was assessed using the Linguistic Sub-test of a published standardised test, the Pre-school Clinical Evaluation of Language Fundamentals (CELF - P) (Wiig, Secord & Semel 2000). The children hear a phrase and are asked to point to the appropriate part of a composite picture for example 'point to the animal in the middle'. The task was carried out and scored as described in the handbook.

Speech discrimination was assessed using a computerised unpublished test, the XAB task of Speech Input Processing in Children (SIPc) (Vance, Rosen & Coleman, in press). The test aims to assess children's speech discrimination skills by using the fictional characters of aliens in space ships. The child sits at the computer; there are three spaceships on screen, one large spaceship at the top of the screen and two smaller ones below. An alien from the large space ship appears and says a non-word X e.g. pish. In turn an alien from each of the smaller space ships also says a non-word A and B. One of the aliens says the

same as the first alien and the other alien says a non- word that differs from the first word by one phoneme e.g. pish and bish. The child must pick the alien which said the same as the first alien. The test comprises of three parts - a trial part which gives the child time to familiarise herself with the computer and the task. The second in which the words are presented without any background noise and the final part in which the stimuli are heard against background noise of multi-talker babble. Each stimulus is presented twice, once with and once without background noise.
The test was loaded onto a laptop computer, and each child was asked to wear headphones. Thus each assessor required a laptop and headphones.

Teacher Questionnaire

The teacher questionnaire was designed by Gilmore (2005). It was used to gather information from teachers regarding their perceptions of their pupils' auditory comprehension, attentive listening and speech discrimination skills – (See appendix 1). The questionnaire was designed to be quick and easy to complete. It consisted of eight separate items; the first five items tested attentive listening skills, the next two applied to auditory comprehension skills and the final item focused on speech discrimination skills. Each item was designed to gain information about a specific behaviour, it contained a close ended statement which the teacher had to consider and apply to the pupil in question using an attitude scale. For example, for attentive listening, teachers were asked to rate the pupil's attentive listening skills in relation to his/her peers in a series of different settings. The settings included during class discussions, in small groups, one to one, in both quiet and noisy environments. The teacher was required to place each pupil into one of the categories listed below:
'Well below average', 'below average', 'average', 'above average' or 'don't know'.
Each category was given a score – 'Well below average' scored 1, 'below average' scored 2 and 'average' or 'above average' scored 3.
The teacher questionnaire was completed at all three assessment periods - T1, T2 and T3. It was given to the teachers as soon as the testing was completed for all the pupils. The questionnaires at T1 were completed by each child's reception class teacher where as T2 and T3 were completed by their class teachers in year 1.

Hearing history questionnaire

The hearing history questionnaire was based upon the Childhood Middle Ear Disease and Hearing Questionnaire (CMEDHQ) (Hind 1999), a published questionnaire designed by the MRC institute of Hearing Research. It contained 11 scored questions under two broad headings: history and presentation of the disease, and consultation/treatment history. The questions focused on trying to identify how at risk the child has been of suffering from hearing difficulties. For example, Question Two asks:

'Apart from any of the routine hearing tests, have you ever seen any of these people about your child's ears or hearing?' The list of options ranges from a GP and Health Visitor to a Speech and Language Therapist for an unrelated problem.

For the purposes of our study the questionnaire was adapted slightly; some of the non-scoring items were removed in order to make it shorter and therefore faster to complete (see appendix 2). The questionnaires were scored in line with the guidelines given with the original questionnaire (Hind 1999).

At T1, January 2005, the questionnaire was sent to the parents of all the children in the study, for whom consent was received.

Procedure

56 children were selected to take part in the study. The children were assessed at three test periods T1 - January 2005, T2 - September 2005 and T3 - January 2006.

A pre-selected battery of assessments that included the XAB SIPc (Vance et al unpublished) and the Linguistic Concept subtest of the CELF-P (Wiig, Record & Semel 2000) were undertaken at each test period by an impartial adult, a final year Speech and Language Therapy student. The assessments were usually carried out away from the classroom in another room or in a quiet area of the school. The assessment items were presented in a random order to each child.

Baseline measures were taken at T1. Due to time constraints at T2, the XAB SIPc (Vance et al, unpublished) was only carried out in quiet and not in noise.

The teacher questionnaires were distributed after the assessments had been carried out at each period of testing.

The hearing history questionnaire was completed once at T1 by the child's parents. It was sent to the parents of all the pupils for whom consent was received to take part in the study.

Results

The Teacher Questionnaire

At T1, 52 out of 56 teacher questionnaires were completed and returned with the speech discrimination question scored 'don't know' or omitted on 3 of the questionnaires. At T2, 45 were completed and returned with the speech discrimination question scored 'don't know' or omitted in 10 of the returned questionnaires. At T3, 43 were completed and returned and the speech discrimination question was scored 'don't know' or omitted in 3 of the returned questionnaires.

Descriptive statistics were calculated for each section of the teacher questionnaire at each of the periods of testing. See Table 1 below:

Table 1: Descriptive statistics for items scored using the teacher questionnaire.

	Attentive Listening (N=15)			**Auditory Comprehension (N=6)**			**Speech Discrimination (N=3)**		
	T1	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
Mean	11.04	11.34	12.00	4.52	4.68	4.87	1.73	1.94	2.03
Standard Deviation	2.56	2.59	2.71	1.09	1.06	1.08	0.45	0.51	0.51
Range	10	10	9	4	3	3	1	2	2

As Table 1 above shows, the mean scores for all three skill areas are higher at each period of testing. The mean scores are higher at T3 and T2 than T1 and higher at T3 than at T2. This data did not comply with parametric assumptions as the data did not approximate normal distribution. Therefore a Wilcoxon-Matched- pairs Signed-ranks Test was undertaken to investigate whether these differences were significant. Table 2 below illustrates the results:

Table 2: Wilcoxon Signed Ranks Test Statistics

	Attentive Listening- Difference between:			Auditory Comp. Difference between :			Speech Disc.- Difference between :		
	T2 –T1	T3 –T2	T3 –T1	T2 - T1	T3-T2	T3 –T1	T2 - T1	T3 –T2	T3 –T1
Z	-1.015	-1.376	-2.766	-0.987	-.132	-2.654	-2.111	-0.577	-2.496
Asymp. Sig. (2 tailed)	0.310	0.169	0.006**	0.324	0.895	0.008**	0.035*	0.564	0.013*

*Significant at the 0.05 level
**Significant at the 0.01 level

As Table 2 shows, there was not a significant difference between attentive listening and auditory comprehension scores between T2 - T1 and T3 - T2. However, there was a significant difference between these scores from T3 and T1 (Attentive Listening - $Z = -2.766$ $P < 0.01$, Auditory comprehension $Z = -2.654$, $P < 0.01$). For speech discrimination, there was not a significant difference in scores between T3 and T2, but there was a significant difference between T2 -T1 and T3 - T1 ($Z = -2.11$, $P< 0.05$, $Z = -2.496$, $P<0.05$). These results support the pattern that was predicted. However, the increases in scores are not as large or significant as predicted for all areas and between all time periods.

Standardised Tests

Descriptive statistics of the raw scores for the sub-test of the CELF at T1, T2 and T3 were calculated and are shown in Table 3 below:

Table 3: CELF raw scores at all periods of testing.

	CELF- Auditory Comprehension		
	T1	T2	T3
Mean (N=20)	9.15	13.06	14.35
Standard Deviation	4.53	4.23	3.98
Range	18	18	17

As Table 3 illustrates, normal distribution was approximated at T1. However, for both T2 and T3, a ceiling effect was seen with the majority of scores being at the top end of the range.

Table 4 below shows descriptive statistics for the XAB SIPc in quiet and in noise.

Table 4: SIPc scores in quiet and in noise at T1, T2 & T3.

	Speech Discrimination – in Quiet			**Speech Discrimination – in Noise**	
	T1	T2	T3	T1	T3
Mean (N=30)	15.32	23.28	23.24	12.50	18.96
Standard Deviation	5.22	4.46	4.92	2.97	3.46
Range	20	20	21	12	15

As Table 4 shows, a floor effect was seen at T1 for speech discrimination in both quiet and in noise. However, at T2 and T3, a ceiling effect is seen in quiet with some positive skew seen at T3 in noise.

The test scores did not comply with parametric assumptions as normal distribution was not approximated, so therefore correlations between formal assessment scores and teacher ratings were calculated using Spearman's Correlation Co-efficient, a non-parametric test.

Table 5 below shows the correlations found between the teachers' ratings of attentive listening, auditory comprehension and speech discrimination with the pupil's raw scores on the formal assessments at T1, T2 and T3.

Table 5: Correlations between teachers' ratings and raw scores on formal assessments.

		Attentive Listening			**Auditory Comprehension**			**Speech Discrimination**		
		T1	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
CELF	**T1**	0.315 * N=47			0.522** N= 47					
	T2		0.256 N=41 NS			0.298 N=41 NS				
	T3			0.425* N= 39			0.556** N= 39			
SIP c-	**T1**	0.60 N=48 NS			0.042 N=48 NS			0.121 N= 45 NS		

	T2		0.287 N=40 NS			0.133 N=40 NS			0.108 N= 31 NS	
	T3			0.404* N=39			0.231 N=39 NS			0.171 N= 36 NS
SIPc - Noise	**T1**	0.156 N=48 NS			0.103 N=48 NS			0.033 N=45 NS		
	T3			0.209 N=39 NS			-0.003 N=39 NS			0.158 N=36 NS

* = Correlation is significant at the 0.05 level (2-tailed).
** = Correlation is significant at the 0.01 level (2-tailed).
NS = not significant

As illustrated in Table 5 above, at T1 there is significant, low, positive correlation between teachers' ratings of attentive listening skills and the pupil's CELF raw score of auditory comprehension ($r = 0.315$, $p < 0.05$). There is also significant, moderate, positive correlation between teachers' ratings of auditory comprehension and the pupil's CELF raw scores of auditory comprehension ($r = 0.522$, $p < 0.01$) at this time period.
At T3, there is significant, moderate, positive correlation between teachers' ratings of attentive listening skills and auditory comprehension with the pupil's CELF raw score of auditory comprehension ($r = 0.425$, $P < 0.01$, $r = 0.556$, $P< 0.01$).
At this period there is also significant, positive correlation between the teachers' ratings of attentive listening and the pupil's score on the speech discrimination task in quiet ($r = 0.404$, $p < 0.05$). However, this pattern is not seen at T1 or T2.

Contrastingly, at T2 there is no correlation between any of the teachers' ratings with any of the scores from the formal assessments.
At T1, T2 and T3 there is no correlation between the teachers' ratings of speech discrimination and scores on the XAB SIPc in noise or in quiet. There is also no correlation between ratings of auditory comprehension and the pupil's scores on the XAB SIPc in noise or in quiet for any of the test periods.

The Hearing History Questionnaire

Of the 56 hearing history questionnaires distributed to the pupil's parents, 46 were returned for analysis. Descriptive statistics were calculated for the scores obtained from the hearing history questionnaire – the Mean 14.7, Standard Deviation 12.22 with a range of 0-44.

A floor effect was observed with the majority of scores at the bottom end of the range. As the data did not approximate normal distribution, correlation was calculated using Spearman's Correlation Co-efficient, a non-parametric test. Table 6 below contains the correlations that were calculated:

Table 6: Correlation between hearing history questionnaire, test scores and teacher ratings.

	Teacher Questionnaire - T1			Assessments – T1		
	Attentive listening	Auditory Comp	Speech Dis.	Celf	SIPc – Quiet	SIPc-Noise
Hearing Correlation Coeffient	-.286 N = 39 NS	-0.04 N=39 NS	0.00 N=36 NS	-0.248 N=41 NS	-.415** N=42	-.349** N=42

** = Correlation is significant at the 0.01 level (2-tailed).

As Table 6 shows, there is significant negative correlation between the hearing history questionnaire and the children's scores on the XAB SIPc in both quiet and in noise ($r = -0.415$, $P < 0.01$, $r = -0.349$, $P < 0.05$). The correlation is more significant in quiet than in noise. The correlation between the teachers' ratings of attentive listening and the hearing score is approaching significant ($r = -0.286$) at the 0.05 level, but is not significant or approaching significant for any other of the teachers' ratings.

Discussion

This study investigated whether teachers would be able to reliably identify children's verbal comprehension, attentive listening and speech discrimination skills at three separate points in time over a 12 month period using a questionnaire.

Firstly, we looked at the teachers' ratings and found that the mean rating for all skill areas was progressively higher throughout the 12 month period. However, these ratings were only significantly higher between T3 and T1 for attentive listening and auditory comprehension and between T2-T1 and T3-T1 for speech discrimination.

Teachers recognised the progress children had made and were able to represent this progress using the questionnaire. The fact these changes were not significantly higher at each time interval may be due to a variety of different reasons. It is possible that the children had made small improvements throughout the year but these changes did not amount to significant differences between each time interval. Alternatively, the children's improvements may not be fully revealed in the classroom setting, so therefore teachers may not have taken 'hidden changes' into account when rating their abilities. The questionnaire itself may not offer sufficient opportunity to represent these changes as being significant. By looking at the correlation between these ratings and the formal assessment scores, we may be able to understand more fully the reasons behind this pattern.

Firstly, for auditory comprehension and attentive listening skills, the study found that teachers' ratings correlated with formal assessments for these skills at T1 and T3. However, at T2 no correlation was found.

A possible explanation for this could be the timings at which these questionnaires were completed. T1 and T3 both occurred in January, the beginning of the second term, the teachers had worked with their pupils for at least one term at this point. Contrastingly, T2 occurred in September, the beginning of the school year where the pupils were new to all the teachers and consequently their ratings were likely to be less accurate. If we are to use formal assessments as our benchmark, then we can state that teachers can reliably rate comprehension and attentive listening skills when they have known the child for at least one term. This finding is in keeping with Williams (2006) study in which she found that teachers of kindergarten children were less able to judge their skills as opposed to years 1 and 2, one explanation for this was due to the reduced amount of time teachers spent with these children.

This has implications for teachers and therapists; as Salvia and Ysseldyke (1981 cited in Bates and Nettelbeck 2001) explained, teachers are often the primary source of

information used in educational decision-making and it is often at the beginning of the school year that teachers put children into groups based on their ability. However if these groupings are based on teachers' perceptions of skills at the beginning of term then children may be judged inaccurately. It also highlights a need for greater shared knowledge between teachers of different years. This would allow the new teacher to benefit from the knowledge and experience of the previous teacher.

No correlation was found between teachers' ratings of speech discrimination and the children's scores on SIPc (Vance et al unpublished) in noise or in quiet. This reflects the findings of Gilmore (2005) who also found no correlation between teachers' ratings of speech discrimination and scores obtained in SIPc. This lack of correlation between teachers' judgments of speech discrimination and SIPc scores is alarming. Research (Bird, Bishop & Freeman 1995, Rvachew and Grawburg 2006, Tsau et al 2004) illustrates a clear link between poor speech discrimination and future language and literacy problems. If teachers cannot reliably identify these skills it is likely they will be unable to identify a large proportion of children who will go on to develop literacy and language difficulties.

From all the questionnaires returned, 18% of these had no information on speech discrimination; teachers had chosen to either answer with 'don't know' or to omit the question on speech discrimination. Contrastingly, the questions on auditory comprehension and attentive listening were completed on 100% of the questionnaires. This could be explained by a lack of understanding of the term 'speech discrimination' on the part of the teachers. As Sadler (2005) found many teachers reported having little or no training on speech and language impairment and low levels of confidence in their abilities to identify and manage children at risk of language and literacy difficulties.

As Flynn and Rahbar's (1998) research suggested, teachers may benefit from additional training particularly for less familiar concepts such as 'speech discrimination' and 'phonological awareness'. They predicted that this is likely to improve teachers' ability to identify those children at risk of future language and literacy difficulties. Williams (2006) incorporated a training element into her study in which teachers attended a professional development session outlining key features to help identify children at risk of language

and literacy difficulties. Final year Speech and Language Therapy students worked alongside teachers to cement this training. In this study, Williams (2006) found teachers were far more confident than teachers in Sadler's (2005) study in their abilities to identify and manage children at risk of language and literacy difficulties. This may be due to the degree of support and training that these teachers had received. This supports the case for offering training and support for teachers in identifying children with speech and language difficulties and helping them understand the importance of skills such as speech discrimination for language and literacy development.

An alternative explanation for the lack of correlation between teachers' judgments of speech discrimination and the test scores obtained in the SIPc (Vance et al unpublished) could lie in the difficulty in making a judgement on this skill without an explicit test. Children are very rarely asked to demonstrate good speech discrimination skills in class; if they do mishear a word they can often rely on contextual information to conceal their difficulties. This finding may reflect the need for an alternative way to identify children with poor speech discrimination skills.

At T3, correlation was found between teachers' ratings of attentive listening and SIPc scores in quiet, although this pattern was not observed for the other periods in testing. This correlation appears surprising at first as no other period of testing echoed this pattern. However it reflects the assumption that the higher the teachers rated the children's auditory attention the higher they scored on the SIPc in quiet. This supports Morgan-Barrie's (1994) explanation of the auditory process which emphasised the need for good auditory attention in order to have accurate auditory processing. With this in mind it is more surprising that this pattern wasn't seen at T1 or T2 for quiet and noise. However this pattern doesn't reflect Geffner et al's (1996) finding in which children with ADD were poorer at speech discrimination in noise but performed as well as controls in quiet. This is likely to be due to the fact that the subjects in our study were not selected purely on whether or not they had attention difficulties and there are likely to be many confounding factors that would impact on the results and cloud such findings.

One explanation for this could be that it is a short falling of the questionnaire, as there may not be sufficient opportunity for the teachers to adequately represent and

discriminate between the children's abilities of attentive listening. However, it is more likely that this finding was only revealed to be significant once there was more variation amongst the group. It is likely that at T1, almost all of the children in the study had a very limited ability to attend to tasks and sounds. However, by T3 the children are older and more mature and would have adapted to the school environment. Many of them will be displaying a far greater ability to attend to tasks for longer in a variety of different settings. However, some of these children will not have developed these skills and may still display difficulties in attending to tasks. This variation amongst the subjects allows patterns to be revealed. One way to overcome this lack of variation from the outset would be to use a group of age-matched controls who had performed within the normal range on the battery of speech and language assessments at T1. Teachers could rate their abilities in the same way as the original subjects at T1, T2 and T3. This would increase the range of abilities in skills such as attentive listening from the outset and may have revealed further patterns such as that found by Geffner et al (1996).

The final part of our study investigated whether a child's hearing history correlated to their scores on formal assessments and teachers' ratings of their abilities.
Negative correlation was found between their hearing history questionnaire score and the children's scores on SIPc in both quiet and noise, and the correlation was more significant in quiet than in noise. The higher the child's score on the hearing history questionnaire, (that is, the more difficulties they had experienced with ear infections et cetera in the past), the lower their score was on the SIPc.
The correlation between the hearing history questionnaire and the SIPc is not surprising and it gives weight to the accuracy of this unpublished assessment. This finding supports Petinou et al's (2001) study; they concluded that fluctuating hearing loss associated with OME might have a negative impact on speech perception. The fact that the correlation is more significant in quiet suggests that children with less history of OME and other hearing difficulties are more skilled at speech discrimination when conditions are optimal, where as children with a history of OME still performed poorly even in optimal listening conditions. This finding also is in agreement with Mody et al's (1999) study in which they found children aged 9 years, with a history of OME in the first year of life

had difficulty discriminating between targets that differed from each other by one sound. They suggested that a history of OME may have persistent and subtle effects on phonological representations and working memory. It is possible that the subjects in our study are showing evidence of having some persistent difficulties however further investigation would be needed to draw any conclusions.

Schilder et al (1994) stated that some additional effects associated with OME are impaired linguistic and cognitive development and reduced educational attainment. This statement may lead us to expect to see negative correlation between the hearing history questionnaire and scores from the formal assessment of auditory comprehension. However the absence of this pattern is likely to be due to the limited variation in our study and the absence of an age- matched control group of normally developing children with no speech and language difficulties. The children in our study were selected because they had the weakest profile in auditory comprehension and speech discrimination and almost a third of the subjects in our study had a major history of hearing difficulties. This reduced variation amongst our subjects makes it difficult for patterns to be identified.

Correlation between the teachers' ratings of attentive listening and the hearing history questionnaire was approaching significance. This suggests that the children's history of hearing difficulties may be manifesting itself in the classroom as poor attentive listening. This pattern is one we may expect to see and perhaps through the use of an aged-matched control group, which would provide wider variation amongst the subjects, may reveal significant correlation between attentive listening ratings and hearing history.

The absence of significant correlation between the hearing history questionnaire and the teachers' ratings of skills may indicate a training need. Teachers may be unaware of the potential impact that OME has on skills such as speech discrimination but also on general cognitive and linguistic development as suggested by Schilder et al (1994). By raising their awareness to some of the key signs of OME and to some of the effects that arise from a history of OME, then teachers may be able to observe children more closely and identify any children displaying difficulties with language or literacy development.

There are some changes that could have been made to improve this study. Firstly, as described above, the absence of an age-matched control group of normally developing children with no speech or language difficulties, has made it difficult to reveal clearly certain relationships that have been hinted at in this study. For example, correlation between teacher ratings of attentive listening and SIPc scores in quiet were significant at T3 but not at T1 or T2. It is difficult to draw conclusions from findings such as these as this pattern was not echoed at the two previous points in testing. A wider range of variation spreading from the least skilled to the most skilled may demonstrate these correlations more clearly at all periods of testing and may even reveal further hidden relationships.

Another possible improvement could have been to alter when the periods of testing occurred. In our study, T1 occurred in January 2005 at the beginning of the winter term, T2 was carried out in September 2005 at the beginning of the autumn term and the school year and T3 occurred in January 2006, again at the beginning of the winter term. Therefore testing was spread over two academic years, meaning that two teachers were involved in rating the skills of each child. The involvement of two teachers may have been a confounding factor that meant that the patterns seen in T1 and T3 were not found at T2. More reliable results may have been found if testing occurred over one school year for example if, T1 took place at the end of the autumn term in December, T2 took place at the end of the winter term in April and if T3 took place in July at the end of the summer term. In this instance, only one teacher would have been involved in the ratings, and all testing periods would have been carried out with both the child settled into the routine of the class and the teacher familiar with the abilities of each pupil.
This may well have resulted in correlation between teachers ratings and standardised test scores at all three points in testing.

Conclusion

This study has found some very interesting points which have wide implications for both Speech and Language Therapists and teachers. Firstly we found teachers can accurately

judge children's auditory comprehension and attentive listening skills using this questionnaire once they have known the child for at least one term. This calls for a need for more shared knowledge between teachers from year to year, especially if children are to be placed in groups depending on their perceived skills at the beginning of the school year.

Secondly, we found that teachers were not able to judge their pupils' speech perception skills using this questionnaire. Reasons accounting for this were identified and discussed. One possible explanation was a lack of understanding on behalf of the teachers about this term. Additional training was suggested as a means to overcome this and perhaps improve their rating ability. An alternative explanation was that speech discrimination is a difficult skill to rate purely from observing a child. It was suggested that a more overt assessment may be needed. However, our third finding revealed significant negative correlation between scores on the hearing history questionnaire and scores on the SIPc (Vance et al unpublished). This means the hearing history questionnaire can identify children at risk of poor speech discrimination who may go on to develop poor PA and literacy difficulties. Therefore, the hearing history questionnaire complements the teacher questionnaire in a very effective way. By using both tools together children's abilities in auditory comprehension, attentive listening and speech discrimination can be accurately identified.

These tools are something that could viably be incorporated into the school system. The hearing history questionnaire could be given to parents at the beginning of the school year; this would alert teachers to those children who are likely to be in need of additional support. The teacher's would be able to continue to use their clinical judgment perhaps in conjunction with the previous year's teacher, to select those children at risk of future language and literacy difficulties. Additional training as described by Williams (2006) and Flynn et al (1998) particularly for skills that have been found to be crucial to the normal development of language and literacy skills. For example, PA and speech perception, could be incorporated into schools to ensure a greater number of children at risk of future literacy difficulties are able to be identified and given additional support.

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Appendix 1:

Listening to Speech Project

Teacher Questionnaire

Child's name:
Today's date:

Attentive listening skills

Attentive listening is a child's ability to focus on what's being said to him/her. Please rate your impression of the child's skills in the following situations, **compared to his/her peers** (tick one box per row):

	Well below average (Never listens attentively)	**Below average** (Tends not to listen attentively)	**Average** (Mostly listens attentively, occasional lapses)	**Above average** (Always listens attentively)	**Don't know**
During class discussions					
In small groups					
One-to-one					
In quiet environments generally					
In noisy environments generally					

Understanding of spoken language

Again, **compared to his/her peers**, please rate your impression of the child's skills in the following situations (tick one box per row):

	Would not understand	**Would require repetition to understand**	**Would understand**	**Don't know**
Understanding basic questions, simple instructions (eg "Where is the ball?", "Give the book to James")				
Understanding complex instructions ("If you've finished your work, put away your book and line up by the door")				
	Often misperceives	**Sometimes misperceives**	**Never misperceives**	**Don't know**
Perceiving words accurately (e.g. 'hearing' the difference between 'ship' and a similar- sounding word like 'chip'.)				

And finally.... Are there any situations not mentioned above, in which the child appears to shows difficulty with attentive listening or understanding?.....

.....

Appendix 2: Hearing History Questionnaire

Listening to Speech Project

Questions about your child's ears.

Thank you very much for allowing us to see your child for our project. It would be very helpful to know how many of the children we are seeing have had problems with their ears or hearing when they were younger. We would be very grateful if you could fill in this form & return it to school in the envelope. If you have any questions about this please leave me a message on 020 7679 4255 or email m.vance@ucl.ac.uk Many thanks for your help Maggie Vance

Child's name _____

Please tick the box with the description that best fits this child.

1 Has your child had a *routine* screen hearing test?

- Health visitor check as a baby? ☐
- School screen ☐
- Other type ☐
- No routine test ☐

2 **Apart from any of the routine hearing tests (as stated in question 1)**, have you ever seen any of these people about your child's ears or hearing? *(Please tick all the boxes that apply)*

- Family doctor (GP) ☐
- Health visitor ☐
- School nurse or school doctor ☐
- Children's Hearing Assessment Centre (CHAC) ☐
- Hospital ear specialist ☐
- Speech therapist for hearing & language ☐
- Speech therapist for other problems ☐
- Other ☐ — please give details _____
- No ☐

3 How many **times** in all have you consulted **any of the people listed in question 2** about your child's ear trouble or hearing difficulties?

(**Do not include** the times when your child had **routine** hearing tests.)

- Never ☐
- Once ☐
- Twice ☐
- Three or more times ☐

4 Has your child ever been ***treated*** by a hospital ear specialist? *(Please tick all the boxes that apply)*

- No ☐
- Yes — insertion of grommets ☐
- Yes — removal of adenoids ☐
- Yes — removal of tonsils ☐
- Yes — fitting of a hearing aid ☐
- Other — Please give details ☐ _____

10 Has your child ever had fluid discharging from the ear? *(Please tick all boxes that apply)*

- No ☐
- Yes — watery ☐
- Yes — pus ☐
- Yes — bloody ☐
- Yes — waxy ☐
- Not sure ☐

11 How often has your child had earache?

- Never ☐
- Only a few times in all ☐
- Several times a year ☐
- Not sure ☐

12 For how many periods has your child tended to pull or tug at his/her ears?

- Never ☐
- Only a few periods in all ☐
- Several periods ☐
- Not sure ☐

13 Has your child breathed chiefly through the mouth?

- Only with colds ☐
- Never ☐
- Rarely ☐
- Often ☐
- Always ☐
- Not sure ☐

14 Has your child sounded as if s/he has a blocked nose?

- Only with colds ☐
- Never ☐
- Rarely ☐
- Often ☐
- Always ☐
- Not sure ☐

15 Has your child snored?

- Only with colds ☐
- Never ☐
- Rarely ☐
- Often ☐
- Always ☐
- Not sure ☐

16 Has your child had difficulty hearing faint sounds?

Never	☐
Rarely	☐
Often	☐
Always	☐
Not sure	☐

17 How many ear infections has your child had?
(i.e. pain in the ear with irritability or a temperature)

None	☐
One	☐
Two or more	☐
Not sure if ever had ear infection	☐

Thank you very much for your time in completing this.

Questions come from the Childhood Middle Ear Disease and Hearing Questionnaire