Assessing hearing in children on the Autistic Spectrum

Experience of Children and Young People's Audiology Centre in St Thomas' Hospital

Presented by:
Jolanta McCall (MSc Ed Audiologist & ToD)
Service Manager Paediatric Hearing Services

PAS based in Newcomen Centre Guy's Hospital since 1987 serving at that time 9 London boroughs
Since April 2009 PAS provides diagnostic and habilitation for children and young people from 0 to 19 years old who are residents of London boroughs of Lambeth, Southwark, Lewisham and existing hearing aid users from Bromley, Bexley, Greenwich, Wandsworth, Kent, Croydon. Provides local service for 2nd tier clinics in Gracefield Gardens (Lambeth), Sunshine House (Southwark) and Kaleidoscope (Lewisham) and specialist 3rd tier. Well established service. The only London non consultant led, 21wte staff, 14.6 wte clinical staff
5500 attended appointments last year
The service consists of NHSP, Paed Audiology, Southwark HSS providing integrated care pathways across health and education

Need to evaluate how PAS conducts special assessment clinics (SPC). Approx 300 SPC clinic a year. Noticed an increase in the number of children on the autism spectrum being referred to the clinic for a hearing test. This assessment not only time consuming and costly, but questions were often raised about the validation and reliability of the results obtain. Need for training for audiologist in the area of autistic spectrum disorder and specifically the issues that make the assessment of hearing especially difficult for a child on the Autistic Spectrum.

Patient satisfaction survey – Prior to the Guy’s and St Thomas’ Charity grant application, the Paediatric Audiology Service (PAS) conducted a Patient Satisfaction Survey where parents commented on the lengthy process of hearing assessment appointments before a diagnosis was reached, and the difficulties that audiologists were facing in applying standard audiological testing with often uncooperative children. The PAS has also conducted an audit of the number of appointments each surveyed child attended in Special Assessment Clinics. This ranged from three appointments to as many as five. There were also children who needed seven appointments for behavioural testing before a diagnosis was reached.

In 2012 the PAS conducted 310 new hearing assessments on children who were judged to have additional complex needs, such as suspected autistic spectrum condition or global developmental delay (data from Audiology Patient Management System Practice Navigator). In the same year 54 children were referred with speech and language delay prior to a definitive ruling on their ASC status.
**Autism and hearing impairment**

- Children on the Autism Spectrum have an above average chance of having a hearing loss, with statistic ranging from 3.5% (Rosenhall, Nordin 1999) to 8.6% (Kielimen, Rantola 2004).
- Educational experience can be disastrous because of the frequently and incorrect diagnosis and the lack of specialist facilities for hearing impaired autistic children (Jure, Rapin Tuchman 1991).
- The number of “deaf autistic” children is thought to be higher than the average and mis-diagnosis and late diagnosis can have a significant impact on a child’s education and their ability to make a good progress both academically and socially (Roper 2003).

**Prevalence of autism:**

- One child in every hundred (National Autistic Society).
- Boys are more likely to be affected than girls – with suggested ratios most likely 3:1.
- Most studies find no effect of socio-economic status. This supports the view that it has genetic rather than environmental causes.
- An estimated 535,000 people have autism in the UK, that’s about 1 in 100.
- 40% of all children with autism wait more than three years for a clear diagnosis.

**Challenges in diagnosing**

- 1 in 166 children under the age of eight has a diagnosis of an autistic spectrum disorder (2001).
- Mild to moderate hearing loss in AS children, autistic children may have been missed.
- Community paediatricians who diagnose autism in the boroughs often refer children for a hearing assessment when they receive their diagnosis therefore the number of children on the Autistic Spectrum being tested is likely to remain high.
- This information indicated that attempting to develop a set of resources, which supported the testing of these children and hoped to make tests more reliable and less stressful.

**How the Triad of Impairment +1 relates to audiological testing**

Autistic children have difficulty in:

- **Social Communication** (difficulty with verbal and non-verbal communication)
- **Social Interaction** (difficulty with social relationships)
- **Imaginative/Creative Thinking** (difficulty in the development of interpersonal play and imagination)

Many people with ASC also have difficulty with motor co-ordination and sensory sensitivities (hypo & hyper).

Children with ASC can be showing different levels of difficulty in each area. This is known as the Autistic Spectrum.

Lorna Wing and Judith Gould coined the term ‘Triad of Impairments’ in their paper published in 1979, which makes up the basis of modern diagnosis. A person with ASC could be experiencing difficulty in these three areas at various degrees, hence the term ‘Spectrum’.

- **Social Communication** (difficulty with verbal and non-verbal communication) – audiological tests include verbal instructions, often not understood by the child.
- **Social Interaction** (difficulty with social relationships) – relating to unknown audiologist, cooperation, communicative partnership with audiologist.
- **Imaginative/Creative Thinking** (difficulty in the development of interpersonal play and imagination) – interest or willingness to complete the task, impact on testing due to unknown clinical settings.

**Role of sensory “sensitivities”** may have on a child reaction to the tests used to assess hearing.

O’Neil & Jones (1997) highlighted that sensory “abnormalities” are central to the autistic experience, standing alongside other “impairments” and contributing to high levels of distress, fear, anxiety and disruption of daily life and social functioning.

Ben- Sasson (2008) found that toddlers on the AS showed less awareness and sensation that typically developing children; this result was claimed to be due to high rates of sensory avoidance or possibly an attempt to withdraw from the environment due to sensory overload.

**Several studies e.g Studies by Leekam** 2007, Klintwall 2010, Kwakye 2011 has established that people on the Autism Spectrum may well experience unusual “sensitivities” from all the senses. While sensory abnormalities are not unique to autism, they are more prevalent in children with autism than in children with other developmental delays. It was proposed that the strand of sensory perception will now be added into the...
latest addition of the Diagnostic and Statistical Manual of Mental Disorders (DSM), the leading diagnostic tool used to diagnose autism DSM -5 will include abnormal response to sensory stimuli as a symptom of autism (Klintwall 2010)

Not every autistic child is the same, ranging from lower end of the spectrum to higher functioning end (Asperges children with average cognitive abilities with areas of extreme specialism ("little professors"). Autistic children on the lower end of the spectrum often have learning difficulties, repetitive behaviour flapping hands, spinning, fascination e.g with wires

Many people with autism have a heightened or unusual sensitivity to sensory stimuli.

**Sound**: An autistic child may become increasingly unsettled in noisy situations, particularly when the noise is confused or unpredictable.

**Touch**: Many autistic children can not bear to be touched. Light touch is usually worse than a firm hug. There can be sensitivity to to certain clothing and a child may refuse to remove or put on certain clothing. Children may also dislike certain textures, so messy play may be refused or avoided. This also applies to the textures of food.

**Visual Perception**: Visual perception may be fragmented or two dimensional. A child may gaze at an object for extended periods of time or may turn away quickly.

**Smell**: A child may be fascinated by smelling people or objects or they may not be able to tolerate certain smells.

**New environment , unusual different feeling sound (sound proof room), being asked to complete a task you don’t understand , no clear meaning or end point, no interest, difficult to engage in communicative partnership.**

Hearing assessment itself (VRA, Play audiometry, Pure Tone Audiometry) does not appear to take into account the special attributes of children on the Autism Spectrum. Both tests require a high level of co-operation between the child and the audiologist. They also rely on a child being willing to complete a task, which may seem to have very little meaning , for a" reward ", which often appeared to be of no interest.

There is a significant difficulty for children on the AS and the audiologist to form the communicative partnership, which is so vital to the test

**Standard ‘behavioral’ audiological testing relies on a strong communicative partnership between the tester and the subject,**

a child is asked to complete a number of tasks while responses to various sounds are monitored. Most of the instructions for the tests are delivered verbally with some modeling of tasks being shown to the child. It is assumed that the child will understand the tasks and want to complete them. The initial observations indicated that this was often not the case for children who are on the Autism Spectrum.

Difficulties in testing: inability to understand or be engaged by the test, resulting in a failure to complete tasks, compounded by possible sensory difficulties and anxiety about a new experience in an unfamiliar setting.

Many children on the Autism Spectrum appeared to be struggling with the communicative partnership required to complete the test successfully. Autism can affect the ability to understand spoken language; often children rely on visual clues
or by copying what others are doing, to understand and make sense of verbal instructions (West, 2007). When this difficulty was combined with the lack of a desire to follow instructions, which were often not motivating to the child, the communicative partnership would often disintegrate and a further test would have to be scheduled. It was also observed that potential anxiety about a trip to a new location, with a new set of demands in an unfamiliar setting could be creating further challenges for the child, the parent/carer and the audiologists. Initial observations suggested that in addition to the child’s anxiety, often the audiologist was also anxious about the test. It was felt that the anxiety of the audiologist could be caused by a possible lack of understanding of the Autism Spectrum; especially a lack of awareness of the impact possible sensory issues may have on testing. It was felt that these factors were often having an impact on the validity of the test outcomes. Clearly it was not possible to remove all these difficulties from the testing process however it was felt that were a number of strategies and support materials which could be put in place to attempt to make the tests more successful and less stressful for all concerned.

When Sophie talked to the audiologists they found this quote powerful:

“Reality to an autistic person is a confusing, interacting mass of events, people, places, sounds and sights. There seems to be no clear boundaries, order or meaning to anything. A large part of my life is spent just trying to work out the pattern behind everything.”

Jolliffe (1992)
(a person with ASD)

We worked closely with Sophie Walker, an Specialist Support Teacher working with the Autism Support Team (AST) in Southwark. Sophie had previously worked for the Hearing Impairment Team so she had some knowledge of how hearing impairment can effect children in the mainstream classroom. Added to this she is now with the AST so seemed well placed to offer advise on this project. Sophie was also undertaking a Masters of Education (Autism) at Birmingham University and was interested in completing her dissertation on the hearing testing of children with Autism. She worked closely with the team at the Audiology Clinic to develop the project outlined above.

3 phases of the project:

- Pre-assessment pack – consisting of parents information booklet, questionnaire for parents and educational settings, social story for younger and older children, visual time table
- Adaptation/new design for waiting area, corridor leading to the audiological suite and audiological booth itself. Choosing a theme to be carried over these three areas to ensure smooth transition from one to another
Clinical changes i.e changes to the protocol, equipment, use of different toys, images/pictures

Training on autism crucial to progress with the project

Training for audiologists included:
• Two sessions (1st- ASC and hearing testing + 2nd) use of visual support materials, visual timetable. Sophie observed several SPC appointments and fed back her findings e.g. audiologists spending time to talk to the parents, finding specific medical information while the child was pulling equipment of the shelves or playing with the wires. It was almost impossible to get the child back. Little opportunity to modify the tests to suit the child’s needs or interests. It also meant that the audiologist and the parent/carer often had to have a discussion about the child’s hearing while the child was waiting for the test to begin.

Children were observed gravitating towards either the toy box or the equipment shelf where they became engrossed in an activity (often a dangerous one) of their own choosing. Unsurprisingly, it was then often additionally challenging for the audiologist to engage the child in the test, as often by this point the child was already distressed or bored and unwilling to co-operate.

Pre-assessment pack Questionnaires

Pre-assessment information (home). Preparing children prior to testing would be crucial. There are 11 questions includes information about nature of child’s difficulties e.g diagnosis of AS, ADHD, speech and language delay, developmental delay, other, how does the child find new environments (fine/difficult), describe the behaviour, which the child displays (crying, trying to run away, biting, hitting, trying to hide), strategies to cope with this behaviour/calm him down (singing, rocking, rewards. One of the most important information – child’s favourites (television shows (Thomas the tank engine, toy story), favourite toys/interests (dinosaurs, trains, cars, Lego). We also ask about child’s hearing. Do the child responds to environmental noises, parents voice at conversational levels and raised voice when the child can/cant see them, response to loud sudden noises. Are the any sounds which can cause the child’s distress (vacuum cleaner, hand drier). Are there certain sounds that the child’s will respond consistently to at low level (crisp packet opening, theme tune from television heard from
Questions around communication (effective communication (verbal, gesture, pointing, PECS, Makaton, BSL)

Same questionnaire sent to educational setting as often children on the Autism Spectrum demonstrated very different behaviours at home to the ones they displayed at school or nursery. There might be different system of rewards Parents to decide who completes educational setting questionnaire (LSL/class teacher/SENCO) i.e the person who spends most time and knows the child the best. We provide the stamped self-addressed envelop. Both Questionnaires to be send a week before the appointment. Not satisfactory record of returns, parents were bringing the questionnaire on the day of the appointment

Still limited returns of questionnaires however we were able to make some changes. For example we have a dedicated clinic administrator who is able to obtain information via phone well in advance before the appointment and changes to the testing are made based on information obtained from parents and ed setting well before the appointment.

The audiologists have the opportunity to read the information prior to meeting the child, which allows enough time for the test to be modified to meet the needs of the child, rather than the child being expected to modify their own behaviour to perform in a standardised hearing assessment.

Social story - Example how to prepare children on the AS can help them cope with new and potentially stressful experiences. In 2008 the Manchester Airport Authority produced a booklet freely available to download to support young people on the AS who are travelling by aeroplane for the first time. This resource was designed to support children at the higher functioning end of the spectrum and has a picture supported checklist and a visual time table included within it. The booklet outlines the different steps that occur when you travel by aeroplane from arriving at the airport to returning home. This idea was used as a starting point for part of the package of support

http://www.manchesterairport.co.uk/manweb.nsf/alldocs/4D4CC20F97DD74008025736400407C2E/$File/Airport+Awareness+book.pdf

NAS web -There are also resources designed to support children and young people with visits to the various health professionals, where information for professionals, parents/carers and people on the AS is available. This site includes information on a visit to the dentist, hairdresser, and at the shops

Social Stories seek to explain a new experience or social convention in an accessible and positive way to a child on the AS. Carol Gray created Social Stories in 1994 and these stories written from the child’s perspective, seek to explain what will happen in a new or challenging situation, to increase the child’s understanding of social conventions and new experiences. As describe by Gray, the stories use a clear pattern of sentences to create a patient and reassuring quality in the story. Social stories are simple and flexible, can be adapted to suit the needs of children of different ages and at different stages on the AS.

The Clinic Social Story includes symbols created by the ‘Writing with Symbols’ software package, available through Widget (www.widgit.com) to produce a symbol supported story of
what will happen during a visit to the Clinic. It is hoped that the parent/carer will read it to their child prior to visiting the Clinic to prepare them for what will happen on the day of the test. Based on the initial observations completed at the Clinic it was apparent that sometime the anxiety of the parent/carer may increase the anxiety of the child, so it was hoped that this Social Story should very clearly set out what is going to happen on the day, so that everyone’s anxiety might be reduced.

**Visual support materials include visual time table, with photographs**

**Visual support materials** – are used to increase understanding and decrease anxiety in children on AS. For example the use of visual time table allows the child to predict and understand what will be happening to them and in what sequence. **Visually cued instruction** can allow for simultaneous processing of oral and graphic language, are special, they provide a tangible recognition cue.

West’s study 2008 supports the contention that children with autism are visual learners. It was also suggested that a pictorial cue may be easy to implement while producing positive changes in behaviour. This study confirms earlier findings that children on the AS can display fewer behavioural problems when visual supports are used to communicate the expectations of them clearly.

In PAS it was observed that several children may have been in a state of hyper-arousal during appointment as shown by anxiety related behaviours such as running around the test suite, flapping their hands and pulling equipment of the tables. Reducing anxiety and arousal may indirectly improve language processing and the use of visual cues can increase focused attention to a task.

---

**Slide 11**

*To examine if the number of hearing tests needed for children - either diagnosed with, or suspected of being on the Autistic Spectrum - could be reduced through the introduction of additional materials and the education of audiologists.*

**Slide 12**

- To examine if the number of hearing tests needed for children - either diagnosed with, or suspected of being on the Autistic Spectrum - could be reduced through the introduction of additional materials and the education of audiologists.
Methodology

- Group A - children tested between August 2010 and March 2011 where no interventions were used.
- Group B - children tested between March 2011 and April 2012 where various levels of intervention were put in place.

Due to time constrains in this presentation with Sophie’s agreement I simplified the methodology.

The number of tests needed for these children was recorded so the number of tests needed to diagnose hearing impairment or discharge from the service. In addition, these children were observed and findings recorded on an Observation Schedule, focusing on their ability to comply with testing. The Observation Schedule also recorded the researcher’s views on the test. The audiologists and parent/carer were also asked to comment on their perceived ‘success’ of the session. The parameters for ‘success’ were be based on several fairly subjective areas of interest, including perceived anxiety level of the child and ability to comply with the tests given.

The second group of children examined known as Group B; these children were selected at random from a series of session at the Special Assessment Clinic between March and November 2011.

Children who took part in the study were between the ages of 4 and 11 years old, all with a similar level of communication skills. Children were seen by the same audiologists who tested them the first time.

Audiologist scored the success of the test using a Likert Scale (Likert, 1932), a seven point scale designed to measure attitude as an attempt to scale responses study.

Findings

- Out of the 12 children tested in Group A (non-intervention group) between 1 and 4 tests were needed before a diagnosis reached.
- Group B (intervention group) only 1-2 tests were required.
- Children in Group B showed a lower level of distress and a higher level of co-operation.
- Perception of test success by Audiologists was significantly higher for Group B (6.62 compare to 4.66 for Group A).
- Perception of test success by Parents was significantly higher for Group B (6.75 compare to 4.55 for Group A).

Summary of Results

A significant reduction in the number of tests needed for Groups B1 compared with A1. This indicates that the support material and additional training did have an impact on the number of tests needed before a child was either diagnosed with a hearing impairment or, more commonly, discharged from the Clinic as a ‘normal’ hearing diagnosis had been reached.

The Observation Schedule was designed to assess the overall responses of children on the Autism Spectrum to having their hearing tested and included children from Group A (tested between August 2010 to March 2011) and B (tested between March 2011 and April 2012). This schedule included a Likert Scale to:

- assess the levels of the child’s compliance, attention and their distress level.
- to record the perception of the success of the test by both the audiologist and the parent/carer.

This Observation Schedule was completed at the conclusion of each test by either the researcher or the audiologists who had conducted the test.

The marking of the Observation Schedule was subjective depending on the perception of either the researcher or the audiologist completing the assessment, so it is crucial to examine the results with this in mind. Results are subjective.
Clinical Protocol for SPC

- Clinic time – 45 minutes
- 2 clinicians (one must be senior)
- Use of reinforcers and stimuli indicated by parents/ed setting questionnaires
- Use of pre-prepared engagement toys/iPad images or child toys
- All testing modified accordingly to the child’s physical and neurological abilities
- VRA in SF, inserts/headphones, BC
- Conditioned Play Audiometry in SF, inserts/headphones, BC
- Modified distraction: standard distraction stimuli as well as iPad/MAG warbler/motors/music
- Speech testing: Ling Sounds/Four Toy Eye pointing test/McCormick/MPT/MJWL/Mr Potato Head
- Attempt Otoscopy, Tymps & TEOAEs/DPOAEs

If no reliable or repeatable results obtained over two sessions with parental professional concern consider sedated ABR or ABR under GA

Possible outcomes

- Satisfactory hearing thresholds – discharge
  Ear specific information at 4 frequencies
  If not 4 frequencies in SF and ear specific at 1 & 4kHz
  If testing in SF performed twice and child will not tolerate inserts or headphones child can be discharged after discussion with parents regarding potentially unidentified unilateral hearing loss
  Bilateral sensorineural hearing loss
  Middle ear effusion and/or conductive hearing loss

Case Study 1
Billy

- 3 ½ years old boy
- Diagnosed with ASC 4 months ago
- Attended with mother
- Normal pregnancy and birth, no risk factors for hearing loss
- No parental concerns about hearing
- Passed NHSP

- Satisfactory hearing thresholds – discharge
  Ear specific information at 4 frequencies
  If not 4 frequencies in SF and ear specific at 1 & 4kHz
  If testing in SF performed twice and child will not tolerate inserts or headphones child can be discharged after discussion with parents regarding potentially unidentified unilateral hearing loss
  Bilateral sensorineural hearing loss
  Middle ear effusion and/or conductive hearing loss

APPENDIX II

- Use visual time table /stepping stones to guide the child from the waiting room into the test room. Use of the pebbles drop them in to the vase at the entrance to the test booth
- Modify games or invent new games tailored to the child’s abilities/preferences i.e. use stickers, iPad apps, rolling a ball between patient and the tester
- If the parents consent, food that they brought may be used to condition/reward the child
- If possible ask parents to bring the child’s toys or use what they have with them
  Basic Makaton/BSL signs/ should be used to communicate with the child
  If a child is not able to /will not give reliable head turns other responses i.e smiles, looking up, eye widening can be used CAUTIOUSLY. The video will need to be peer reviewed by Clinical Lead/Principal Audiologist and parents

- Satisfactory hearing thresholds – discharge
  Ear specific information at 4 frequencies
  If not 4 frequencies in SF and ear specific at 1 & 4kHz
  If testing in SF performed twice and child will not tolerate inserts or headphones child can be discharged after discussion with parents regarding potentially unidentified unilateral hearing loss
  Bilateral sensorineural hearing loss
  Middle ear effusion and/or conductive hearing loss

- 3 ½ years old boy
- Diagnosed with ASC 4 months ago
- Attended with mother
- Normal pregnancy and birth, no risk factors for hearing loss
- No parental concerns about hearing
- Passed NHSP
Information from Questionnaire

- Responds to sounds at home
- Does not/will not follow instructions
- Plays alone
- Likes Mickey Mouse – A LOT!!
- Will come running when hears Mickey Mouse Club theme tune

Equipment

- Audiology test booth
- Otosuite ASTERA diagnostic PC audiometer
- Audio editing software to prepare music clips or soundfiles to be presented via PC audiometer
- Sound Level Meter
- HIBROW LCD VRA reinforcers
- Discrete talkback /talk forward for tester & engager
- Selection of toys/ games/ iPad apps to engage

From the waiting area to the test booth

- Immediately goes to “engager” who has toys out on table
- Will not tolerate otoscopy – proceed to VRA
- CONDITION IN SF : “MICKEY MOUSE CLUB MARCH” PRESENTED FROM RIGHT SPEAKER @ 40-45dBA- with MM picture. 3 consecutive sharp head turns
- Reduce MMCM to 30dBA and present sound
- Billy turns and is rewarded with MM pic/animation via “HIBROW” visual reinforcement /LCD mounted on wall
- No sound trial : does not turn
- Present at 30dBA - turns and is rewarded with MM pic/animation

Conditioning

- Responds to sounds at home
- Does not/will not follow instructions
- Plays alone
- Likes Mickey Mouse – A LOT!!
- Will come running when hears Mickey Mouse Club theme tune

- Audiology test booth
- Otosuite ASTERA diagnostic PC audiometer
- Audio editing software to prepare music clips or soundfiles to be presented via PC audiometer
- Sound Level Meter
- HIBROW LCD VRA reinforcers
- Discrete talkback /talk forward for tester & engager
- Selection of toys/ games/ iPad apps to engage
Slide 24

Testing

- Present 1kHz warble tone in SF from RIGHT at 40dBHL (calibrated)
- Billy turns and is rewarded with MM animation
- Will not tolerate Otoscopy / TEOAE or tympanometry
- Will allow ears to be touched – attempt VRA with H’phones- only tolerates for 2 presentations and then becomes upset when we attempt more.

Slide 25

Discussion with Mother

- SF VRA results suggest “Billy’s” overall hearing at the frequencies tested (500Hz 1000Hz 2000Hz and 4000Hz) within normal ie <=20dBHL.
- Cannot rule out unilateral hearing loss
- Agree to RV: parents to encourage Billy to use headphones at home.
- Billy will be reviewed in 3 months (with the same 2 clinicians) to obtain ear specific info
- He has had a non-traumatic visit to CYPAC

Slide 26

Case Study 2

- 4 year old with recent diagnosis of ASC
- Attended with both parents
- Will respond to his name and answer questions
- “Loves Thomas the Tank Engine”
- Amenable to otoscopy, tympanometry and OAE: normal middle ear function and recordable OAE in both ears
- Will tolerate headphones and insert earphones
- Unable to condition for play audiometry
- Unable to obtain reliable responses for VRA or distraction
- Not interested in McCormick Toy Test
- Is playing intently with iPad app: “Old McDonald”: when asked at around 40dBA with no visual cues, to point to each animal on screen, does so correctly each time

- Present 1kHz warble tone in SF from RIGHT at 40dBHL (calibrated)
- Billy turns and is rewarded with MM animation
- Proceeds to perform conventional SF VRA.
- Will not tolerate Otoscopy / TEOAE or tympanometry
- Will allow ears to be touched – attempt VRA with H’phones- only tolerates for 2 presentations and then becomes upset when we attempt more.

- SF VRA results suggest “Billy’s” overall hearing at the frequencies tested (500Hz 1000Hz 2000Hz and 4000Hz) within normal ie <=20dBHL.
- Cannot rule out unilateral hearing loss
- Agree to RV: parents to encourage Billy to use headphones at home.
- Billy will be reviewed in 3 months (with the same 2 clinicians) to obtain ear specific info
- He has had a non-traumatic visit to CYPAC

- 4 year old with recent diagnosis of ASC
- Attended with both parents
- Will respond to his name and answer questions
- “Loves Thomas the Tank Engine”
- Amenable to otoscopy, tympanometry and OAE: normal middle ear function and recordable OAE in both ears
- Will tolerate headphones and insert earphones
- Unable to condition for play audiometry
- Unable to obtain reliable responses for VRA or distraction
- Not interested in McCormick Toy Test
- Is playing intently with iPad app: “Old McDonald”: when asked at around 40dBA with no visual cues, to point to each animal on screen, does so correctly each time
Discussion with parents

Plan:
- Incorporate TTTE into the next test session
- Idea is to utilise TTTE sounds and pictures to create a test where Adam will hear the different engine whistles and will put a token in a pot for each one.
- Analysing the frequencies of 12 different signature whistles to get 4 which correspond closest to the 500Hz, 1kHz, 2kHz and 4kHz warble tones
- 4 different tokens to represent 4 different stimuli
- Once Adam is playing the game in SF and responding reliably
- Commence with warble tones

Frequency analysis of warbles and whistles: using iPad and Audio Kit app

Conclusions

- There is validity in attempts to make hearing tests for children on the Autism Spectrum more efficient and less traumatic, reliable and cost effective.
- The results indicate that the training for audiologists has been an especially successful way for different services to work together to share information and knowledge to improve the experience of children on the Autism Spectrum.
- There is a real need to continue to explore the unique experience of children on the Autism Spectrum in relation to their hearing assessment.

Proof of principle has shown validity of the project. Future plans: AV to analyse clinic results, build up a bank of resources

- There is validity in attempts to make hearing tests for children on the Autism Spectrum more efficient and less traumatic, reliable and cost effective.
- The results indicate that the training for audiologists has been an especially successful way for different services to work together to share information and knowledge to improve the experience of children on the Autism Spectrum.
- There is a real need to continue to explore the unique experience of children on the Autism Spectrum in relation to their hearing assessment.
Acknowledgements:

Many thanks to:

Sophie Walker - Specialist Support Teacher (Autism)
PAS Audiologists: Franicine D’Souza, Rosanne Fava, Naomi Austin, Fiona Duncan, Neil Hoey, Jannet Cornbishley, Sarah Laister

GSTT charity