Abstract

Objective: There is currently no singularly accepted definition of hyperacusis. The aim of this study was to determine a definition and description of hyperacusis by clinician consensus.

Design: A three-round Delphi survey involving hearing healthcare professionals built towards clinical consensus on a definition of hyperacusis. Round 1 involved three open-ended questions about hyperacusis. Seventy-nine statements were generated on descriptions, impact, sounds, and potential features of hyperacusis. Agreement on the relevance of each statement to defining or describing hyperacusis was then measured in Rounds 2 and 3. General consensus was defined a priori as ≥70% agreement, or ≥90 for clinical decision making.

Study Sample: Forty-five hearing healthcare professionals were recruited to take part in this study. Forty-one completed Round 1, 36 completed Round 2, and 33 completed Round 3.

Results: Consensus was reached on 42/79 statements. From these a consensus definition includes "A reduced tolerance to sound(s) that are perceived as normal to the majority of the population or were perceived as normal to the person before their onset of hyperacusis". A consensus description of hyperacusis was also determined.

Conclusions: This consensus definition of hyperacusis will help to determine the scope of clinical practice guidelines and influence needed research on hyperacusis.

Key words: Sound tolerance, sound sensitivity, uncomfortable loudness levels, psychoacoustics/hearing science

Introduction

Hyperacusis, literally meaning excessive hearing, is a hearing disorder which affects how a person perceives sound. It has been described in many different ways, including an "unusual tolerance to ordinary environmental sounds" (Vernon, 1987), "an unusual hypersensitivity or discomfort induced by sound" (Marriage and Barnes, 1995), and "an aversion to loud sounds" (Baguley et al., 2013). It is often described in terms of altering the 'tolerance' or 'sensitivity' towards certain sounds (Auerbach et al., 2014, Phillips and Carr, 1998, Hébert et al., 2013, Khalfa et al., 2004, Wagenaar et al., 2010).

Hyperacusis is sometimes conflated with other hearing disorders such as phonophobia or misophonia. Phonophobia (originating from Greek words of 'sound' and 'fear') is an anxiety disorder, which is characterised as being an unwarranted and persistent fear of sound (Mathisen, 1969). Misophonia involves the experience of intense emotional reactions to sounds (Taylor, 2017, Potgieter et al., 2019), and often presents with adverse reactions to specific patterns of sounds, or sounds presented in certain situations. Thus, although separate conditions, misophonia, phonophobia, and hyperacusis are not considered to be mutually exclusive. Indeed, Jastreboff and Jastreboff (2014) used decreased sound tolerance (DST) as an umbrella term to describe multiple disorders that affect the perception of sound, including hyperacusis and misophonia. They described DST as being present when a person displays negative reactions to sounds that would not cause such reaction in the average listener. Jastreboff and Jastreboff (2014) categorised phonophobia as a subtype of misophonia, rather than an independent condition. Tyler et al. (2014) also suggested that phonophobia and misophonia were different characteristics of hyperacusis, having proposed that hyperacusis should be subcategorised as loudness, annoyance (also considered as misophonia), fear (also considered as phonophobia) and pain hyperacusis.

The relationship between loudness recruitment and hyperacusis is also unclear (Marriage and Barnes, 1995). Loudness recruitment involves an abnormally rapid growth in perceived loudness, often associated with outer hair cell (OHC) loss (Moore, 1998). Recruitment is a phenomenon that occurs in people with hearing loss, in which low magnitude sounds cannot be heard, but a small growth in stimulus intensity can be perceived as a large growth by the listener. This is thought to be a separate phenomenon to hyperacusis, although it has been reported that 59.1% of people with hyperacusis have some form of hearing impairment (Paulin et al., 2016), many in the high frequency range (Sheldrake et al., 2015), suggesting OHC loss. Recruitment and hyperacusis can take place at the same time (Baguley, 2003). Furthermore, people with hearing loss can have hyperacusis without having recruitment issues (Sheldrake et al., 2015).

Hyperacusis is frequently found comorbid with tinnitus (the perception of sound in the absence of any external sound source; Levine and Oron, 2015). As many as 86% of people with hyperacusis also report tinnitus (Anari et al., 1999, Sheldrake et al., 2015), and around 40% of people who present with tinnitus as a primary complaint also report hyperacusis (Jastreboff and Jastreboff, 2000). Indeed, hyperacusis has been described as a pre-tinnitus state (Jastreboff and Hazell, 1993, Guimarães et al., 2014), thought to be caused by a central gain within auditory pathways. Often, tinnitus and hyperacusis are treated within the same clinic or service, with attention focussed primarily on tinnitus. Some studies have even pointed to aetiological connections between tinnitus and hyperacusis, such as hyperactivity within the auditory network (Chen et al., 2015) and loss of hearing threshold sensitivity (though not necessary for onset; Dauman and Bouscau-Faure, 2005). There are also many other medical conditions that show comorbidity with hyperacusis, some of which also present with increased sensitivity of other senses including vision (reaction to light) and touch. Such conditions include Williams syndrome (Klein et al., 1990, Gothelf et al., 2006), autism spectrum disorder (Danesh et al.,

2015), depression (Paulin et al., 2016), chronic fatigue syndrome, Lyme disease, Meniere's disease and posttraumatic stress disorder (Goodson and Hull, 2015).

Hyperacusis, by its various descriptions, is thought to affect between 3.2 and 17.2% of the population (Hannula et al., 2011, Coelho et al., 2007, Andersson et al., 2002, Fabijanska et al., 1999). It can present itself in many ways, with common symptoms including headache, discomfort, anxiety, and fatigue. Some people with hyperacusis report pain upon hearing certain sounds. Hyperacusis can be extremely debilitating, causing people to avoid social situations, heavily impacting on a person's quality of life. People with hyperacusis often wear hearing protectors, such as ear plugs or headphones, in an attempt to protect themselves from noises that cause discomfort (Blaesing and Kroener-Herwig, 2012, Jüris et al., 2014, Paulin et al., 2016). Although this may seem intuitive to a person experiencing hyperacusis, prolonged use of ear protection can cause the auditory system to become even more sensitive to noise, thereby intensifying symptoms (Formby et al., 2003, Munro et al., 2014). Avoiding sound sources can also lead to the same phenomenon (Baguley, 2003).

A range of different tools are currently used to assess hyperacusis. Multi-item questionnaires include the hyperacusis questionnaire (HQ), which quantifies and evaluates different features of hyperacusis (Khalfa et al., 2002), the Multiple-Activity Scale for Hyperacusis (MASH), which rates the impact certain activities have on everyday life (Dauman and Bouscau-Faure, 2005),the German Questionnaire on Hypersensitivity to Sound (Geräuschüberempfindlichkeit; GÜF), which assesses the subjective distress in patients with hypersensitive hearing (Blasing et al., 2010, Nelting et al., 2002) and the Inventory of Hyperacusis Symptoms (IHS), which assesses severity of subjective hyperacusis impact (Greenberg and Carlos, 2018). Another tool is the Uncomfortable Loudness Levels (ULLs) test, which is used to determine the loudness level that becomes uncomfortable for the listener at different pure tone frequencies. A key issue with this measurement, despite some research on the topic (e.g. Aazh et al., 2018, Aazh and

Moore, 2017), is that there are no officially recommended cut-off levels that enable diagnosis of hyperacusis. In typically hearing individuals with no known loudness tolerance problem, ULLs vary from 86-98 dbHL (Knobel and Sanchez, 2006). In people reporting hyperacusis, ULLs have been reported that range from 69.3 dB HL to 76dB HL (Juris et al., 2013). There is mixed evidence for a relationship between HQ scores and ULLs (Meeus et al., 2010, Aazh and Moore, 2017).

In terms of hyperacusis management, there is little in the literature (Fackrell et al., 2017), and many unanswered questions. Recently, a set of 28 research priorities were defined using the James Lind Alliance Priority Setting Partnership method (Fackrell et al., 2019a, Fackrell et al., 2019b). As well as priorities relating to the physiology and treatment of hyperacusis, many questions related to diagnostic criteria, and how to distinguish hyperacusis from other hearing-related conditions.

The aim of this study was to determine a clinician consensus definition of hyperacusis, to inform diagnosis and the scope of future clinical practice guidelines.

Methods

This study followed a standard Delphi methodology. The Delphi method is an iterative process that seeks anonymous judgements and controlled feedback from experts until a consensus is reached (Linstone and Turoff, 1975). A three round Delphi survey sought clinical consensus on a definition and further description of hyperacusis, in an expert panel of hearing healthcare professionals. The Delphi review constituted a service evaluation so ethical review board approval was not required.

Recruitment of expert panel

Invitation emails were sent to a range of hearing healthcare clinicians with expertise in hyperacusis within the UK. Emails were sent initially to those who had previously participated

in a hyperacusis prioritisation exercise (Fackrell et al., 2019) and expressed a wish to participate in further hyperacusis-related activities. Some clinicians who agreed to take part in the study also shared an invitation with appropriate colleagues within their networks. The invitation email contained a description of the study aims and Delphi process, and an approximate timeline for participation. Clinicians were eligible to take part if they (1) had experience of managing adults and/or children with hyperacusis, and (2) were willing to share their expert opinions in a three-part Delphi survey about hyperacusis. Initially 45 hearing healthcare professionals agreed to take part. Only participants who completed Round 1 were eligible to participate in Round 2, and only participants completing Round 2 were eligible to participate in Round 3.

Delphi survey

The online Delphi survey was designed to include three rounds. Round 1 consisted of open-ended questions on hyperacusis. Rounds 2 and 3 contained a series of statements which members of the panel were asked to evaluate. All three rounds of the Delphi survey were designed using Online Surveys (https://www.onlinesurveys.ac.uk/) and distributed electronically with personalised links via email. Each member of the expert panel was automatically assigned a randomly generated participant identification number, and all responses were anonymised.

Design of Round 1 Open-Ended Questionnaire

The first round consisted of three open-ended questions designed to broadly extract what participants considered did and did not constitute hyperacusis. Questions were: (1) What is your current understanding/definition of hyperacusis?; (2) What do you observe to be the main presenting features of hyperacusis?; and (3) What characteristics or conditions do you think are commonly mistaken for hyperacusis but are not?. There was no limit on the length of responses.

Additional demographic information collected included: job role, whether working in the public/private sector, years in current profession, and an approximate number of hyperacusis patients seen in the previous 3 months.

Design of Round 2 Closed Questionnaire

The responses provided by panellists in Round 1 were organised into statements and then grouped into themes using a thematic analysis approach (Boyatzis, 1998). Analysis was carried out independently by two authors who then agreed a final dataset. The protocol of thematic analysis was predefined in five steps.

1. Familiarisation process. Each author immersed themselves with answers to all questions, allowing themselves to become acquainted with each response.
2. The author began to look for recurring themes or ideas within responses to each individual question.
3. The author began to generate codes which identify a feature of the original response, taking the most meaningful element(s).
4. Codes that were considered to be equivalent were grouped together into themes. After this was completed, authors joined to discuss and agree the codes and themes.
5. All themes and codes were reviewed, and a consensus was reached by all authors on each theme.

Eight themes were identified and formed sections of the Round 2 questionnaire. The first two themes were ‘tolerance’ and ‘sensitivity’ and included statements related to how hyperacusis is defined. Under these themes, participants were asked to consider whether each statement provided the best (score 1) to worst (score 4) description of hyperacusis.

The next three themes included general descriptions of hyperacusis, the impact of hyperacusis, and the sounds involved in hyperacusis. Participants were asked to rate the extent to which they

agreed with each statement with the response options: 1 = Always; 2, = Almost Always; 3 = Sometimes; 4 = Almost Never; 5 = Never, or 6 = Not sure.

The remaining themes provided a list of potential features of hyperacusis; conditions, emotions, and 'other' features that may relate to hyperacusis. Participants were asked to indicate whether they considered each feature a (1) defining feature of hyperacusis; (2) common feature of hyperacusis; (3) occasional feature of hyperacusis; (4) not a feature of hyperacusis; or (5) not sure. Participants had the option to provide any comments at the end of the questionnaire. Some conditions in this round could be considered as comorbid with hyperacusis. Participants were reminded to rate these as features of hyperacusis, and not as comorbidities.

Design of Round 3 Closed Questionnaire

Round 3 consisted of the same list of closed statements used in Round 2. For each statement, summary results (percentages of panellists who chose each response option) from Round 2 were reported back to the panellists. In Round 3 participants were given the opportunity to revise their responses, and to provide comments at the end of the questionnaire.

Interpretation/Consolidation and Final Consensus

To generate percentage agreement, the number of participants responding 'Always' and 'Almost Always' on each statement was summed, as were the number of respondents answering 'Never' and 'Almost Never'. This gave three categories: 'Always', 'Sometimes' and 'Never'. For this Delphi, the general consensus level was set a priori to be 70% agreement, i.e. 70% or more respondents answered within the same category. However, for the purpose of a consensus definition of hyperacusis that can inform clinical decision making, the more stringent agreement level of 90% for statements was required.

Results

The Delphi survey was conducted between January 2019 and April 2019. In Round 1, 41/45 participants completed the survey (91.1% response rate). Demographics of those who completed Round 1 are given in Table 1. The response rate in Round 2 was 36/41 (87.8%), and in Round 3 was 33/36 (91.7%).

Levels of agreement

Statements that reached the highest level of agreement to be the best descriptors of hyperacusis were '*A reduced tolerance to sound(s)*' (90.9%) and '*An increased sensitivity to sound(s)*' (78.8%). Many statements that could either 'Always' or 'Sometimes' describe hyperacusis reached consensus. There was 81.8% agreement that '*Hyperacusis can always cause an abnormal response to normal sound(s)*'. Eight further statements on which consensus was reached were that hyperacusis can *sometimes*

- Impact a person's relationship (93.9% agreement)
- Cause a person to use ear protection, such as ear plugs or earphones (97% agreement)
- Reduce a person's confidence (93.9% agreement)
- Cause poor concentration (87.9% agreement)
- Cause a person to withdraw from social situations (81.9%agreement)
- Limit the daily activities of a person (84.8% agreement)
- Cause a person to avoid social situations (78.8% agreement)
- Disrupt daily functioning (78.8%)

'*Sounds perceived as normal to the majority of the population'* and *'Sounds perceived as normal to the person before their onset of hyperacusis'* were both recognised as *always*

involved with hyperacusis, with agreement of 100% and 91% respectively. Sounds that were voted to *sometimes* involve hyperacusis were '*moderate sounds*' and '*annoying sounds'*, both with an agreement of 90%.

Potential features of hyperacusis identified from Round 1 were categorised as conditions, emotions, or other (Supplementary Material 1).

Conditions: No conditions reached consensus for being a *defining* or *common* feature of hyperacusis. As an occasional feature of hyperacusis, 'Superior canal dehiscence' had 78.8% agreement, and 'Sensory disorder' had 72.7% agreement.

Emotions: There was high levels of agreement that the following were *common* features of hyperacusis: avoidance (90.9% agreement), withdrawal (93.9% agreement), annoyance (93.9% agreement), sensitivity (90.9% agreement), intolerance (93.9% agreement), upset (81.8% agreement), aversion (87.9% agreement), irritability (81.8% agreement), altered behaviour (84.8% agreement), anxiety (87.9% agreement), high stress (81.8% agreement), distress (87.9% agreement), fear (78.8% agreement), loss of confidence (75.8% agreement) and frustration (78.8% agreement). Emotions considered *occasionally* presented in hyperacusis were anger (81.8% agreement) and depression (81.8% agreement).

Although emotions avoidance, withdrawal, annoyance, sensitivity and intolerance reached a 90% consensus, they were voted as *common* and not *defining* features of hyperacusis. For this reason, it was decided that they will be placed within the consensus-based description of hyperacusis, rather than definition.

Other: Other features considered to be *common* presenting features in hyperacusis were hypervigilant/hyperalert hearing (81.8% agreement), and discomfort towards sounds (75.8% agreement). Headaches were as agreed by 75.8% of participants to be an *occasional* feature in

hyperacusis. Incorrect programming of hearing aids as well as a normal reaction to loud sounds were both established as not being a feature of hyperacusis (87.9% agreement on both).

A consensus-based definition and description of hyperacusis

Four statements reached consensus (90% agreement level) to form a consensus definition of hyperacusis suitable for clinical decision making. Based on these, hyperacusis was defined as

A reduced tolerance to sound(s) that are perceived as normal to the majority of the population or were perceived as normal to the person before their onset of hyperacusis, where 'normal' refers to sounds that are generally well tolerated.

A consensus-based (70% agreement level) description of hyperacusis is that it is an increased sensitivity to sounds(s). Hyperacusis always involves an abnormal response to normal sound(s), and some people with hyperacusis can also be affected by moderately loud or annoying sounds. Hyperacusis can sometimes impact a person's relationship, reduce a person's confidence, and cause them to withdraw from or avoid social situations, limiting their daily activity and disrupting daily functioning. Poor concentration is also sometimes present with hyperacusis. Hyperacusis can lead a person to use ear plugs, ear phones, or sound defenders in an attempt to protect themselves from noise.

By consensus, avoidance, withdrawal, annoyance, sensitivity, intolerance, upset, aversion, irritability, altered behaviour, anxiety, high stress, distress, fear, and frustration were considered commonly present in people with hyperacusis. Depression and anger were considered occasionally present. Other features considered common in hyperacusis were hypervigilant/hyperalert hearing and discomfort towards sounds. Headaches were also considered an occasional feature of hyperacusis.

Discussion

This study is the first to establish a clinical consensus-based definition and description of hyperacusis. This can usefully inform diagnostics and the scope of clinical practice guidelines. Practice guidelines are needed to ensure consistent clinical examination of patients with suspected hyperacusis. This will also allow comparisons to be made across clinical populations.

Though this is the first study to establish a consensus-based definition of hyperacusis, previous definitions/descriptions have been used within literature. For example, in a review on clinical interventions for hyperacusis in adults, Fackrell et al. (2017) described hyperacusis as "…the perception of everyday environmental sound as being overwhelmingly loud or intense". They also report terminology such as 'reduced', 'decreased', or 'collapsed sound tolerance' as being used to describe hyperacusis. Our Delphi review provides consensus-based support for the use of 'reduced' and 'tolerance' when describing hyperacusis, but not for 'environmental sound as being overwhelmingly loud or intense'. Tyler et al. (2014) described loudness hyperacusis as "[…] moderately intense sounds are judged to be very loud compared with what a person with normal hearing would perceive.". This Delphi review has provided a consensus-based definition of hyperacusis as one condition, whereas Tyler et al. (2014) proposed sub-categories of hyperacusis, including loudness, annoyance, pain and fear hyperacusis. In this review, the terms 'annoyance' and 'fear' reached consensus as common but not defining features of hyperacusis. Furthermore, 'pain' did not reach a consensus as a feature of hyperacusis so was not included within the definition.

Hyperacusis is a growing field of research with many unanswered research questions recently identified. A clear accepted definition of hyperacusis is an essential step forward in hyperacusis research, and will be valuable in working towards answering the 28 priority research questions as determined by professionals and patients with hyperacusis (Fackrell et al., 2019a). One of the top 10 priority questions asks "Are there different meaningful types of hyperacusis?" Interestingly, categorising hyperacusis was not mentioned by the expert panel at any stage of

this Delphi review, as proposed by Tyler et al. (2014). This simple terminology may assist in the diagnosis and management of patients; however, further research is needed before these conditions can be formally classified as sub-types of hyperacusis, rather than separate phenomena such as phonophobia or misophonia. However, research into the mechanisms underlying different symptoms of hyperacusis are sparse, and more is needed to determine whether there are indeed different subtypes and potentially different therapeutic targets.

Within the Delphi, the statement "Hyperacusis can *sometimes* be described as a reduction in the Uncomfortable Loudness Levels (ULL) in Pure Tone Audiometry (PTA)" reached a 78.8% agreement. Despite this, The British Society of Audiology recommended procedure for the Determination of ULLs (BSA, 2011) recommended that ULLs should not be performed routinely within clinical situations as it involves exposing patients to high levels of sounds, which can be especially distressing to a patient with hyperacusis. It is also important to note that the pure tones used in ULLs may not meaningfully represent the types of sound causing distress in certain individuals (Fackrell and Hoare, 2019). Where not clinically indicated, the British Society of Audiology (Hoare et al., 2019) recommend use of multi-item questionnaires such as the HQ (Khalfa et al., 2002), the MASH (Dauman and Bouscau-Faure, 2005) and the GUF (Nelting and Finlayson, 2004, Nelting et al., 2002) to assess for hyperacusis. This newly formed definition and description of hyperacusis may inform the creation of a new assessment scale for hyperacusis, which may help with the development of new practice guidance development.

Interestingly, 57.8% of respondents in this Delphi review said that hyperacusis can be described as an emotional reaction to sound(s), yet 66.7% of people agreed that misophonia was only an occasional feature of hyperacusis. This highlights the potential ambiguity in questions relating to conditions that are associated with hyperacusis, but not comorbid. Furthermore emotions that reached consensus as being common features of hyperacusis included annoyance,

frustration, and irritability, which typically feature in misophonia (Potgieter et al., 2019), and fear, avoidance, withdrawal, aversion, and anxiety, which typically feature in phonophobia (Asha'ari et al., 2010) . In this Delphi, 66.7% of people also agreed that phonophobia was an occasional feature of hyperacusis. Results from this Delphi suggest that phonophobia and misophonia are indeed separate conditions to hyperacusis.

A limitation of this Delphi review is that a small number of experts felt that some questions were slightly unclear or ambiguous, especially those in relation to conditions that may be included as a feature of hyperacusis, but not as a comorbid condition. In completing Round 3 one participant noted *"I found some ambiguity in the questions relating to other conditions (not including comorbidities) this time that I don't think occurred to me last time. I have answered the Qs 'as a feature of hyperacusis' e.g. tinnitus: although hyperacusis is very often present alongside tinnitus, tinnitus is not a feature of hyperacusis per se."* Around 86% of people with hyperacusis as a primary complaint also complain of tinnitus (Anari et al., 1999). This shows that tinnitus is commonly comorbid with hyperacusis but does not necessarily mean that tinnitus is a feature of hyperacusis, although studies have pointed to similar aetiologies between the conditions, such as cochlear damage causing altered brain responses or central gain (Knipper et al., 2013). It has also been demonstrated that people with tinnitus have enhanced auditory sensitivity, compared to a non-tinnitus population (Hebert et al., 2013). Consensus was not met for any conditions as a defining, common, or occasional features of hyperacusis. They therefore were not included in the final definition or description.

One participant wrote *"In my experience, clinicians don't often understand the differences [between hyperacusis, phonophobia and misophonia], plus in online searches these terms are often used interchangeably when in fact they are different from one another".* This highlights the need for a consensus derived definition of hyperacusis as well as clear clinical guidelines outlining the difference between each condition involving sound tolerance. Another participant

stated that it was difficult to say whether items were 'defining' features of hyperacusis on their own, saying that hyperacusis is a collection of symptoms rather than individual symptoms. The consensus-based description should serve to highlight the many potential symptoms that clinicians should be alert to in supporting people who have hyperacusis.

This Delphi process was limited to UK participants, to help inform diagnostics and the scope of UK clinical practise guidelines. However, this means the consensus-based definition is also limited to UK audiences.

Conclusion:

This study used the Delphi review process to find a consensus-based definition and description of hyperacusis. A series of statements reached consensus and a definition of hyperacusis with an accompanying description has been suggested. This is an essential starting point to determine the scope of clinical practice guidelines, and will also support and fuel further research into the mechanisms and management of hyperacusis.

Acknowledgments

Julie Brady, Julie Carr, David Baguley, Richard Nicholson (Nottingham University Hospitals NHS Trust), Anirvan Banerjee (South Tees Hospital NHS Foundation Trust), Clare Marris (Sheffield Teaching Hospital NHS Foundation Trust), Pam Comiskey (NHS Fife), Georgina Wilkinson (Manchester University NHS Foundation Trust), Peter Byrom (Peter Byrom Audiology, Sheffield), Laura Turton (South Warwickshire NHS Foundation), Bernadette Parker (University Hospitals Coventry and Warwickshire NHS Trust), Mary-Louise Montague (NHS Lothian), Leza Munro (NHS Forth Valley), Joanne Goss (GIG Cymru NHS Wales), Ali Hilali (Bridgewater Community Healthcare NHS Foundation Trust), Veronica Kennedy (Bolton NHS Foundation Trust), Beth Claesen (Bath and North East Somerset – Virgin Care), Tony Kay (Aintree University Hospital NHS Foundation Trust), Zarina Naeem (Manchester

University NHS Foundation Trust), Alan Hopkirk (Invizear) are thanked for their contributions in this study.

Table 1. Demographics of the expert panel.

	Frequency
Job Role:	
Audiologist	17
Audiologist/Hearing Therapist	12
ENT Specialist	3
Audiovestibular physician	3
Clinical Scientist	3
Paediatrician	2
Academic/CBT Psychotherapist	1
Sector:	
Public (NHS)	37
Private	4
Years in current profession:	
0 - 9	6
10 -19	8
20 -29	16
30+	11
Hyperacusis patients seen in last 3 months:	
0-4	13
5-9	15
10-14	8
15-19	2
20	2
40	1

References

AAZH, H., MCFERRAN, D. & MOORE, B. C. J. 2018. Uncomfortable loudness levels among children and adolescents seeking help for tinnitus and/or hyperacusis. *Int J Audiol,* 57**,** 618-623.
AAZH, H. & MOORE, B. C. J. 2017. Factors related to uncomfortable loudness levels for patients seen in a tinnitus and hyperacusis clinic. *Int J Audiol,* 56**,** 793-800.
ANARI, M., AXELSSON, A., ELIASSON, A. & MAGNUSSON, L. 1999. Hypersensitivity to sound: Questionnaire data, audiometry and classification. *Scandinavian Audiology,* 28**,** 219-230.
ANDERSSON, G., LINDVALL, N., HURSTI, T. & CARLBRING, P. 2002. Hypersensitivity to sound (hyperacusis): a prevalence study conducted via the Internet and post. *Int J Audiol,* 41**,** 545-54.
ASHA'ARI, Z. A., MAT ZAIN, N. & RAZALI, A. 2010. Phonophobia and hyperacusis: practical points from a case report. *The Malaysian journal of medical sciences : MJMS,* 17**,** 49-51.
AUERBACH, B. D., RODRIGUES, P. V. & SALVI, R. J. 2014. Central gain control in tinnitus and hyperacusis. *Frontiers in neurology,* 5**,** 206-206.
BAGULEY, D., MCFERRAN, D. & HALL, D. 2013. Tinnitus. *The Lancet,* 382**,** 1600-1607.
BAGULEY, D. M. 2003. Hyperacusis. *Journal of the Royal Society of Medicine,* 96**,** 582-585.
BLAESING, L. & KROENER-HERWIG, B. 2012. Self-reported and behavioral sound avoidance in tinnitus and hyperacusis subjects, and association with anxiety ratings. *Int J Audiol,* 51**,** 611-7.
BLASING, L., GOEBEL, G., FLOTZINGER, U., BERTHOLD, A. & KRONER-HERWIG, B. 2010. Hypersensitivity to sound in tinnitus patients: an analysis of a construct based on questionnaire and audiological data. *Int J Audiol,* 49**,** 518-26.
BOYATZIS, R. E. 1998. *Transforming qualitative information: Thematic analysis and code development*, sage.
BSA 2011. Recommended procedure: Determination of uncomfortable loudness levels. British Society of Audiology Reading, UK.
CHEN, Y.-C., LI, X., LIU, L., WANG, J., LU, C.-Q., YANG, M., JIAO, Y., ZANG, F.-C., RADZIWON, K., CHEN, G.-D., SUN, W., KRISHNAN MUTHAIAH, V. P., SALVI, R. & TENG, G.-J. 2015. Tinnitus and hyperacusis involve hyperactivity and enhanced connectivity in auditory-limbic-arousal-cerebellar network. *eLife,* 4**,** e06576-e06576.
COELHO, C. B., SANCHEZ, T. G. & TYLER, R. S. 2007. Hyperacusis, sound annoyance, and loudness hypersensitivity in children. *Prog Brain Res,* 166**,** 169-78.
DANESH, A. A., LANG, D., KAF, W., ANDREASSEN, W. D., SCOTT, J. & ESHRAGHI, A. A. 2015. Tinnitus and hyperacusis in autism spectrum disorders with emphasis on high functioning individuals diagnosed with Asperger's Syndrome. *Int J Pediatr Otorhinolaryngol,* 79**,** 1683-8.
DAUMAN, R. & BOUSCAU-FAURE, F. 2005. Assessment and amelioration of hyperacusis in tinnitus patients. *Acta Oto-Laryngologica,* 125**,** 503-509.
FABIJANSKA, A., ROGOWSKI, M., BARTNIK, G. & SKARZYNSKI, H. Epidemiology of tinnitus and hyperacusis in Poland. Proceedings of the sixth international tinnitus seminar, 1999. Citeseer, 569-571.
FACKRELL, K. & HOARE, D. J. 2019. Scales and questionnaires for decreased sound tolerance. *Hyperacusis and disorders of sound intolerance: clinical and research perspectives.* Plural Publishing, San Diego.
FACKRELL, K., POTGIETER, I., SHEKHAWAT, G. S., BAGULEY, D. M., SEREDA, M. & HOARE, D. J. 2017. Clinical Interventions for Hyperacusis in Adults: A Scoping Review to Assess the Current Position and Determine Priorities for Research. *Biomed Res Int,* 2017**,** 2723715.
FACKRELL, K., STRATMANN, L., GRONLUND, T. A. & HOARE, D. J. 2019a. Top ten hyperacusis research priorities in the UK. *The Lancet,* 393**,** 404-405.
FACKRELL, K., STRATMANN, L., KENNEDY, V., MACDONALD, C., HODGSON, H., WRAY, N., FARRELL, C., MEADOWS, M., SHELDRAKE, J., BYROM, P., BAGULEY, D. M., KENTISH, R., CHAPMAN, S., MARRIAGE, J., PHILLIPS, J., POLLARD, T., HENSHAW, H., GRONLUND, T. A. & HOARE, D. J. 2019b. Identifying and prioritising unanswered research questions for people with

hyperacusis: James Lind Alliance Hyperacusis Priority Setting Partnership. *BMJ Open,* 9**,** e032178.
FORMBY, C., SHERLOCK, L. P. & GOLD, S. L. 2003. Adaptive plasticity of loudness induced by chronic attenuation and enhancement of the acoustic background (L). *The Journal of the Acoustical Society of America,* 114**,** 55-58.
GOODSON, S. & HULL, R. 2015. Hyperacusis. *American Speech-Language-Hearing Association. Audiology Information Series: Hyperacusis*.
GOTHELF, D., FARBER, N., RAVEH, E., APTER, A. & ATTIAS, J. 2006. Hyperacusis in Williams syndrome: characteristics and associated neuroaudiologic abnormalities. *Neurology,* 66**,** 390-5.
GREENBERG, B. & CARLOS, M. 2018. Psychometric Properties and Factor Structure of a New Scale to Measure Hyperacusis: Introducing the Inventory of Hyperacusis Symptoms. *Ear Hear,* 39**,** 1025-1034.
GUIMARÃES, A. C., DE CARVALHO, G. M., MONTEIRO ZAPPELINI, C. E., MEZZALIRA, R., STOLER, G., PASCHOAL, J. R. & MÁRCIA MARIA DE FREITAS DIAS, V. 2014. Study of the relationship between the degree of tinnitus annoyance the presence of hyperacusis☆☆Please cite this article as: Guimarães AC, Carvalho GM, Voltolini MM, Zappelini CE, Mezzalira R, Stoler G, et al. Study of the relationship between the degree of tinnitus annoyance and the presence of hyperacusis. Braz J Otorhinolaryngol. 2014;80:24-8. *Brazilian Journal of Otorhinolaryngology,* 80**,** 24-28.
HANNULA, S., BLOIGU, R., MAJAMAA, K., SORRI, M. & MAKI-TORKKO, E. 2011. Self-reported hearing problems among older adults: prevalence and comparison to measured hearing impairment. *J Am Acad Audiol,* 22**,** 550-9.
HEBERT, S., FOURNIER, P. & NORENA, A. 2013. The auditory sensitivity is increased in tinnitus ears. *J Neurosci,* 33**,** 2356-64.
HÉBERT, S., FOURNIER, P. & NOREÑA, A. 2013. The Auditory Sensitivity is Increased in Tinnitus Ears. *The Journal of Neuroscience,* 33**,** 2356-2364.
HOARE, D. J., BYROM, P. & SHADIS, A. 2019. *Determination of uncomfortable loudness levels* [Online]. British Society of Audiology (BSA). Available: http://www.thebsa.org.uk/wp-content/uploads/2019/07/ULLs-recommended-procedure-Public-Consultation-Copy.pdf [Accessed 01/03/2020].
JASTREBOFF, P. J. & HAZELL, J. W. 1993. A neurophysiological approach to tinnitus: clinical implications. *British journal of audiology,* 27**,** 7-17.
JASTREBOFF, P. J. & JASTREBOFF, M. M. 2000. Tinnitus Retraining Therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. *J Am Acad Audiol,* 11**,** 162-77.
JURIS, L., ANDERSSON, G., LARSEN, H. C. & EKSELIUS, L. 2013. Psychiatric comorbidity and personality traits in patients with hyperacusis. *Int J Audiol,* 52**,** 230-5.
JÜRIS, L., ANDERSSON, G., LARSEN, H. C. & EKSELIUS, L. 2014. Cognitive behaviour therapy for hyperacusis: A randomized controlled trial. *Behaviour Research and Therapy,* 54**,** 30-37.
KHALFA, S., BRUNEAU, N., ROGE, B., GEORGIEFF, N., VEUILLET, E., ADRIEN, J. L., BARTHELEMY, C. & COLLET, L. 2004. Increased perception of loudness in autism. *Hear Res,* 198**,** 87-92.
KHALFA, S., DUBAL, S., VEUILLET, E., PEREZ-DIAZ, F., JOUVENT, R. & COLLET, L. 2002. Psychometric normalization of a hyperacusis questionnaire. *Orl,* 64**,** 436-442.
KLEIN, A. J., ARMSTRONG, B. L., GREER, M. K. & BROWN, F. R., 3RD 1990. Hyperacusis and otitis media in individuals with Williams syndrome. *J Speech Hear Disord,* 55**,** 339-44.
KNIPPER, M., VAN DIJK, P., NUNES, I., RUTTIGER, L. & ZIMMERMANN, U. 2013. Advances in the neurobiology of hearing disorders: recent developments regarding the basis of tinnitus and hyperacusis. *Prog Neurobiol,* 111**,** 17-33.
KNOBEL, K. A. & SANCHEZ, T. G. 2006. [Loudness discomfort level in normal hearing individuals]. *Pro Fono,* 18**,** 31-40.
LEVINE, R. A. & ORON, Y. 2015. Tinnitus. *Handb Clin Neurol,* 129**,** 409-31.
LINSTONE, H. A. & TUROFF, M. 1975. *The Delphi Method*, Addison-Wesley Reading, MA.

MARRIAGE, J. & BARNES, N. M. 1995. Is central hyperacusis a symptom of 5-hydroxytryptamine (5-HT) dysfunction? *The Journal of Laryngology & Otology,* 109**,** 915-921.
MATHISEN, H. 1969. Phonophobia After Stapedectomy. *Acta Oto-Laryngologica,* 68**,** 73-77.
MEEUS, O. M., SPAEPEN, M., RIDDER, D. D. & HEYNING, P. H. 2010. Correlation between hyperacusis measurements in daily ENT practice. *Int J Audiol,* 49**,** 7-13.
MOORE, E. 1998. *Cochlear Hearing Loss,* London, Whurr.
MUNRO, K. J., TURTLE, C. & SCHAETTE, R. 2014. Plasticity and modified loudness following short-term unilateral deprivation: evidence of multiple gain mechanisms within the auditory system. *J Acoust Soc Am,* 135**,** 315-22.
NELTING, M. & FINLAYSON, N. K. 2004. *Geräuschüberempfindlichkeits-Fragebogen: GÜF; Manual*, Hogrefe.
NELTING, M., RIENHOFF, N. K., HESSE, G. & LAMPARTER, U. 2002. Die Erfassung des subjektiven Leidens unter Hyperakusis mit einem Selbstbeurteilungsbogen zur Geräuschüberempfindlichkeit (GÜF). *Laryngo-Rhino-Otol,* 81**,** 327-334.
PAULIN, J., ANDERSSON, L. & NORDIN, S. 2016. Characteristics of hyperacusis in the general population. *Noise & health,* 18**,** 178-184.
PHILLIPS, D. P. & CARR, M. M. 1998. Disturbances of loudness perception. *J Am Acad Audiol,* 9**,** 371-9; quiz 399.
POTGIETER, I., MACDONALD, C., PARTRIDGE, L., CIMA, R., SHELDRAKE, J. & HOARE, D. J. 2019. Misophonia: A scoping review of research. *Journal of Clinical Psychology,* 75**,** 1203-1218.
SHELDRAKE, J., DIEHL, P. U. & SCHAETTE, R. 2015. Audiometric Characteristics of Hyperacusis Patients. *Frontiers in Neurology,* 6.
TAYLOR, S. 2017. Misophonia: A new mental disorder? *Med Hypotheses,* 103**,** 109-117.
TYLER, R. S., PIENKOWSKI, M., RONCANCIO, E. R., JUN, H. J., BROZOSKI, T., DAUMAN, N., DAUMAN, N., ANDERSSON, G., KEINER, A. J., CACACE, A. T., MARTIN, N. & MOORE, B. C. 2014. A review of hyperacusis and future directions: part I. Definitions and manifestations. *Am J Audiol,* 23**,** 402-19.
VERNON, J. A. 1987. Pathophysiology of tinnitus: a special case--hyperacusis and a proposed treatment. *Am J Otol,* 8**,** 201-2.
WAGENAAR, O., WIERINGA, M. & VERSCHUURE, H. 2010. A cognitive model of tinnitus and hyperacusis; a clinical tool for patient information, appeasement and assessment. *Int Tinnitus J,* 16**,** 66-72.