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An online evaluation of the reliability and validity of the Sound Sensitivity Symptoms Questionnaire (SSSQ) and Hyperacusis Impact Questionnaire (HIQ) with an adult population experiencing hyperacusis

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Who experiences hyperacusis?

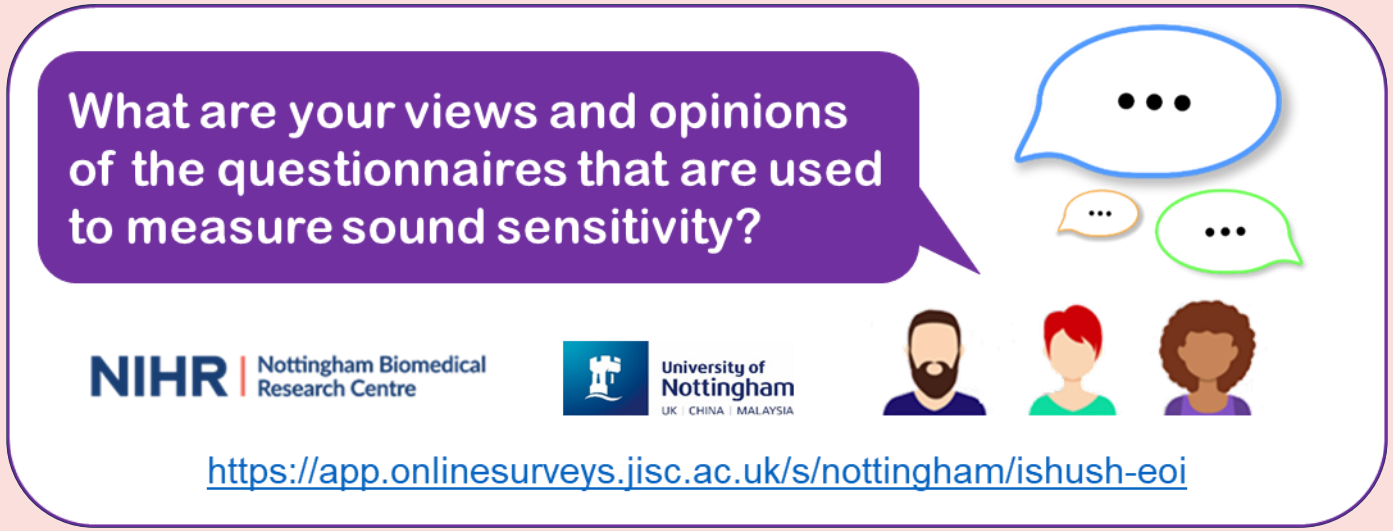
- A reduced tolerance to sound(s) that are perceived as normal to the majority of the population or were perceived as normal to the person before their onset of hyperacusis, where “normal” refers to sounds that are generally well tolerated.
- Affects approx. **3%** of children and **14%** of adults
- Associated with **tinnitus**, depression, autism, William’s syndrome, and dementia

How do measure hyperacusis?

- Questionnaires currently used for diagnosis and treatment
  - Hyperacusis questionnaire (HQ)
  - Inventory of hyperacusis symptoms (IHS)
- BUT the validity and reliability has been questioned.

- To combat issues two new questionnaires developed:
  - Hyperacusis impact questionnaire (HIQ)
  - Sound sensitivity symptoms questionnaire (SSSQ)
- However, the validity and reliability of these need to be independently evaluated for use online

Aim



The aim of this project was to evaluate the validity and reliability of the HIQ and SSSQ in an adult population experiencing hyperacusis for use online.

Methods

- Online survey was conducted from July 2023
- Participants completed:
  - Demographic questions
  - Hyperacusis Impact Questionnaire (HIQ)[1]
  - Sound Sensitivity Symptoms Questionnaire (SSSQ)[1]
  - Hyperacusis questionnaire (HQ)[2]
  - Inventory of hyperacusis symptoms (IHS)[3]
  - Tinnitus Functional Index (TFI)[4]
  - Patient Health Questionnaire (PHQ-9)[5]
  - Generalised Anxiety Disorder-7 (GAD-7)[6]

Questionnaire	Nº items, response options, total range
Hyperacusis Impact Questionnaire (HIQ). [1]	8 items
	0 to 1 day (0), 2 to 6 days (1), 7 to 10 days (2), and 11 to 14 days (3)
	0 – 24
Sound Sensitivity Symptoms Questionnaire (SSSQ). [1]	5 items (Loudness, Pain, Annoyance, Fear hyperacusis, Misophonia)
	0 to 1 day (0), 2 to 6 days (1), 7 to 10 days (2), and 11 to 14 days (3)
	0 – 15

1. Aazh et al. (2022). 2. Khalfa et al. (2002). ; 3. Greenberg & Carlos (2018). 4 Meikle et al. (2012).; 5. Spitzer et al. (2011); 6. Spitzer et al. (2006)

Analysis methods

Construct validity – Pearson's correlations

- Do they correlate with questionnaires measuring similar constructs (e.g., hyperacusis)?
- Do they differentiate between questionnaires measuring constructs that are theoretically independent (TFI, PHQ, GAD)?

Criteria for correlations

0.8 – 1.00	Extremely strong
0.6 – 0.79	Strong
0.3 – 0.59	Moderate
0.0 – 0.29	Weak

Internal consistency – Cronbach's Alpha

- Are the items related to each other?

Criteria for Cronbach's alpha

0.80 – 0.95	Excellent
0.70 – 0.79	Acceptable
0.60 – 0.69	Questionable
< 0.60	Unacceptable

Factorial structure – Principal component analysis

- Are the items measuring the same underlying construct?

Criteria for Factor analysis

> 50% of variance explained

>0.4 Factor loadings

Sample Characteristics

- 76 adults completed, 42 females (55.3%) and 34 males (44.7%)
- Mean age of 50.2± 16.5 years (range: 19 to 81 years)
- Participants were experiencing moderate to severe hyperacusis.
- 93% (71) reported tinnitus
- 55% (42) report experiencing mild hearing loss
- Anxiety and depression indicated

Questionnaire	Mean (SD)
Hyperacusis Impact Questionnaire (HIQ)	15.55 (7.57)
Sound Sensitivity Symptoms Questionnaire (SSSQ)	9.30 (3.81)
Hyperacusis questionnaire (HQ)	29.26 (8.19)
Inventory of hyperacusis symptoms (IHS)	56.41 (15.23)
Tinnitus Functional Index	39.18 (29.85)
Patient Health Questionnaire-9 (PHQ-9)	11.01 (7.86)
Generalised Anxiety Disorder Scale-7 (GAD-7)	9.34 (6.85)

How does the HIQ and SSSQ compare to other questionnaires?

- HIQ:
  - Strong correlations with HQ, IHS, and SSSQ
- SSSQ:
  - Moderate correlations with HQ and IHS
- HIQ and SSSQ:
  - Weak correlations with TFI
  - Moderate correlations with GAD-7 and PHQ-9

0.6 – 0.79 Strong
0.3 – 0.59 Moderate
0.0 – 0.29 Weak

HIQ	1			
SSSQ	0.67	1		
HQ	0.64	0.56	1	
IHS	0.66	0.55	0.59	1
TFI	0.11	0.18	0.06	0.27
PHQ-9	0.44	0.41	0.34	0.62
GAD-7	0.47	0.48	0.37	0.54
	HIQ	**SSSQ**	**HQ**	**IHS**

Pearson's correlations coefficients for the HIQ, SSSQ, HQ, IHS, TFI, PHQ-9, and GAD-7 scores

Are all the questions measuring the same construct?

- HIQ:
  - Cronbach's alpha = 0.926
  - One factor with an eigenvalue above 1 (Table 1)
- SSSQ:
  - Cronbach's alpha = 0.635 (increases with removal of item 4)
  - Two factors with eigenvalues above 1 (Table 2), item 4 had communality below 0.5

Table 1. HIQ Item factor loadings

Component Matrix[a]

	Component 1
4. Unable to relax in noisy places	.897
3. Lack og concentration in noisy places	.882
5. Difficulty in carrying out certain day-to-day activities/tasks in noisy places	.868
6. Lack of enjoyment from leisure activities in noisy places	.853
1. Feeling anxious when hearing loud noises	.784
8. Getting tired quickly in noisy places	.784
2. Avoiding certain places because it is too noisy	.733
7. Experiencing low mood because of your intolerance to sound	.695

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Table 2. SSSQ Item factor loadings

Rotated Component Matrix[a]

	Component 1	2
2. Pain in your ears when hearing certain loud sounds? Examples: loud music, sirens, motorcycles, building work, lawn mower, train stations.	.823	
3. Discomfort (physical sensations other than ear pain) in your ears when hearing certain loud sounds?	.792	
1. Having a problem tolerating sounds because they often seem "too loud" to you?	.630	
5. Fear that certain sounds may make your hearing and/or tinnitus worse?	.609	
4. Feeling angry or anxious when hearing certain sounds related to eating noises, lip smacking, sniffling, breathing, clicking sounds, tapping?		.936

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

Conclusions

- The newly developed HIQ was found to measure the target construct and is valid and reliable for use online and using tablets.
  - EFA showed HIQ had good structural validity– inclusion of all items justified
- The SSSQ was more problematic.
  - Item 4 did not correlate with the other items - should not be included in overall score
  - Item 4 focuses on misophonia NOT hyperacusis BUT would be informative for evaluating symptoms of misophonia
- Further validations of both questionnaires may still be necessary for the future to further assess reliability

Thank you for listening.