

## Use of WHODAS 2.0 in Tinnitus Patients: Correlating Results with THI

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### ABSTRACT

The World Health Organization's (WHO) Disability Assessment Schedule (WHODAS 2.0) is a generic health status instrument developed from a comprehensive set of items related to 'Activity' and 'Participation' component of WHO's International Classification of Functioning, Disability and Health (ICF) conceptual framework. It consists of six domains: Cognition, Mobility, Self care, Interpersonal, Life activities and Participation. As a tinnitus sufferer exhibits psychosomatic symptoms which are incorporated in WHODAS 2.0, this instrument can be used on tinnitus subjects to measure their status and disability in ICF framework. The objective of the present study was to determine psychometric properties of WHODAS 2.0 on a sample of 88 individuals with tinnitus. Tinnitus Handicap Inventory (THI), one of the most common tinnitus assessment scale was also used in the study. A series of statistical analysis was conducted on the collected data. Audiologic evaluations were followed by scale administration. Raw scores were coded and domain scores, total scores obtained. Mean total score of 47.77 and 47.15 was obtained from THI and WHODAS 2.0 respectively. Correlations to examine convergent validity between the two scales showed strong statistically significant ( $p < 0.0005$ ) correlation [ $r(\text{Total scores}) = 0.852$ ;  $r(\text{overall scores}) = 0.851$ ,  $r(\text{grades}) = 0.860$ ]. Internal consistency reliability was adequate for all domains with moderate to strong domain-total correlation except for mobility and self care. Test-retest reliability statistic for total score showed a strong correlation [ $r = 0.842$ ,  $p < 0.0005$ ]. Based on the results it was concluded that cognition, interpersonal, life activities and participation domains of WHODAS 2.0 are relevant and hence can be used in tinnitus assessment battery.

**Key Words:** Activity, Participation, Cognition, WHO, ICF, Tinnitus

### INTRODUCTION

Tinnitus is an auditory sensation perceived within the human ear or head in the absence of any corresponding external sound. [1,2] It can be perceived in one or both the ears. Population based epidemiologic study of hearing loss in adults showed a prevalence rate of 10 to 15 percent of individuals suffering with tinnitus worldwide. [3,4] The prevalence has ranged from 7.1% in 2007–2008 (National Centre for Health Statistics, 2016) to 14.6% in

2011–2012 (National Centre for Health Statistics, 2016). [5] Basically tinnitus is of 2 types: Objective Tinnitus and Subjective tinnitus. In the former the sound emitted from the ear is audible to another person whereas in the latter condition tinnitus is audible only to the patient suffering from it. [6] Source of subjective tinnitus is attributed to neurophysiological origin [2] whereas objective tinnitus may have vascular, muscular, respiratory or temporomandibular joint origin. [2] Secondary otologic

conditions which can precipitate tinnitus are noise induced hearing loss, presbycusis, otosclerosis, Meniere's disease, vestibular schwannoma and otitis media among others. In spite of a number of hypothesis which have been postulated to describe the cause of tinnitus none have been established so far. Over the period of years, with an increase in the prevalence of tinnitus, research in this field have also gained importance. In both the forms the impact of tinnitus can range of mild unaffected type to severe intolerable problem. The impact is not only anatomical or physiological in nature rather its multifaceted affecting various somatic and psychological domains related to functioning like sleeplessness, depression, anxiety, annoyance, irritation, fear, lack of concentration, withdrawal, loneliness or avoidance. [7] The more varied its symptoms, the more challenging its assessment. Studies [8] show the use of four different approaches to evaluate tinnitus treatment: Psychoacoustic tests, Rating scales (Verbal Rating Scale, Numerical Rating Scale, Visual Analog Scale), Questionnaires describing functional effects of tinnitus and Patients' global perception of treatment related change (both self and examiner administered). Pure tone audiometry, tympanometry, tinnitus pitch, loudness matching, tinnitus maskability and residual inhibition are the predominant psychoacoustic measures to assess tinnitus. Brain imaging, test of Auditory brainstem response, Otoacoustic acoustic emission are extended evaluations which aid in more detail characterisation of tinnitus. [9] In spite of these high-tech measures, most often tinnitus severity is underrated due to poor correlation between findings of objective psychoacoustic diagnostic measures and actual impact of tinnitus. Hence, standard disease specific instruments on tinnitus are essential to elaborately quantify tinnitus severity. Such instruments should be extremely sensitive to psychosomatic and social effects seen in tinnitus patients. Tools have been extensively developed and used for screening purposes, intake evaluation

and measuring treatment outcomes. [8] Use of severity rating scales have been documented as early as 1984 by Miekle et al [10] where patients rated the severity of tinnitus on a scale from 1 to 10, with 1 representing 'very mild tinnitus' and 10 representing 'extremely severe tinnitus. Tinnitus Handicap Inventory [11] is one such most commonly used tool which describes the functional effects of tinnitus. It is a reliable tool used during intake evaluations as well as assessing treatment outcomes. This brief, self report, easily administered, psychometrically robust measure is unaffected by variables like age, gender and hearing loss and is easy to score and interpret. [11-13] Due to its use in varied population, THI has been translated and standardised into several European and South American languages. High internal consistency of the translated versions [THI-English (0.93), [11] THI-Danish (0.93), [14] THI-Italian (0.91), [15] THI-Lithuanian (0.93), [16] THI-Portuguese (0.94), [17] THI-Tamil (0.98) [13]] indicates its applicability and adaptation to various cultures. The short version of THI consisting of 12 items THI-12 (Internal consistency of 0.89) has also been validated in German. [18]

Although THI is a standard disease specific questionnaire for assessing the impact of tinnitus in daily life, like other standard tools, uniformity and universally accepted descriptions are compromised in its results. Unlike a generic tool, this tool focuses primarily on the individual aspect, consequence of tinnitus on a patient's environmental arena, social integration and contextual perspectives are not much revealed.

World Health Organisation's International Classification of Functioning Disability and Health (ICF, 2001), [19] a revised version of International Classification of Impairments, Disabilities and Handicaps (ICIDH, 1980) [20] provides a conceptual framework which can assess any health condition beyond the consequence of a disease or disorder (i.e. impairment, disability and handicap). ICF scrutinises the

function of an individual at three levels: body, person and societal level defining ‘disability’ as a ‘decrement in each functioning domain’. [21] It integrates the major models of disability - the medical model and the social model – as what is called a “bio-psycho-social synthesis”. [22] As ICF is a conceptual framework with an exhaustive set of items identified with standard codes, its practical application is dependent on assessment tool derived from it. World Health Organisation’s Disability Assessment Schedule (WHODAS) 2.0 (2010) [21] is one such generic assessment tool developed based upon the comprehensive set of items derived from ICF. It is designed to assess ‘Activity limitation’ and ‘Participation restriction’ experienced by an individual due to his health condition (Table 1). ‘Activity’ is the execution of a task or action and ‘Activity limitations’ are the difficulties an individual may have in executing activities. ‘Participation’ is involvement in a life situation and ‘Participation restrictions’ are the problems an individual may experience in involvement in life situations. [19] Generic assessment tools do not focus on any particular disease or disorder, they are etiologically neutral and assess the self perceived overall health status of an individual. [21] They provide standard language and conceptual basis for defining and measuring disability. Results of such measures are also useful in framing health care measures and policy making at a population level.

**Table 1 Level of Functioning and Disability used in International Classification of Functioning**

Level of functioning	Parallel level of disability
Body functions and structures	Impairments
Activities	Activity limitations
Participation	Participation restrictions

WHODAS 2.0 was developed through an extensive cross-cultural study, spanning 19 countries across the world, India being one of them. After a phase of rigorous and extensive field test stretched over a period of 12 years, the final draft of 36 items was selected based on item

response theory from a pool of 96 items present in its initial draft. It has excellent psychometric properties with overall internal consistency and test retest reliability of 0.98. It is applicable for adults above the age of 18years and available in more than 30 different languages across the globe. WHODAS 2.0 has been applied in population studies as well as in specific clinical group studies like inflammatory arthritis, patients with stroke, depression, anxiety, schizophrenia and hearing loss. [21]

The use of generic tools broadens the perspective of disability assessment in any health condition and allows comparisons across populations, conditions or clinical groups. Further ICF framework enables examination of medical, functional, social and environmental factors in the same individual at the same time. ICF based studies have been conducted to study characteristics of tinnitus [22] in general as well as in persons suffering from noise induced tinnitus. [23] Both studies have indicated activity limitation and participation restriction in tinnitus sufferers reflecting their disability in one or more spheres of functioning. The use of WHODAS 2.0 will be the first of its kind to study the use of a generic assessment tool on tinnitus patients. The intent of this study is not to replace the traditional tool THI, but to assess additional spheres of a tinnitus patient which are affected due to this otologic condition. The prime objective of the present study is to ascertain the applicability of WHODAS 2.0 as an assessment tool in tinnitus patients. This is achieved by examining the convergent validity, internal consistency and test retest reliability of WHODAS 2.0 scores, correlating its results with THI. The findings of the study would further conclude if WHODAS 2.0 is a valid tool to assess activity limitation and participation restriction in tinnitus patients as stated in ICF framework.

## MATERIALS AND METHODS

A total of 88 subjects (57 males and 31 females) within an age range of 30-70 years (mean age 50.39 yrs) fluent in English, with a chief complain of tinnitus for not less than a period of 3 months were sampled under purposive sampling from two Govt. hospitals and three privately owned Hearing care clinics over a period of 11 months. Subjects with associated comorbid disease, medical condition, neurologic or psychiatric disorder other than diabetes and hypertension were exempted from the study. Data was collected in two phases after a formal consent declaration from the subjects for participation in the study. In the first phase, a detail case history and medical history via interview was taken followed by objective assessments: otoscopy, pure tone audiometry, speech audiometry, tinnitus matching and tympanometry. Pure tone audiometry was conducted using dual channel diagnostic audiometer at standard frequencies calibrated to ANSI-S-3.6 (1996) standards in soundproof room under ambient noise conditions. Frequencies tested were 250 Hz to 8 kHz and 250 Hz to 4 kHz for air and bone conduction audiometry respectively. Speech Recognition Threshold was obtained for frequencies 500Hz to 4kHz for subjects with associated hearing loss. Immittance audiometry was done using Impedance Audiometer (calibrated to the manufacturers specifications) to rule out middle ear pathology. Tinnitus evaluation [24] included intensity matching and pitch matching with octave confusion and test of minimum masking intensity level. On Audiometry, those tested positive of hearing loss greater than mild degree (Clarks classification of hearing loss, 1981) [25] were debarred from the second phase of data collection.

In the second phase details of attributes of tinnitus pertaining to its nature, type, associated disturbances (such as attention concentration, sleep, irritability, tolerance) were obtained using a preformulated intake questionnaire in a formal interview setting. This was followed by administering two standard tools to

characterise the profile of individuals with tinnitus which may be a primary or secondary condition to hearing loss.

**Tinnitus Handicap Inventory (THI):** This is a conventional self report tool given by Newman et al (1996). [11] The 25-items in the tool are broadly categorised into three subscales: 'Functional' subscale (11Items)-representing items reflecting limitations in mental, social/occupational and physical domains, 'Emotional' subscale stating emotional state of tinnitus sufferers like anger, irritability, frustration and depression (9 Items) and 'Catastrophic' subscale reflecting patient's desperation, perception of tinnitus as terrible disease and inability to control and escape tinnitus (5 Items). Ratings were scored on a three point Likert scale with 'Yes', 'Sometimes' and 'No' options for each item. Subscale score and total score were calculated to measure the overall degree of perceived handicap ranging on a scale from 0 to 100 with slight, mild, moderate, severe and catastrophic categories.

**World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0):** This is a generic functional health status instrument [26] edited by Üstün et al (2010) [21] available in three versions: 36 items, 11 items and 12+24 item versions with the first two benefited with usage options of Interviewer, Self or Proxy administered. However the 12+24 version could be administered only through interview or computer adaptive testing mode. All the versions include six domains of assessment: Cognition (6 items), Mobility (5 items), Self Care (4 items), Getting along with people/Interpersonal (5 items), Life activities (8 items) (Household and Work or school activities) and Participation (8 items). The former three are 'Activity' addressing domains with the later three addressing 'Participation'. In our study 36-item self administered version was used. Raw scores were rated on a 5 point rating scale with 'None', 'Mild', 'Moderate',

‘Severe’ and ‘Extreme or Cannot do’ options which were then recoded as per the syntax of scoring algorithm provided. Domain specific scores and overall summary scores were computed separately for subjects with and without remunerated work items which provided them with income. Overall score was rated on a scale ranging from 0 to 100 divided proportionately into five equal intervals. Each interval reflected the degree of disability as slight, mild, moderate, severe and extreme.

Subjects fulfilling the inclusion criteria had to go through both the stages of data collection which was either completed in their first visit or carried over to their second consecutive follow up depending upon their appointment schedule and time constraints. A follow up retest was done for 55 cases (during second to third week) who were administered WHODAS 2.0 in a second round prior to taking any treatment regime for tinnitus. Scores were tabulated, and statistical analysis performed.

**STATISTICAL ANALYSIS**

The tabulated data was analysed using SSPS for Windows version 16.0. Descriptive analysis was done on the collected data through tinnitus evaluation and interview:

- Frequency distribution was obtained for Tinnitus characteristics in terms of tinnitus laterality, acoustic trait, pitch and intensity and tinnitus periodicity.
- Bivariate analysis was done between overall scores and grades of THI and WHODAS 2.0; to find THI and WHODAS 2.0 grades in different age groups, in individuals with and without hearing loss and in individuals with different employment status.
- Convergent validity of WHODAS 2.0 was obtained by finding the degree of association between overall grades and total scores of THI and WHODAS 2.0 using Spearman’s (rho) correlation coefficient and Pearson’s correlation coefficient respectively at 0.01 significance level.

- Internal Consistency reliability of WHODAS 2.0 was analysed using cronbach’s alpha and inter domain and domain to total score correlation coefficient at 0.01 significance level.

-Test – retest reliability was done to find stability in repeated measures in WHODAS 2.0 scores over time with Pearson’s correlation coefficient.

**RESULT**

**Descriptive analysis**

A total of 88 subjects had participated in the study. They were divided into two groups based on their chronological age: Group A and Group B with mean age of 50.39 years. The detail demographic descriptions in terms of marital and employment status or presence of hearing loss are summarised in Table 2.

**Table: 2 Demographic detail for all participants**

Demographic Variable	Category	Frequency (%)
Age	Gr A (30-50yrs)	43 (48.9)
	Gr B (51-70yrs)	45 (51.5)
Gender	Male	57 (64.7)
	Female	31 (35.3)
Marital Status	Never Married	7 (7.9)
	Married	75 (85.2)
	Widowed	6 (6.9)
Associated Hearing Loss	Yes	54 (61.4)
	No	34 (38.6)
Employment Status	Paid	26 (29.5)
	Self Employed	24 (27.3)
	Non Paid Work	2 (2.3)
	Homemaker	17 (19.3)
	Retired	5 (5.7)
	Unemployed (Other Reasons)	14 (15.9)

Pure tone audiometry and tympanometry was conducted followed by objective tinnitus matching. Recorded tinnitus features are tabulated in Table no 3. Although acoustic trait was noted as ringing by 31.8%, majority of subjects (36%) were unable to attribute the sound sensation to any specific acoustic trait, had moderate (43.1%) levels of tinnitus with high pitch (68.1%)

Objective assessments were followed by questionnaire data intake. Scores from the different domains of WHODAS 2.0 were analysed and compared to scores of THI (Table 4). Mean total of THI and WHODAS

2.0 was 47.77 and 47.15 respectively. Cognition was scored most affected domain (mean 47.05) followed by Participation (mean 46.92), Interpersonal relationship (mean 43.70) in WHODAS 2.0. Activity

related areas were scored low in comparison to participation domains. Mobility and Self Care were the least affected domains. On THI, Functional (58.92) and Emotional (45.18) subscales had high mean scores.

**Table: 3 Tinnitus Characterisation (% distribution)**

Tinnitus Feature		N (%)	Tinnitus Feature		N (%)
Acoustic Trait	Ringing	28(31.8)	Pitch*	High	60(68.1)
	Buzzing	10(11.3)		Low	25(28.4)
	Hissing	14(15.9)		Unspecified	3(3.4)
	Unspecified	36(40.9)	Loudness**	Soft	17(19.3)
Laterality	Right Ear	32(36.3)		Moderate	38(43.1)
	Left Ear	22(25)		Loud	33(37.5)
	Both Ear	14(15.9)	Periodicity	Continuous	56(63.6)
Head	20(22.7)	Intermittent		32(36.4)	

\*High=>1 kHz; Low=<=1 kHz; Unspecified=could not be matched

\*\* Soft=<=15dBSL; Moderate=<=30dBSL; Loud=>30dBSL

**Table: 4 Mean and SD of THI subscale and WHODAS 2.0 Domain Scores**

THI Subscale	Mean	S.D
Functional	58.92	11.3
Emotional	45.18	22.45
Catastrophic	32.15	15.8
Total Score	47.77	13.71
WHODAS 2.0 Domain	Mean	S.D
Do 1- Cognition*	47.05	16.9
Do 2- Mobility*	8.40	10.7
Do 3- Self Care*	5.32	14.6
Do 4 -Interpersonal**	43.70	25.4
Do 5_1- Household Activities**	41.0	21.6
Do 5_2- Work Activities**	40.34	25.4
Do 6- Participation**	46.92	15.8
Overall Score	47.15	16.39

\*Items under Activity domain of ICF framework

\*\*Items under Participation domain of ICF framework

Percentage distributions of subjects under various grades of THI and WHODAS

2.0 was calculated to study variation in grades in different age group, in comorbid condition of associated hearing loss and different employment status (Table 5). Both the tools recorded a higher percentage of subjects with moderate severity levels of handicappedness (THI-25%) and disability (WHODAS 2.0- 25%) irrespective of age. Whereas, in condition of associated hearing loss more no of subjects reported severe (20.5%) grades on THI but moderate grade (34.1%) on WHODAS 2.0. Homemakers, salaried employed and self employed subjects showed mild to severe grades in both the tools.

**Table: 5 Percentage distributions of subjects under various grades of THI and WHODAS 2.0**  
THI Grade\*/WHODAS 2.0 Grade\*\*

Variable		Slight	Mild	Moderate	Severe	extreme
Age	Gr A	1.1/3.4	17/19.3	25/21.6	3.4/4.5	2.0/0
	Gr B	0/1.1	5.7/10.2	25/23.9	18.2/12.5	2.3/3.4
Associated HL	Yes	0/0	3.4/6.8	33.0/34.1	20.5/17.0	4.5/3.4
	No	1.1/4.5	19.3/22.7	17.0/11.4	1.1/0.0	0/0
Employment Status	Paid	0/2.3	8.0/11.4	15.9/13.6	5.7/2.3	0/0
	Self Employed	0/0	10.2/12.5	9.1/9.1	8.0/5.7	0/0
	Non Paid Work	0/0	0/0	1.1/1.1	1.1/1.1	0/0
	Homemaker	0/0	1.1/2.3	13.6/11.4	2.3/2.3	2.3/0
	Retired	0/0	1.1/1.1	1.1/2.3	3.4/2.3	0/0
	Unemployed (Other Reasons)	1.1/2.3	2.3/2.3	9.1/8	1.1/3.4	2.3/0

**WHODAS 2.0 relationship to THI**

As the present study aimed to analyse the relationship between disease specific conventional tool THI to that of generic assessment tool WHODAS 2.0 on tinnitus patients, a series of analysis was done to establish this. The level of associations between THI scores and WHODAS 2.0 total scores and overall

computed scores were calculated to study the convergent validity of WHODAS 2.0. (Table 6a). Pearson product moment Correlation coefficient of 0.852 (p<0.0005) and 0.851 ((p<0.0005) was obtained respectively at significance level of 0.01. Spearman’s correlation (rho) was calculated to study the degree of association between the perceived grades of both the tools. It

was 0.860 ( $p < 0.0005$ ) at significance level of 0.01 (Table 6b).

**Table: 6a Correlations between THI Score and WHODAS 2.0 Total Score and Overall Score**

WHODAS 2.0 score		THI scores
Pearson's Correlation	WHODAS 2.0 Total Scores	0.852*
	Sig (2-tailed)	0**
	N	88
Pearson's Correlation	WHODAS 2.0 Overall Scores	0.851*
	Sig (2-tailed)	0**
	N	88
* Correlation is significant at the 0.01 level (2-tailed)		
**Sig. (2-tailed) = 0 is p-value < 0.0005		

**Table: 6b Correlations between THI Grade and WHODAS 2.0 Grade**

WHODAS 2.0 Grade		THI Grade
Spearman's Correlation (rho)	WHODAS 2.0 Grade	0.860*
	Sig (2-tailed)	0**
	N	88

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

\*\*Sig. (2-tailed) = 0 is p-value < 0.0005

As both the scales were further subdivided into categories, bivariate analysis was done to study if any association existed among the specific categories of each scale. Pearson-Product Moment Correlation Coefficients between Scores of WHODAS 2.0 domains and THI subscales (Table 7) shows the results. Moderate positive statistically significant ( $p < 0.01$ ) correlation was found between scores of cognition and all the subscales of THI. Weak to moderate statistically significant correlations were found between scores of Interpersonal Relationship and THI subscales as well. However very weak correlations were seen between scores of mobility and self care domains with THI subscales.

**Table: 7 Pearson-Product Moment Correlation Coefficients Calculated Between Scores of WHODAS 2.0 domains and THI subscales**

	WHODAS 2.0						
	Cognition	Mobility	Self Care	Inter-Personal	Household Activities	Work Activities	Participation
<b>THI</b>							
<b>Functional</b>	<b>0.55</b>	0.12	0.08	<u>0.34</u>	0.27	0.13	<u>0.32</u>
<b>Emotional</b>	<b>0.51</b>	0.19	0.12	<b>0.57</b>	<u>0.32</u>	0.27	<u>0.41</u>
<b>Catastrophic</b>	<b>0.52</b>	0.05	0.20	<b>0.51</b>	<u>0.33</u>	<u>0.21</u>	<u>0.38</u>

Correlation that are statistically significant at  $p < 0.01$  are underlined.

Correlation which are moderate and above are shown in Bold

Internal consistency reliability of WHODAS 2.0 was calculated through Cronbach's alpha. As indicated in inter domain and domain to total score correlation (Table 8a & 8b), moderate to weak positive correlations with magnitudes ranging from 0.668 to 0.340 were found within the domain; strong positive domain

to total score correlation was seen for all domains at 0.01 significant level except for mobility and self care which showed very weak correlations. Average reliability coefficient, Cronbach's alpha value for all possible domain splits was 0.83, with values above 0.80 for cognition, interpersonal, work and participation domains (Table 8c)

**Table: 8a Inter-Domain and Domain- Total correlation matrix of WHODAS 2.0 scores**

	Do 1	Do 2	Do 3	Do 4	Do 5_1	Do 5_2	Do 6	Total
<b>Do 1</b>	1	0.07	0.1	0.668*	0.540*	0.345*	0.536*	0.829*
<b>Do 2</b>	0.07	1	0.14	0.22	0.18	0.08	0.20	0.28
<b>Do 3</b>	0.1	0.14	1	0.21	0.17	0.15	0.19	0.30
<b>Do 4</b>	0.668*	0.22	0.21	1	0.589*	0.340*	0.466*	0.813*
<b>Do 5_1</b>	0.540*	0.18	0.17	0.589*	1	0.498*	0.692*	0.819*
<b>Do 5_2</b>	0.345*	0.08	0.15	0.340*	0.498*	1	0.465*	0.548*
<b>Do 6</b>	0.536*	0.20	0.29	0.466*	0.692*	0.465*	1	0.826*
<b>Total</b>	0.829*	0.28	0.30	0.813*	0.819*	0.548*	0.826*	1

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

**Table: 8b Categorical representation of corresponding magnitudes of Inter-Domain correlation of WHODAS 2.0 scores**

	Do 2	Do 3	Do 4	Do 5_1	Do 5_2	Do 6
<b>Do 1</b>	Very weak	Very weak	Moderate	Moderate	Weak	Moderate
<b>Do 2</b>		Very weak	Very weak	Very weak	Very weak	Very weak
<b>Do 3</b>			Very weak	Very weak	Very weak	Very weak
<b>Do 4</b>				Moderate	Weak	Weak
<b>Do 5_1</b>					Weak	Moderate
<b>Do 5_2</b>						Weak

**Table: 8c** Cronbach's  $\alpha$  for WHODAS 2.0 Domain and Total Scale Scores

Domain	Corrected item total correlation	Cronbach's alpha
Cognition	0.67	0.80
Mobility	0.48	0.34
Self Care	0.42	0.42
Interpersonal	0.64	0.80
Household	0.74	0.77
Work	0.58	0.87
Participation	0.71	0.80
Total	0.92	0.83

Test retest reliability of WHODAS 2.0 scores (Table 9) indicated an increase in retest mean scores for all domains except for cognition, mobility and self care. Pearson correlation coefficient between initial baseline to retest scores was 0.842 ( $p < 0.0005$ ) and was statistically significant.

**Table: 9** Test-Retest Categorical representation of corresponding magnitudes of correlation between Inter-Domain and Domain –Total WHODAS 2.0 scores

WHODAS 2.0 score	Baseline mean (S.D)	Retest mean (S.D)
Cognition	47.05 (16.9)	45.2 (14.4)
Mobility	8.40 (10.7)	8.2 (12.6)
Self Care	5.32 (14.6)	5.28 (18.15)
Interpersonal	43.70 (25.4)	45.9 (22.7)
Household	41.0 (21.6)	43.2 (18.4)
Work	40.34 (25.4)	40.81 (23.9)
Participation	46.92 (15.8)	48.50 (12.44)
Total	47.15 (16.39)	48.37 (18.32)

## DISCUSSION

In the present study the applicability of WHODAS 2.0 in tinnitus patients have been examined. As no previous studies have documented findings related to use of generic assessment tool in tinnitus population, the results of the present study have been compared across a wider range of age group with varied personal and social status. Patients included in the study suffered from all possible forms of tinnitus exhibiting acoustic trait of ringing, hissing, buzzing, some sound sensations not distinct to characterise, high pitched, low pitched, with loudness ranging from soft to high levels. The mean data for each of THI subscales and WHODAS 2.0 domain scores were in a close range except for mobility and self care domain of WHODAS 2.0. High mean score was obtained for cognition domain indicating reduced functioning in cognitive activities like concentrating, remembering, problem solving, learning or

communication. Poor scores in this domain reflected activity limitation of tinnitus patients. However, other activities like getting around or moving from one place to another (Mobility), personal activities like getting dressed, maintaining hygiene and grooming (Self Care) were not much affected. Participation of tinnitus subjects in community based social activities; work related social contacts, interpersonal relationship with family members, spouse, close friends or stranger and other specific personal or environmental contextual factors were affected with high mean scores across all items assessing participation, interpersonal relationship and life activities related to household or work. This indicated participation restrictions of individuals with tinnitus as well, as defined in ICF framework. These findings correlated with results of earlier studies [22,23] which had shown activity limitation and participation restriction in tinnitus sufferers.

Convergent validity of WHODAS 2.0 was calculated to examine the consistency between the generic scale and the disease specific scale. It also examined whether domain scores of WHODAS 2.0 assess the similar constructs which are assessed by THI in tinnitus patients. Strong positive correlation between THI total score with WHODAS 2.0 total score suggested items of WHODAS 2.0 could assess similar theoretical constructs as those of THI. However domain specific correlation were lower compared to total score correlations. Moderate correlations were found between THI subscales and Cognition and Interpersonal domain of WHODAS 2.0. This finding at par indicated that impaired mental cognitive state in tinnitus patients also affect their functional performance, emotional status and their ability to cope up with their immediate environment. [7] Participation and Life activity domain showed weak correlation although significant, indicating that the correlation was not by a matter of chance but rather consistent in tinnitus patients in these areas. In spite of weak to moderate subscale to



domain correlation, the high magnitude of total score correlation coefficient between the two scales strongly implied the possibility of use of WHODAS 2.0 as a functional health status measurement instrument in tinnitus patients. These findings support the validity of using of WHODAS 2.0 scale in tinnitus patients.

Cronbach's alpha of 0.83 obtained in the present study suggested good reliability of overall WHODAS 2.0 domain items. This finding was in line with study of Carmines et al. [27] which stated scales with internal consistency reliability of more than 0.8 can be widely used. Further, this criterion was met by Cognition, Interpersonal, Work and Participation domain score stating its adequacy for use in tinnitus patients. However, use of Mobility and Self Care domain should be done with caution as they showed low reliability coefficients.

Test retest reliability coefficient of 0.842 indicated good consistency of WHODAS 2.0 scores over time. An increase in retest mean score was seen for all domains except for Cognition. This could be attributed to adaptation and impact of counselling to tinnitus patients at the time of their initial consultation which enabled them to improve their cognitive functions like attention and concentration in spite of tinnitus. As specific tinnitus targeted treatment regime had not been undertaken for any of the patient during the time of retest, increase in mean retest scores likely indicated the need to focus on intervention strategies to relief the patients from tinnitus spell.

## CONCLUSION

The present study was designed to study the potential utility of WHODAS 2.0 scale in tinnitus patients. Based upon the quantitative outcome measures indicating strong correlation between the scores of the two scales, high internal consistency of the domain items and good test retest reliability, it is concluded that WHODAS 2.0 is sensitive to changes in psychosocial and

communication functioning among tinnitus subjects. It is a valid tool for assessing activity limitation and participation restriction in subjects owing to this otologic condition. As WHODAS 2.0 draws its root from ICF framework the assessment of impact of tinnitus in this scale further describes tinnitus in a biopsychosocial perspective vividly conceptualising its functioning and disability parameters. In this study, WHODAS 2.0 has assisted in measuring health status of tinnitus patients in terms of their disability levels. Disability assessments are crucial as it forms the basis for measuring specific treatment outcomes and prioritising treatment goals. Results support the conclusion that cognition, participation, interpersonal and life activity domains of WHODAS 2.0 efficiently captures the disability conditions due to tinnitus. At the same time being a generic scale and culturally sensitive it provides a common metric to compare disability due to tinnitus with other comorbid disease or disordered health condition across cultures. However, owing to its etiologically neutral properties, WHODAS 2.0 should be used with caution in tinnitus population so as not to overemphasize or underrate this clinical condition. Further research can be conducted to study the use of WHODAS 2.0 on larger tinnitus population assessing outcome measures of intervention.

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