

UK Biobank

**UK Biobank normative data for the
Digit Triplet Test**

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<http://www.ukbiobank.ac.uk/>



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1 Background

The Digit Triplet Test (DTT) correlates strongly with pure tone audiometric measures, so may be regarded as a measure of hearing impairment. Continuous DTT data may be used in correlation-based analyses.

One may also wish to describe the proportion of participants who have levels of hearing impairment significantly below the normal range (for example, the proportion of hearing impaired males versus females, or diabetics versus non-diabetics with impaired hearing). In previous research with the DTT and in the telephone screening versions of the DTT, its performance has been categorised with reference to a group of young adults with normal hearing (Hall, 2006; Smits, Kapteyn, & Houtgast, 2004; Vlaming et al., 2011).

This document describes how the DTT performance categories were derived for the version of the DTT used by UK Biobank, and provides DTT performance categories which may be used to interpret DTT data.

2 Participants

The normative group consisted of 20 volunteers with normal hearing aged 18 to 29 years.

Selection criteria:

- Otologically normal as described by ISO 8253-3 (1998)
- Aged 18-30 years
- Audiometric thresholds across all frequencies (0.25 to 8 kHz) ≤ 20 dB HL in both ears
- No history, or signs or symptoms of ear disease
- No history of undue exposure to noise
- No loud noise exposure in the last 24 hours which may have resulted in a temporary threshold shift
- No exposure to potentially ototoxic drugs
- No family history of hearing impairment
- No troublesome tinnitus
- English as a first language

3 Procedure

Participants performed the UK Biobank version of the DTT with the same headphones as used by UK Biobank (Sennheiser HD-25). Testing was administered by Dr Piers Dawes, University of Manchester.

Prior to testing, the aims of the experiment and information on the testing procedure were given to the participant; they then had the opportunity to ask any questions before written consent was obtained. A health questionnaire was completed to ensure that the participant met the selection criteria. Otoscopy was performed to ensure there were no pinna deformations, excessive wax or blockages within the ear canal, or conditions of the tympanic membrane or external auditory meatus.

Pure tone audiometry and tympanometry were conducted in accordance with the British Society of Audiology recommended procedures (British Society of Audiology, 2004; 1992) to verify normal hearing. Participants were only included if pure tone audiometric thresholds were <25 dB HL between 250 Hz and 8,000 Hz bilaterally with middle ear compliance and pressure within normal limits.

4 Results

Mean speech reception threshold in the better ear was -8.00 dB SNR, SD = 1.24.

Performance categories based on those used by the UK telephone hearing screening version of the DTT (<http://www.actiononhearingloss.org.uk/>) are as follows:

‘Normal’: SRT < -5.5 dB

‘Insufficient’: -5.5 dB to -3.5 dB

‘Poor’: SRT > -3.5 dB¹.

The distributions of ‘Normal’, ‘Insufficient’ and ‘Poor’ performers in the UK Biobank population are described in Dawes, P., et al. (in press [as of Nov 2013]). "Hearing in middle age: a population snapshot of 40-69 year olds in the UK." Ear and hearing.

¹ The category names (‘insufficient’ and ‘poor’) are the same as those used in previous publications concerning the DTT (Hall, 2006; Smits et al., 2004; Vlaming et al., 2011). The cut-off for the ‘insufficient’ category is performance lower than -2 standard deviations with respect to the normative sample while the ‘poor’ category is defined by a further 2 dB step, which corresponds to an increase of hearing threshold level of around 10 dB (Smits et al., 2004; Vlaming et al., 2011).

5 References

- Hall, J. S. (2006). *The development of a new English sentence in noise test and an English number recognition test*. (MSc), University of Southampton, Southampton.
- Smits, C., Kapteyn, T. S., & Houtgast, T. (2004). Development and validation of an automatic speech-in-noise screening test by telephone. *International Journal of Audiology*, 43, 15-28.
- Vlaming, M. S. M. G., Kollmeier, B., Dreschler, W. A., Rainer, M., Wouters, J., Gover, B., . . . Houtgast, T. (2011). HearCom: Hearing in the Communication Society. *Acta Acoustica united with Acustica*, 97(2), 175-192.