



Minimum Training Guideline

Basic audiometry and tympanometry

Date: November 2016

Due for review: November 2021

General foreword

Accreditation of BSA Courses
Minimum Training Guidelines for
Basic Audiometry & Tympanometry
BSA
2016



This document is one of a family of BSA Training Guidelines, which includes Industrial Audiometry, Otoscopy & Impression Taking, Aural Care, Ear Examination and Basic Audiometry & Tympanometry – all of which allow the awarding of BSA Certificates.

Although care has been taken in preparing this information, the BSA does not and cannot guarantee the interpretation and application of it. The BSA cannot be held responsible for any errors or omissions, and the BSA accepts no liability whatsoever for any loss or damage howsoever arising. This document supersedes any previous version of this guideline and stands until superseded or withdrawn by the BSA.

All practitioners who undertake these procedures after having attended a BSA accredited course are advised to have an awareness of their own scope of practice and understand their own limitations. The BSA highly recommends supervision and support as required by the individual.

Comments on this document are welcomed and should be sent to:

British Society of Audiology
Blackburn House,
Redhouse Road
Seafield,
Bathgate
EH47 7AQ
Tel: +44 (0)118 9660622

bsa@thebsa.org.uk
www.thebsa.org

Published by the British Society of Audiology

© British Society of Audiology, 2016

All rights reserved. This document may be freely reproduced in full for educational and not-for-profit purposes. No other reproduction is allowed without the written permission of the British Society of Audiology. Please avoid paper wastage e.g. use 'Duplex Printing' where possible.





Authors and acknowledgements

Produced by:
The BSA's Professional Guidance Group

With thanks to:
All the feedback received in the membership consultation

1. Contents

2	Introduction.....	4
3	Scope of document.....	4
	3.1 Practitioners.....	4
	3.2 Patients.....	5
	3.3 Procedures.....	5
	3.3.1 Pure tone audiometry by air-conduction without masking.....	5
	3.3.2 Tympanometry.....	5
	3.4 Referral of patients to specialist services.....	6
4	Equipment.....	6
	4.1 Audiometers.....	6
	4.2 Tympanometers.....	6
	4.3 Calibration of Audiometers and Tympanometers.....	6
5	Test Environment.....	7
	5.1 Maximum ambient noise levels for pure-tone audiometry.....	7
	5.2 Measurement of ambient noise levels.....	7
	5.3 Achieving required ambient noise levels.....	7
	5.4 Acoustical environment for tympanometry.....	7
6	Staff Training.....	8
	6.1 Knowledge and understanding.....	8
	6.2 Skills.....	8
	6.3 Training Syllabus.....	9
7	References.....	10
	Appendix 1 – Standards.....	11
	Appendix 2 – Guidance on Referral.....	11
	Appendix 3 – Permissible Ambient Noise Levels for Audiometry.....	13





2. Introduction

This document replaces previous guidance produced by the BSA (1999). Its purpose is to offer guidance on the performance of basic hearing assessments by staff who are not qualified audiologists.

Qualified audiological professionals in purpose-designed audiology departments conduct most hearing assessments. However, there are many situations in which it may be desirable for assessments to be undertaken away from audiology departments and by personnel who are not qualified audiologists (for example in occupational health, general practice, schools and health clinics). To measure hearing accurately, it is necessary to follow appropriate test protocols because incorrect procedures may render the results invalid. This document is for health care personnel who are not qualified audiologists, but who wish to carry out pure-tone audiometry and tympanometry as part of their service. The Society wishes to encourage these personnel to adopt high quality procedures, which conform to national standards.

3. Scope of the document

This document does not provide information about how to carry out the procedures, which can be found in the appropriate BSA recommended procedures (see references). It is also important for personnel running an audiology service to be trained in the interpretation of results, however this is outside the scope of this document.

The aims of the document are:

- To outline audiology services that might be provided by those who are not audiological professionals, and to provide information and guidelines regarding the appropriate standards and protocols that should be followed
- To outline the minimum training that should be completed by those wishing to undertake this work, this also being a guide to potential training providers seeking BSA accreditation for their training program, allowing the award of BSA Certificates.

3.1 Practitioners

This document describes the training and assessments that might be undertaken by practitioners who are not qualified audiological professionals. For example, it covers assessments that might be undertaken by occupational health professionals, nurses, teachers





of the deaf, general practitioners, hearing researchers, hearing care assistants and audiological assistants.

Professionals with qualifications in audiology, including BSc, MSc and HCPC registration as a hearing aid dispenser (or similar equivalent qualifications) would not normally require additional training to undertake the assessments described in this document.

3.2 Patients

This document applies to the testing of adults and children. For audiometry on children it is recommended that tests should be confined to those aged 6 years and older (who are not developmentally delayed) and who are capable of performing pure-tone audiometry with earphones (hearing screening is not covered by this document, see 3.3 below). There is no recommended minimum age for tympanometry, although practitioners are advised that tympanometry (including otoscopy), can be challenging with young children, and the interpretation of results can also be difficult. It is recommended that anyone undertaking tympanometry on younger children has sufficient experience or supervision.

3.3 Procedures

Two procedures are relevant in the situations described above:

3.3.1 Pure tone audiometry by air-conduction without masking

This is the measurement of hearing threshold levels through earphones in each ear separately.

3.3.2 Tympanometry

This is not a test of hearing but is rather a test of middle ear function. It gives information on the mobility of the tympanic membrane and middle ear structures.

This document relates to manual rather than automated assessments. It does not relate to either industrial audiometry, (for which alternative recommendations are available), nor to hearing screening procedures. (*Screening* means a procedure, which simply has a pass or fail outcome for a specific sound presentation level, with no measurement of hearing threshold levels.)





3.4 Referral of patients to specialist services

The Society recommends the use of local criteria for referral to specialist services following audiological assessment, and the criteria may vary depending on the purposes of the assessment. Practitioners must be mindful of their duty to work within the limits of their scope of practice. However, for guidance purposes, notes on referable conditions are provided in Appendix 2.

4. Equipment

4.1 Audiometers

Specifications for pure-tone audiometers are stated in BS EN 60645-1. For the purposes defined above, an instrument capable of presenting air conduction (earphone) stimuli at frequencies of 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz at hearing levels from -10 dB HL to 80 dB HL will usually be adequate. Bone conduction and masking facilities are not required.

4.2 Tympanometers

A basic instrument offering tympanometry alone is suitable, facilities for middle-ear reflex testing are not required. The standard BS EN 60645-5 states specifications for tympanometers (also known as otoadmittance meters).

4.3 Calibration of Audiometers and Tympanometers

A full calibration programme is an essential part of an audiometry and/or tympanometry service, to ensure results are repeatable and reliable.

A calibration programme includes three stages:

Stage A includes daily and weekly checks by the user. Routine Stage A checks for audiometers and tympanometers are outlined in the BSA Recommended Procedures for Pure Tone Air and Bone Conduction Threshold Audiometry with and without Masking, and for Tympanometry.

Stage B is the periodic objective calibration, carried out by specialist providers.

Stage C is the baseline, full objective calibration required when an instrument is new and after repair. As with Stage B calibration, this is carried out by specialist providers.





5. Test environment

5.1 Maximum ambient noise levels for pure-tone audiometry

In order to reliably achieve the ambient noise levels required to test pure tone thresholds down to 0 dB HL at all frequencies (which by definition represents normal hearing in young adults), a sound-treated booth is advised. The acoustical environment must comply with the sound levels as specified in BS EN ISO 8253 – 1, see Appendix 3.

5.2 Measurement of ambient noise levels

Ambient noise measurements at each third-octave band, as specified in Appendix 3, require specialist equipment and expertise.

In many non-hospital environments a sound-treated booth will not be available and a full ambient noise assessment will not be possible. However, it is essential that the ambient noise is minimised and checked with an accurate and calibrated sound level meter. The level should be recorded.

In general, the ambient noise should not exceed 35 dB (A) if testing is to proceed.

5.3 Achieving required ambient noise levels

Background noise can be reduced in some of the following ways:

- Testing in a room away from noise e.g. traffic, waiting area, playground, staff rooms;
- Time-tabling audiometry sessions for quiet times of the week;
- Applying sound damping by having soft furnishings, carpets, curtains etc.
- Fitting double glazing

Testers must be alert to the effects of transient noise on results, and halt the test during any transient loud sound, such as a low-flying aircraft, voices or phones ringing.

5.4 Acoustical environment for tympanometry

Tympanometry may be carried out in any room. Sound treatment is not required, although the ambient noise should preferably not exceed 50 dB (A).





6. Staff Training

Training is essential for reliable results and all staff undertaking pure tone audiometry and/or tympanometry should have knowledge and skills in the following areas:

6.1 Knowledge and understanding

- a. Anatomy and physiology of the outer, middle and inner ear;
- b. Basic physics (acoustics) including decibel scales, in particular dBHL and dB(A), and the Hz frequency scale;
- c. Principles of pure tone audiometry and the BSA recommended procedure;
- d. Definitions of normal hearing, conductive hearing loss, sensorineural hearing loss, and common pathologies causing them;
- e. Principles of tympanometry and the BSA recommended procedure;
- f. Basic otoscopy including the effects of wax on audiometric results;
- g. Contraindications for audiometry and tympanometry;
- h. Function of all equipment and the need for regular calibration at stages A, B and C;
- i. Factors which could affect the reliability or validity of the test results, including non-organic hearing loss;
- j. Documentation of test results using the BSA recommended format;
- k. Relevant specialist services available locally;
- l. Communication needs of hearing impaired people;
- m. Medical ethics including consent and confidentiality;
- n. Relevant health and safety issues e.g. discharging ears

6.2 Skills

The tester must be able to:

- a. Perform otoscopy, in accordance with BSA recommended procedure, as a pre-requisite for testing;
- b. Reliably perform air-conduction audiometry and/or tympanometry, and accurately record results according to the BSA recommended procedures;
- c. Carry out daily checks of equipment for faults, and organise objective calibration procedures at regular intervals;





- d. Operate a sound level meter to monitor ambient noise and/or arrange noise measurement;
- e. Give clear instructions to patients (including those with hearing impairment) as to the response required in each test;
- f. Undertake the management of relevant records;
- g. Communicate information to other professionals.

6.3 Training Syllabus

The knowledge and the associated skills should be acquired through courses accredited by the BSA. There are no formal entry requirements. Courses should be practical and include extensive 'hands-on' experience under the supervision of qualified and experienced tutors.

Delegates may train in audiometry, tympanometry or both. A course for a single topic should last two days (14 hours tuition); a course for both topics should last three days (21 hours tuition). On satisfactory completion of an accredited course, delegates will be awarded a BSA Certificate in 'Basic Audiometry', 'Basic Tympanometry' or 'Basic Audiometry & Tympanometry'.

The following syllabus and duration of its components represent the minimum requirements, and some of the written assessments and theory tuition might be undertaken away from the classroom. Tuition required for each topic is suggested, but course providers are invited to submit their own course details for approval by the BSA Learning Events Group. In the following list, (A) indicates a requirement for audiometry, (T) indicates a requirement for tympanometry, (A+T) indicates a requirement for both audiometry and tympanometry.

- Basic Anatomy (A+T) (1 hour)
- Communication with hearing impaired subjects (A+T) (½ hour)
- Introduction to Hearing Loss (A+T) (1 hour)
- Confidentiality, informed consent and record handling. (A+T) (½ hour)
- Use of otoscope, theory & practice (A+T) (1 hour)
- Reliability of results, test environment, calibration requirements (A+T) (½ hour)
- Referral criteria and contra-indications to testing (A+T) (1 hour)
- Use of a sound level meter (A) (½ hour)
- The audiogram and interpretation (A) (1½ hours)
- Correct method for pure tone a-c threshold determination (A) (1 hour)





- Practise audiometry (A) (2 hours)
- Introduction to the concepts of b-c and masking tests (A) (½ hour)
- Introduction to non-organic hearing loss (A) (½ hour)
- Principles of tympanometry (T) (1½ hours)
- The tympanogram and interpretation of results (T) (1 hour)
- Correct method for tympanometry (T) (½ hour)
- Practise tympanometry (T) (2 hours)
- Introduction to the concepts of middle ear reflexes (T) (1 hour)
- Practical assessment (A+T) (1 hour)
- Written assessment (A+T) (1½ hours)

Refresher training is recommended at intervals not exceeding 3 years, and this might be provided through formal courses or workplace assessment.

7. References

Where references are undated, refer to the latest versions on the appropriate websites.

BAA (2016) Guidelines for the Direct Referral of Adults with Hearing Difficult to Audiology Services. British Academy of Audiology. www.baaudiology.org

BAA (2016) Guidelines for the Onward Referral of Adults Directly Referred to Audiology Services. British Academy of Audiology. www.baaudiology.org

BSA Procedure for processing documents. British Society of Audiology. www.thebsa.org.uk

BSA Recommended Procedure: Pure tone air and bone conduction threshold audiometry with and without masking. British Society of Audiology. www.thebsa.org.uk

BSA Recommended Procedure: Ear Examination. British Society of Audiology. www.thebsa.org.uk

BSA Recommended Procedure: Tympanometry. British Society of Audiology. www.thebsa.org.uk

BSA (1999) Hearing Assessment in General Practice, Schools and Health Clinics. Guidelines for Professionals who are not Qualified Audiologists. British Society of Audiology.

BSHAA Guidance on Professional Practice for Hearing Aid Audiologists. British Society of Hearing Aid Audiologists. www.bshaa.com





Appendix 1: Standards

BS EN 60645-1. Audiometric equipment part 1. Pure-tone audiometers.

BS EN 60645-5. Audiometric equipment part 5: Instruments for the measurement of aural acoustic impedance/admittance.

BS EN ISO 8253-1. Acoustics. Audiometric Test Methods. Part 1: Basic Pure Tone Air and Bone Conduction Threshold Audiometry.

Appendix 2: Referrals

The Society recommends the use of local criteria for referral to specialist services following audiological assessment, and the criteria may vary depending on the purposes of the assessment. However, for guidance purposes, a list of referable conditions are provided that should be used alongside and/or in addition to local policies for onward referral. The referable conditions are broadly based on current practice (see also BSHAA Guidance on Professional Practice for Hearing Aid Audiologists, and BAA 2016).

The requirement of whether or not to refer will depend on the specialism of the person doing the test, and whether or not the patient is already being (or has been) reviewed by his/her GP, audiologist or specialist practitioner (e.g. ENT) in relation to the condition. Ultimately, it is at the discretion of the practitioner to make a decision whether to make a referral, and patient consent (e.g. verbal) shall be obtained prior to making the referral. Clear patient records should be made regarding any referrals made or recommendations for referral.

For children aged below 16 years of age, it is recommended that any possible hearing loss or abnormality, shown by audiometry or tympanometry, is referred to specialist services.

The following conditions shall be considered for referral to medical services (e.g. GP/ENT) if they have been present within the last 3 months (unless stated otherwise):

Findings on History:

- Earache or pain affecting either ear that has lasted for more than 7 days;
- Infection or discharge other than wax extruding from either ear;
- Rapid hearing loss or rapid deterioration of hearing (not associated with colds);





- Sudden hearing loss or deterioration of hearing within 1 week– emergency referral required;
- A sensation of ringing or buzzing in the ears (known as tinnitus), that is unilateral or asymmetrical, pulsatile or distressing and has lasted for more than 7 days;
- A sensation of movement e.g. spinning, floating, swaying or dizzy spells (known as vertigo), or balance problems not to be confused with the common unsteadiness often associated with age;
- Hearing that is subject to fluctuation beyond that associated with colds.

Findings on examination:

- Complete or partial obstruction of the external auditory canal that would not allow proper examination of the eardrum and/or accurate hearing test or tympanometry;
- Abnormal appearance of the eardrum and/or the outer ear.

Findings following assessment:

- Hearing loss worse than would be expected for age;
- Hearing loss in patients under the age of 40;
- Asymmetrical hearing loss;
- Suspected conductive element to hearing loss, ascertained by tympanometry.

Other findings:

- Ability to discriminate speech worse than expected from audiogram;
- Any other unusual presenting features at the discretion of the practitioner.

The following conditions shall be considered for referral to specialist audiology services if no medical opinion required (see above):

- Hearing loss that causes participation restriction (e.g. difficulties participating in social events) or activity limitation (e.g. talking on the phone, hearing the doorbell etc.)





Appendix 3 Maximum Permissible Ambient Noise Levels

The following table shows the maximum permissible ambient noise levels for measuring air conduction thresholds to a minimum hearing level of 0 dB HL. From BS EN ISO 8253-1.

Mid frequency of 1/3 octave band in Hz	dB Ref: 20 uPa	Mid frequency of 1/3 octave band in Hz	dB Ref: 20 uPa	Mid frequency of 1/3 octave band in Hz	dB Ref: 20uPa
31.5	66	250	19	2000	30
40	62	315	18	2500	32
50	57	400	18	3150	34
63	52	500	18	4000	36
80	48	630	18	5000	35
100	43	800	20	6300	34
125	39	1000	23	8000	33
160	30	1250	25		
200	20	1600	27		

To measure minimum hearing threshold down to levels above 0 dB HL, higher ambient noise levels might be acceptable (for further details see BSA Recommended Procedure: Pure tone air and bone conduction threshold audiometry with and without masking for pure tone audiometry).

Insert earphones (e.g. Etymotic Research ER3 and ER5) and noise-excluding earphones (e.g. audiocups) will not require such stringent ambient noise levels as they reduce the amount of ambient noise reaching the ears, if they are fitted correctly. However, full details of the frequency-specific attenuation characteristics of these devices need to be considered, together with full details of the ambient noise, before tests can be carried out in environments that exceed the noise levels listed above.

