

Otoacoustic emissions versus audiometry in monitoring hearing loss after long-term noise exposure – a systematic review ¹

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1 Appendices

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Appendix A: search strategy for Medline

Search Strategy: 2016-03-14

#	Searches	Results
1	Otoacoustic Emissions, Spontaneous/	3342
2	(otoacoustic* or oto-acoustic* or otoacustic* or otoemission* or oto-emission*).tw,kf.	4643
3	((OAE or OAEs or EOAE* or EOE or EOE* or SOAE* or SSOAEs or SSOAEs or DPOAE* or laDPOAE* or TEOAE* or TAOE* or TOAE* or CEOAE* or VSOAE*) not ((older adult* adj2 epilep*) or EOSinoph* Esophag* or "Ontology of Adverse Event*" or Electro-Orientat* Effect* or East of England*)).tw,kw.	3451
4	(distortion product* or transient-evoked or click-evoked).tw,kf.	3642
5	or/1-4 [OAE]	6182
6	(animals/ not humans/) or (rat or rats or rabbit* or mice or mous* or murine or sheep or ovine or ewe or ewes or dog or dogs or canine or cat or cats or feline or baboon* or monkey* or primates or chinchilla*).ti.	4412599
7	5 not 6 [OAE human]	4738
8	Hearing Loss, Noise-Induced/	6407
9	noise, occupational/	2857
10	music/ or mp3-player/ or radio/	13576

11	leisure activities/ or recreation/ or dancing/ or basketball/ or boxing/ or football/ or soccer/	25701
12	military personnel/ or military medicine/ or blast injuries/ or firearms/	59488
13	engineering/ or industry/ or manufacturing industry/ or construction industry/ or mining/ or fisheries/	46027
14	noise, transportation/ or exp transportation/ or automobile driving/	72405
15	dental clinics/ or dental high-speed equipment/ or dentists/	19661
16	snoring/	3480
17	(environmental exposure/ or occupational exposure/ or occupational medicine/ or occupational diseases/ or occupational health/) and (noise/ or noise*.ti.)	3820
18	noise & health.jn.	507
19	(hearing adj2 (loss* or impair* or damage* or harm* or deterior* or change* or disability* or ability or disorder* or dysfunction*) adj6 (noise* or music or musician*)).tw,kf.	3386
20	(NIHL or ONIHL or HSPIHL).tw,kf.	520
21	(noise* adj3 (group* or population* or contracting or pollut* or hindrance* or nuisance* or induce* or etiol* or aetiol* or expos* or overexpos* or dosimetr* or dose* or damage* or trauma* or harm* or injur* or hazard* or susceptibl* or profession* or occupation* or industr* or work* or high intensit* or acute or chronic or long-term or longterm or short-term or shortterm or sudden* or loud or impulsive or impact or firing or recreat* or leisu* or traffic)).tw,kf.	13427
22	((impulse or continuous*) adj1 noise*).tw,kf.	819
23	((hearing conservation adj (program* or test*)) or HCP or HCPs).tw,kf.	3106
24	(music* adj3 (loud* or devic* or digital or amplified or band* or instrument* or expos* or overexp* or induced or listen* or recreat* or leisu* or professional* or amateur* or work* or people)).tw,kf.	3364
25	((portable or personal) adj3 (music or player* or audio or listening or stereo)).tw,kf.	345
26	((stereo or music or audio) adj3 player*).tw,kf.	121
27	(PLD or PLDs or PM-system* or PMs or MP3 or MP-3 or ipod* or i-pod*).tw,kf.	8963
28	((max* or loud* or high or level or listen* or music* or sound* or noise* or devic* or control) adj3 volum*).tw,kf.	27985
29	(musician* or (band*1 adj2 (member* or marching or brass or amateur* or professional* or perform* or rehears*)) or singer* or choir* or opera or operas or concert* or postconcert* or orchestr* or symphon* or popconcert* or pop or rock or jazz* or heavy metal or bar or	120083

	bars or trumpet* or percussion* or violin* or danc* or disco or discos or disco-s or discothe* or house music* or dj or djs or d-j or disc jockey* or aerobics).tw,kf.	
30	(spectator* or ((recreation* or soccer or PSL or sport* or football* or basketball) adj3 (match* or event* or game*)) or vuvuzela*).tw,kf.	3210
31	(snoring and snorer*).tw,kf.	658
32	((high or loud) adj sound*).tw,kf.	620
33	(acoustic adj (shock* or nois*).tw,kf.	423
34	(occupat* adj3 (hearing loss* or hearing impair*).tw,kf.	404
35	(hunting or hunters or police* or militar* or battalion* or soldier* or air force or aircrew or infantr* or ((marine or army or mil) adj3 (personn* or officer* or staff or recruit* or corps or men or people or worker*)) or marines or navy or airbas* or bomb* or blast or blasts or shoot* or fire or firearm* or firing noise* or firework* or ((small or combat or service*) adj2 arm*) or artillery or weapon* or gunfir* or gunshot* or shotgun* or gun or guns or rifle* or pistol* or kalashnikov* or missile*).tw,kf.	191795
36	(aviation or airport* or flight* or pilots or aircrew* or air crew* or jet plane* or jet fighter* or aircraft* or air craft* or airplan* or air plan* or aeroplan* or warplane* or helicopter* or ship or ships or fishing or fisherm#n* or fishery or fisheries or railroad* or railway* or locomotive* or roads or car driver* or automobile*).tw,kf.	90787
37	((nois* or ship* or jet or boat* or vessel* or person* or work* or employ* or profession* or driver* or room*) adj6 engin*).tw,kf.	5315
38	(industri* adj3 (work* or setting or hearing loss* or hearing impair* or expos* or recording*).tw,kf.	5613
39	((construction or maintenance or drilling) adj3 (work* or apprentric* or industr* or trade*).tw,kf.	4347
40	((factory or factories or plant or plants or industr*) adj3 (stamping or metal*)) or metalwork* or metal-work* or metalproduct* or metal-product*).tw,kf.	4860
41	(dentist* or dental clinic*).tw,kf.	65307
42	((teacher* or class room* or classroom*) and nois*).mp.	375
43	or/8-42 [NIHL]	687116
44	43 and 7	460

Appendix B: modified Downs and Black checklist

Adopted from Downs and Black (**Error! Reference source not found.**).

No.	BD nr	Subject		Score
Reporting				
1	1	Is the hypothesis/aim/objective of the study clearly described?	1= yes 0= no	
2	2	Are the main outcomes to be measured clearly described in the introduction or methods section? If the main outcomes are first mentioned in the results section, the question should be answered no. <i>ALL primary outcomes should be described for YES</i>	1= yes 0= no	
3	3	Are the characteristics of the patients and population included in the study clearly described? Inclusion and/or exclusion criteria should be given. <i>At least age, gender and type of group should be described for YES.</i>	1= yes 0= no	
4	4 MOD	Are the interventions of interest clearly described? <i>Is noise described in terms of (estimated) level and duration of exposure?</i>	1= yes 0= no	
5	5	Are the distributions of principal confounders in each group of subjects to be compared clearly described? A list of principal confounders is provided. <i>For YES: age, previous noise exposure, use of hearing protection and middle ear status should be described</i>	2= yes 1= partially 0= no	
6	6	Are the main findings of the study clearly described? Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions.	1= yes 0= no	
7	7	Does the study provide estimates of the (random) variability in the data for the main outcomes? In non-normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. <i>For YES an attempt should be made to describe variation in the data.</i>	1= yes 0= no	
8	9 MOD	Are test statistics (t, F, U, etc.), correlation or regression coefficient (Pearson's r, Spearman's rho, etc.), or measure of effect size (eta-squared, partial-eta-squared, omega-squared, etc.) provided? <i>Was: Have actual probability values been reported (e.g. rather 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.01</i>	1= yes 0= no	
external validity				
9	11	Were the subjects asked to participate in the study representative of the entire population from which they were recruited? The study must identify the source population for patients and describe how the patients were selected.	1= yes 0= no 0= unable to determine	

internal validity – bias				
10	16	If any of the results of the study were based on “data dredging”, was this made clear? Any analyses that had not been planned at the outset of the study should be clearly indicated. If no retrospective unplanned subgroup analyses were reported, then answer YES.	1= yes 0= no	
11	17	In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients? Where follow-up was the same or similar for all study patients the answer should be YES. Studies where differences in follow-up are ignored should be answered no.	1= yes 0= no 0= unable to determine	
12	18 MOD	Were the statistical tests used to assess the main outcomes appropriate? The statistical techniques used must be appropriate to the data. For example non-parametric methods should be used for small sample sizes. Where little statistical analysis has been undertaken but there is no evidence of bias, answer should be yes. Is distribution of data (normal or not) is not described it should be assumed that the estimates used were appropriate and the question should be answered with YES. <i>Corrections for repeated measures (time/ frequency/ear) or reporting how these multiple comparisons are dealt with is YES</i>	2= yes 1= partially 0= no	
13	20	Were the main outcome measures used accurate (valid and reliable)? For studies where the outcome measures are clearly described, the question should be answered yes. For studies which refer to other work or that demonstrates the outcome measures are accurate, question should be YES. <i>If SNR/waverepro is used without any reference to noise floors = NO</i>	1= yes 0= no	
internal validity - selection bias				
14	26	Were losses of patients to follow-up taken into account? If the numbers of patients lost to follow-up are not reported = no <i>If data inclusion criteria are used (e.g. based on SNR) and amount of excluded data points is not reported = no</i>	1= yes 0= no	
Total score			Min:0 Max:16	

Appendix C: Results from the Downs and Black checklist per study

The score is determined as 1=Yes, 0=No or Unable To Determine, except for item 5 and 12 where 2=Yes.

1=partially, 0=No.

		A Duvdevany & Furst (Error!	D Helleman & Dreschler (Error!	E Helleman et al. (Error! Reference	F Job et al (Error! Reference source	B Konopka et al. (Error! Reference	G Lapsley Miller et al. (Error! Reference	H Lapsley Miller et al. (Error! Reference	C Marshall et al. (Error! Reference	I Moukos et al. (Error! Reference	J Murray et al.(Error!	K Seixas et al. (Error! Reference source	L Seixas et al. (Error! Reference source	M Shupak et al. (Error! Reference
	Reporting													
1	Is hypothesis clear?	1	1	1	1	1	1	1	0	1	1	1	1	1
2	Main outcomes in the introduction or methods?	1	1	1	1	1	0	0	0	0	1	1	1	1
3	Are inclusion and/or exclusion criteria population clear?	1	1	1	0	0	1	1	1	1	1	1	1	1
4	Is interventions (noise) clearly described?	1	0	0	1	1	1	1	1	1	1	1	1	1
5	Principal confounders mentioned?	1	1	1	1	1	2	2	2	1	1	2	2	2
6	Can the main findings be checked by reader?	1	1	1	1	1	1	1	0	1	1	1	1	1
7	Is variation in outcome data described?	1	1	1	0	0	1	1	1	1	1	1	1	1
8	Are test statistics, corr or regr coeff or measure of effect size provided?	1	1	1	0	0	1	1	1	1	0	0	0	1
	External validity													
9	is identification of source population and selection clear?	0	0	0	0	0	0	0	1	0	0	0	1	0
	Internal validity - bias													
10	No "data dredging"? Not planned analyses clearly indicated?	0	1	1	1	1	1	0	1	1	1	1	1	1
11	Adjustements for different lengths of follow-up?	1	1	1	1	1	1	1	1	1	1	1	1	1
12	Are statistical tests used appropriate? Description of multiple comparisons?	2	2	2	1	2	1	2	1	2	1	1	1	1
13	Were the main outcome measures used accurate (SNR)?	1	1	1	1	0	1	1	1	0	0	1	1	0
	Internal validity - selection bias													
14	Loss to follow-up reported? Excluded data points (SNR-inclusion) reported?	0	1	1	1	0	1	0	1	0	1	0	1	0
	Total score	12	13	13	10	9	13	12	12	11	10	12	14	12

1 **Figure 1: Flow diagram of the conducted search (based on the PRISMA 2009 Flow Diagram)**

2

3 **Figure 2: Shift in audiometry (dB HL) versus shift in emission level (dB SPL) for TEAOE in the 4 kHz**
4 **band (A) and for the high frequency averaged DPOAE (B). Please note the ranges of the axes. The**
5 **color of the circles corresponds to the duration, with darker colors representing longer durations.**
6 **The dashed line represents the two studies by Seixas and colleagues going from 3 years follow-up**
7 **(L31) to 10 years (L8).**