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Analysis and comparison of clinical practice guidelines regarding treatment recommendations for chronic tinnitus in adults: a systematic review

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ABSTRACT

Objectives To determine if, and to what extent, published clinical practice guidelines for the treatment of chronic tinnitus vary in their recommendations.

Design Systematic review of guidelines.

Data sources PubMed, EMBASE and GIN electronic databases were searched in March 2022 and the search was updated in June 2023.

Eligibility criteria We included clinical practice guidelines that gave recommendations on the treatment of tinnitus. No language restrictions were applied.

Data extraction and synthesis Two independent reviewers extracted the data and used the AGREE checklist to report on reporting.

Results A total of 10 guidelines were identified and included, published between 2011 and 2021. Recommendations for 13 types of tinnitus treatments were compared. Large differences in guideline development and methodology were found. Seven of the 10 guidelines included a systematic search of the literature to identify the available evidence. Six of the 10 guidelines used a framework for the development of the guideline. Reporting was poor in multiple guidelines. Counselling and cognitive behavioural therapy were the only treatments that were recommended for treating tinnitus associated distress by all guidelines that reported on these topics. Tinnitus retraining therapy, sound therapy, hearing aids and cochlear implantation were not unanimously recommended either due to the lack of evidence, a high risk of bias or judgement of no beneficial effect of the specific treatment.

Conclusions There were notable differences with respect to whether guidelines considered the available evidence sufficient enough to make a recommendation. Notably, we identified substantial differences in the rigour of guideline design and development. Reporting was poor in many guidelines. Future guidelines could benefit from the use of reporting tools to improve reporting and transparency and the inclusion of guideline experts and patients to improve the quality of clinical practice guidelines on tinnitus.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ In-depth evaluation and comparison of the recommendations for treatment of tinnitus by different guidelines.
⇒ Designs of different tinnitus guidelines were compared in a systematic way.
⇒ There was no published research protocol for this study.

INTRODUCTION

Chronic tinnitus is a heterogeneous condition with a high variety of symptoms and wide diversity in tinnitus related impact on daily life. In clinical practice, tinnitus patients do present with different needs to a wide range of different healthcare providers. Depending on the country, institute or healthcare setting at which patients present with their tinnitus, treatment pathways vary[1 2] A high-quality and up-to-date clinical practice guideline could aid these physicians to provide evidence based advise for the diagnosis and treatment of tinnitus.

Clinical practice guidelines are defined as: 'Statements that include recommendations, intended to optimise patient care, that are informed by systematic review (SR) of evidence and an assessment of the benefits and harms of alternative options'.[3] Nowadays, clinical practice guidelines are considered to be an evident consequence of evidence-based medicine and facilitate physicians and healthcare workers to incorporate the best available evidence in daily practice.[4 5]

The number of clinical guidelines has increased dramatically over the past decade. As a consequence, several guidelines can exist on the same topic, often within the same geographic region. Those guidelines may vary in their recommendations and in the provided strength of recommendation, especially when the available evidence is weak.[6 7] Factors that may contribute to disparities between clinical practice guidelines are the lack of high-quality evidence, differences

in the interpretation of the evidence, different methods to establish the guideline, socioeconomic differences, cultural influences regarding expectations of risks and benefits and differences in healthcare systems.[8] Whether the available evidence is considered to be of low or high quality, all recommendations that are given in clinical practice guidelines require both evaluation of the evidence and consensus from the development team regarding the interpretation of the evidence and the possible harm versus benefit of the recommended intervention.[9] Comparing recommendations between guidelines on the same topic, its development and the level of evidence stated for each recommendation could help physicians to unravel the reason for discrepancies and guide their decision or judgement on how to handle the content of a guideline. Also, it could initiate a debate about how to improve the development and application of guidelines in clinical care such as tinnitus treatments, which is fuelled by the recent opinion paper by Langguth *et al* on the strength and pitfalls of tinnitus guidelines.[1]

Therefore, we aim to determine the differences in recommendations between clinical practice guidelines that report on the treatment of chronic tinnitus. We assess the differences in design and execution of guideline development, content of the recommendations and the provided level of evidence to identify similarities and discrepancies.

METHODS

Search strategy and selection of tinnitus guidelines

We conducted a systematic literature search on the 2 March 2022, which was updated the 20 June 2023 in the PubMed, EMBASE and GIN digital literature databases to identify clinical practice guidelines regarding the treatment of chronic tinnitus in adults (see online supplemental file 1 for the search strategy). No restrictions regarding publication date or language were applied. Articles were eligible for inclusion if in the publication the authors stated to develop or regarded their work as being a clinical practice guideline. Guidelines for children, evidence reports without recommendations or comments on existing guidelines were excluded. The search results were screened on title and abstract after removal of duplicates using predefined inclusion and exclusion criteria that are mentioned before by two researchers independently (SM and IS). Rayyan software was used.[10] The selected articles were read in full by two researchers (SM, IS or AS). Reference lists of the included articles were reviewed to select relevant articles which were not identified in the search. Disagreement between researchers was resolved by discussion till consensus was reached. This study is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[11]

Data extraction

Data regarding country of origin, year of publication, included treatment options, professionals and organisations which were involved within the guideline development, methods that were used to improve reporting of the guideline, methods used for classification of the level of evidence, methods used to grade the level of confidence in the evidence, methods used to grade the level of recommendation and the given recommendations were extracted from the guidelines. The search date of the literature study, the used digital databases, articles on which the evidence was based, study design of these articles, the preferred outcome measures to describe the treatment effect, the argumentation behind the recommendations, the intended target users and goals or aims of the guideline writers were also extracted. The data were extracted by two researchers independently (SM, IS or AS).

Assessment of reporting of the guidelines

The AGREE checklist instrument was used to evaluate the reporting in the included guidelines.[12] Two authors (SM, IS or AS) independently filled out the checklist for each guideline. The AGREE checklist consists of 23 items which are divided into 6 domains: scope and purpose, stakeholder involvement, rigour of development, clarity of presentation, applicability and editorial independence. All items have multiple reporting criteria to evaluate and give an indication about the rigour of reporting in the guideline. We chose the AGREE checklist because it does not require to determine a score for each item, which makes outcomes less dependent on the personal opinion of the assessors.

Comparison of evidence and recommendations

We compared the recommendations for tinnitus treatments that were made in the guidelines based on the strength of the recommendation, level of evidence and the direction of the recommendation. Treatment options were included for comparison if two or more guidelines reported on the specific treatment option. The outcome measures that the guidelines intended to report and the actual reported outcomes for the recommendations on tinnitus treatments were also compared.

Analysis

The results of the data extraction were summarised with descriptive statistics. No quantitative analyses were performed because this was out of the scope of this review.

Patients and public involvement

None.

RESULTS

Search and selection

After removal of duplicates 468 articles were screened for eligibility on title and abstract. A total of 20 articles were read full text (figure 1). Four guidelines were identified through cross-referencing. Nine guidelines and one

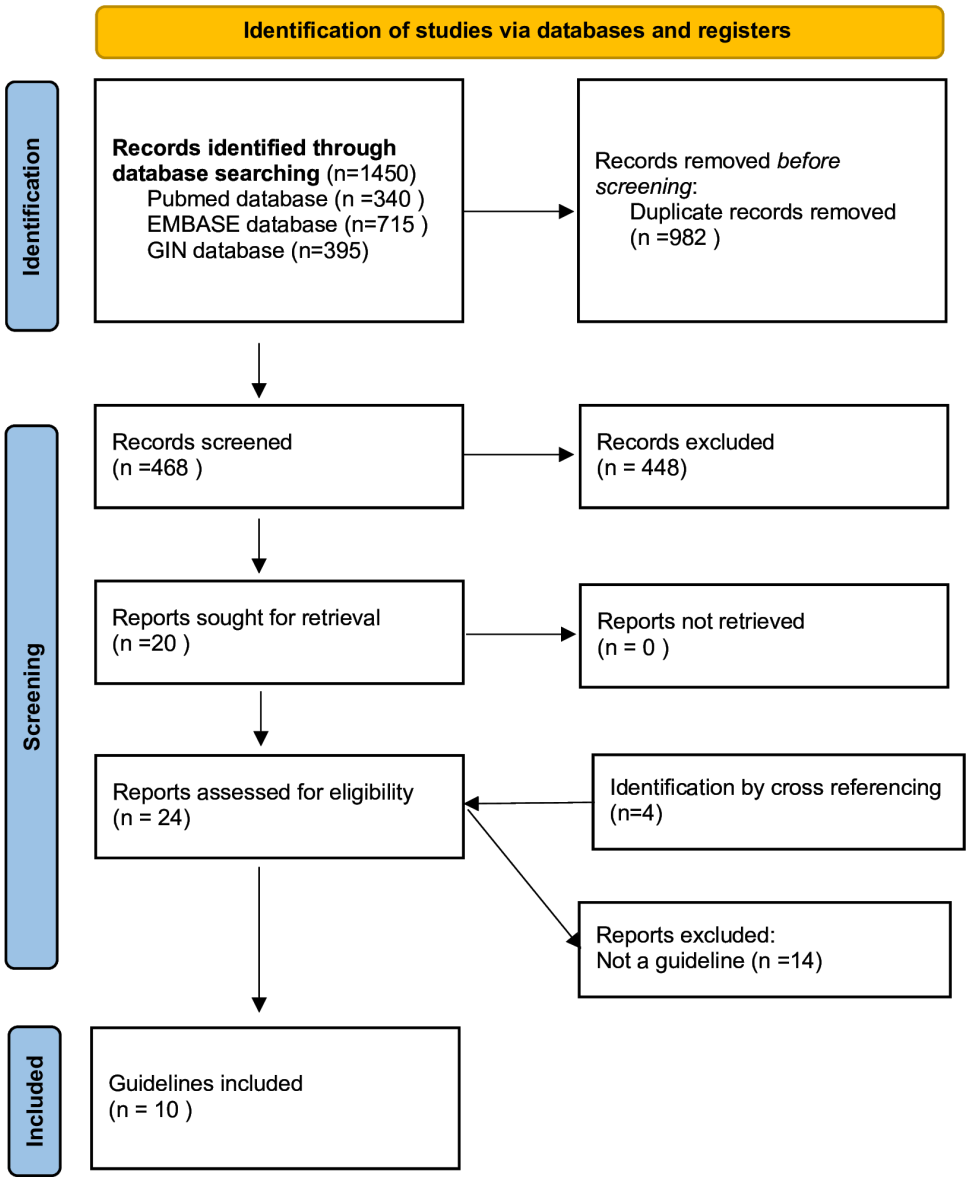

Figure 1 Flow chart. Adopted from Page *et al*.[11]

updated guideline were included in the analyses. The guidelines were published from 2011 to 2021. The guidelines were published in Denmark, Sweden, Japan, the Netherlands, Germany, the United Kingdom, Europe, Switzerland and the USA and were written in English, German, Danish, Swedish and Dutch.[13–22] The German guideline of 2015 was revised in 2021 and both were included.[14 15]

Goals of the guidelines

All guidelines reported their main goal.[13–21] In 3 out of 10 guidelines, they aimed to create more uniformity in the treatment of tinnitus patients.[13 17 19] In 4 out of 10 guidelines, they aimed to illustrate the available therapy options.[14 15 20 22] In 2 out of 10 guidelines, they aimed to provide evidence-based recommendations;[16 18] and in 1 guideline, they aimed to improve care for tinnitus patients.[21]

Target users of the guidelines

The targeted users for the guidelines were clinicians managing patients with tinnitus,[14–16 19] otolaryngologists,[13 17 21] audiologists[18 21] and the staff of a hearing and balance clinic.[21] The guidelines were also addressed to: psychiatrists,[13–15 19] general practitioners,[13–15 21] psychologists,[13–15 19] oral and maxillofacial surgeons,[15] neurologists,[15] dentists,[15] nurses,[19] social care workers,[20] patients or patient organisations.[20 21]

Reporting of the guidelines

In the scope and purpose domain, all guidelines were found to report their objectives except the Swiss guideline.[22] Research questions and target populations were not always reported clearly. Stakeholder involvement domain: group membership was not clearly reported in the Japanese guideline[17] where in other guidelines this was more clearly stated. Preferences and views of the

target population were not reported in 4 out of 10 guidelines.[16 18 19 21] Target users were reported in all guidelines. Rigour of development domain: In the Swedish, Swiss and Danish guidelines, there was no description of any systematic search of the evidence, external review or updating procedure.[18 21 22] Recommendation development was also not clearly reported in the Japanese and EU guideline.[17 19] Clarity of presentation domain: key recommendations were not mentioned in 3 out of 10 guidelines.[18 21 22] Applicability domain: monitoring and auditing criteria and were not reported in any guideline. Resource implications were only reported in the UK guideline.[20] Editorial independence domain: the funding body was not reported in 3 out of 10 guidelines.[18 21 22] In 5 out of 10 guidelines, funding was not clearly reported.[13 14 16 17 19] Competing interests were not mentioned in two 2 of 10 guidelines.[18 21] See online supplemental file 2 for the AGREE checklist.

Guideline characteristics

Otolaryngological societies were responsible for the development of 5 (including one updated guideline) out of 10 guidelines.[13–17] The other guidelines were developed by national institutes of health,[18 20] a consortium,[19] a medical association[22] or where hospital initiated.[21] Otolaryngologists, (N=8) audiologists (N=6), psychologists and psychiatrists (N=6) were most frequently involved in the development. Eight out of 10 guidelines[13–16 18–21] included multiple specialties in the development of their guideline, 1 out of 10 guidelines included only otorhinolaryngologists.[17] None of the guidelines reported the involvement of a methodologist/epidemiologist. Three guidelines reported the help of either information specialists or knowledge institutes.[13 16 20] The USA guideline[16] and the UK guideline[20] reported that an information specialist assisted with the literature search. The Dutch guideline[13] reported that they had support from the Dutch Knowledge institute for medical specialists. See table 1 for summary characteristics of the included guidelines.

Guideline design: electronic literature databases used for evidence synthesis

Seven out of 10 guidelines reported the use of one or more electronic literature database(s) which they used for their evidence synthesis.[13–17 19 20] In 6 out of the 10 guidelines, the Cochrane digital database was used.[13–17 20] Four out of 10 used Medline[13 16 19 20] or/and PubMed,[14 15 17 19] EMBASE was used in 3 out of 10.[13 16 20] CINAHL was used in 3 out of 10.[16 19 20] Other used databases were the medical journal web, Guideline.gov, GIN and the google search engine.

Guideline design: outcome measures to evaluate tinnitus treatments

Eight out of 10 included guidelines reported the outcome on which they aimed to base their recommendation.[13–15 17–21] Tinnitus severity was mentioned in 8 out of 10 guidelines.[13–15 17–21] Tinnitus-related quality of life in 3 out of 10,[13 17 19] possible harms of treatment in 1[13] and general quality of life in none. In the final evidence synthesis, tinnitus severity was an outcome in 7 out of 10,[13–17 19 20] tinnitus-related quality of life in 5 out of 10,[13 15–17 20] general quality of life in 5 out of 10[13 15 16 19 20] and possible harm of treatment in 4 out of 10.[13 15 16 19]

Guideline design: reporting tools and checklists for guideline development

Six out of 10 guidelines used a tool or framework for their guideline development.[13–17 20] Two guidelines[16 17] used the proposal for standardised reporting of clinical practice guidelines (COGS checklist).[23] The USA guideline also used a clinical practice guideline development manual beside COGS.[23 24] The German guideline and its update[14 15] both used the German Instrument for Methodological guideline appraisal (DELBI).[25] The UK guideline[20] used the National institute for health and care excellence guideline framework and the Dutch guideline[13] used the report of the Dutch advisory commission for guidelines.[26]

In 2 out of 10 guidelines, the Oxford Center of Evidence-Based Medicine criteria (CEBMC)[27] were used to grade the level of recommendation.[15 19] In the 2021 revision of the German guideline,[14] both the CEBMC and the Grading of Recommendations, Assessment, Development and Evolutions framework (GRADE)[28] were used. In 2 out of 10 guidelines, GRADE was used to classify the level of evidence but in both guidelines no grading of the level of recommendation was provided.[13 20] In the American guideline, the recommendation classification of the American Academy of Pediatrics[29] was used to classify the level of evidence and CEBMC to grade the level of recommendation.[16] In the Japanese guideline,[17] the Minds manual V.2.0[30] was used to classify the level of evidence and the level of recommendation. Two guidelines did not use or did not report a classification system to grade the level of evidence or level of recommendation.[18 21] Because none of the included guidelines used a similar combination of classification tools we were unable to compare the reported levels of evidence between guidelines. See table 2 for a summary of classification systems used in the guidelines.

Guideline design: included study designs for evidence synthesis

Seven out of 10 guidelines reported the aimed study design to include for evidence syntheses.[13–17 19 20] Of these, 3 out of 10 aimed to include SR, meta-analysis (MA), randomised controlled trials (RCT)s or observational studies on tinnitus treatment.[14 16 19] In the German guideline and its update, they stated to include SR or RCTs when these were available or otherwise other study designs.[14 15] In the Dutch guideline only treatment options for which an SR or MA was available were investigated.[13] In the European guideline, no specification was made on study designs to be included for evidence synthesis. Three guidelines did not report about the study designs to be

Table 1 Main characteristics of included guidelines

Country of origin	Title	Year of publication	Included treatments	Professions involved in guideline development	Organisation responsible for guideline development
Sweden[21]	Tinnitus Vårdprogram (tinnitus care programme)	2011	Hearing aids, sound therapy, TRT	Audiologists, otorhinolaryngologists	Hearing and Balance Clinic Karolinska University Hospital
USA[16]	Clinical Practice Guideline: Tinnitus	2014	rTMS, CBT, Hearing aids, sound therapy, medication, dietary supplements, acupuncture, education and counselling.	Otorhinolaryngologist (paediatric and adult), neurotologist/otologist, neurologist, behavioural neuroscientist, geriatrician, audiologist, family physician, radiologist, physician, radiologist, psychiatrist, internist, psychoaucoustician, advanced nurse practitioner, resident physician and advocates, information specialist	American Academy of Otolaryngology-Head and Neck Surgery Foundation
Germany 2015[15]	S3-Leitlinie Chronischer Tinnitus (Guideline chronic tinnitus)	2015	rTMS, TDCS, CBT, hearing aids, noise generators, hearing therapy, music therapy, acoustic neuromodulation, cochlear implantation, TRT, medication, dietary supplements, acupuncture, counselling, hyperbaric oxygen therapy.	Otorhinolaryngologist, audiologists, neurologists, psychiatrist, psychologists, paediatricians, dentists and patient representative groups	German society of otolaryngology and Head and Neck surgery
The Netherlands[13]	Richtlijn Tinnitus (Guideline tinnitus)	2016	TDCS, rTMS, CBT, Hearing aids, sound therapy, chochlear implantation, TRT, CR neuromodulation, alternative therapies.	Otorhinolaryngologist, clinical physicists, psychologist, behavioural therapists and patient representative groups.	Dutch society of otorhinolaryngology and Head and Neck surgery
Denmark[18]	Tinnitus-hyperacusis Vejledning I udredning og intervention (Tinnitus-hyperacusis Guidance in assessment and intervention)	2017	TRT, CBT, sound therapy, sleep advices.	Audiologist, hearing consultant	Danish Speech-Hearing-Vision Institutions
Europe[19]	A multidisciplinary European guideline for tinnitus: diagnostics, assessment and treatment	2019	rTMS, TDCS, tASC, Vagus nerve stimulation, CBT, hearing aids, sound therapy (masking therapy, neuromonics approach, notched music stimulation, costomised music stimulation), acoustic CR, cochlear implantation, TRT, medication, dietary supplements, acupuncture, invasive neurostimulators (beside cochlear implants)	Otorhinolaryngologist, neuroscientists, psychologist	TINNET consortium

Continued

Table 1 Continued

Country of origin	Title	Year of publication	Included treatments	Professions involved in guideline development	Organisation responsible for guideline development
Switzerland[22]	Guideline Tinnitus	2019	CBT, hearing aids, sound therapy, TRT, biofeedback and stress reduction program. Acupuncture, medication, vitamins, hyperbaric oxygen therapy, music therapy	Otorhinolaryngologist, internal medicine, medical doctor.	MEDIX (regional medical consortium)
Japan[17]	Clinical practice guidelines for diagnosis and treatment of chronic Tinnitus in Japan	2020	rTMS, CBT, Hearing aids, sound therapy, cochlear implantation, TRT, medication, acupuncture, laser therapy, counselling.	Otorhinolaryngologist	Oto-Rhino-Laryngological Society of Japan
UK[20]	Tinnitus: assessment and management	2020	TDCS, acoustic CR neurostimulation, rTMS, CBT, mindfulness, hearing aids, sound therapy, medication (betahistamine), counselling.	Dean of health sciences school, consultant audiovestibular physician, head of audiology, advanced audiologist/ hearing therapist, general practitioner, clinical scientist, consultant clinical psychologist, clinical psychologist, consultant ENT surgeon, lay member, teacher of the deaf and consultant clinical scientist in audiology, information specialist	National Institute for Health and Care Excellence
Germany 2021[14]	S3-Leitlinie Chronischer Tinnitus (guideline chronic tinnitus)	2021 (update)	Counseling, hearing aids, noise generators, cochlear implants, hearing therapy, CBT, TRT, sound therapy, music therapy, medication, rTMS, TDCS, transcutaneous neurostimulation, low level laser, dietary supplements acupuncture, self-help.	Otorhinolaryngologist, psychiatrist, audiologist, dentist, behaviour therapist, psychologist, paediatrician, neurologist, patient representative groups, European tinnitus network*	German Society of Otolaryngology and Head and Neck Surgery

*For the complete list of professionals involved see page 2: 017-064m_S3_Chronischer_Tinnitus_2021–2009_1.pdf (awmf.org).
CBT, cognitive–behavioural therapy; CR, coordinated reset; NR, not reported; rTMS, repetitive transcranial magnetic stimulation; TDCS, transcranial direct current stimulation; TRT, tinnitus retraining therapy.

included for their synthesis or the evidence to support their recommendations.[18 21 22] See table 3 for a summary of the guideline design characteristics.

Tinnitus treatments included in guidelines

On the following tinnitus treatments guidelines reported a recommendation: counselling/tinnitus support (n=5), cognitive–behavioural therapy (CBT) (n=8), tinnitus retraining therapy (TRT) (n=8), sound therapy (n=6), hearing aids (n=8), cochlear implants (CI) (n=5), nervus vagus stimulation (NVS) (n=3), repetitive transcranial magnetic stimulation (rTMS) (n=7), transcranial direct current stimulation (TDCS) (n=5), acoustic coordinated reset (CR) neuromodulation (n=4), drug therapy (n=7), dietary supplements (n=4) and acupuncture (n=6). Therapies were only evaluated when they were reported in two or more guidelines. Therefore, the recommendations on hyperbaric oxygen therapy, sleep advice, laser therapy, neuromonics approach and mindfulness were excluded from further analysis. For further information, see online supplemental files 3–7 and online supplemental file 8 (overview of recommendations).

Recommendations for tinnitus treatment

Counseling/CBT

Counselling was recommended with the same level of recommendation in 5 out of 10 guidelines that reported on this topic.[14–17 20] CBT was recommended in 8 out of 10 guidelines which reported on the topic with a minimal

Table 2 Summary of classification systems of level of evidence and grading systems of recommendation used in included clinical practice guidelines on the treatment of tinnitus

Classification for level of evidence (used grading system)			Classification for grade of recommendation (used grading system)	
Dutch guideline[13]				
(GRADE)‡			(None)	
High		Very confident in the effect estimate. Further research is very unlikely to change confidence in estimate of effect	None reported	
Moderate		Moderately confident in the effect estimate. Further research is likely to have an important impact on our confidence in the estimate of the effect and my change the estimate		
Low		Limited confident in the effect estimate. Further research is very likely to have an important impact on the confidence in the estimate of the effect and is likely change the estimate		
Very low		Little confidence in the effect estimate. Any estimate of the effect is very uncertain		
European guideline[19]				
(CEBMC)§			(GRADE)	
1a		SR or RCTs	Strong recommendation	Level 1a, 1b or 2a evidence
1b		Individual RCTs		
1c		All or none effects		
2a		SR (with homogeneity) of cohort studies		
2b		Individual cohort study	Weak recommendation	Level 2b, 2c or 3a evidence
2c		‘Outcomes’ research; ecological studies		
3a		SR (with homogeneity) of case–control studies		
3b		Individual case–control study	No recommendation	Only level 3b, 4 or five evidence
	4	Case series		
	5	Expert opinion without explicit critical appraisal		
American guideline[16]				
(AAP, CEBMC)*			(AAP, CEBMC)¶*	
A		Well-designed RCTs	Strong recommendation	Benefits clearly exceed the harms, grade A or B evidence quality
B		RCT; overwhelmingly consistent evidence from observational studies	Recommendation	Benefits exceed the harms, grade B or C evidence
C		Observational studies	Option	Evidence shows little clear advantage for approach, grade A, B or C

Continued

Table 2 Continued

Classification for level of evidence (used grading system)		Classification for grade of recommendation (used grading system)	
X	Exceptional situations where validating studies cannot be performed and there is a clear preponderance of benefits over harm	No recommendation	Unclear balance between benefits and harm and lack of pertinent evidence
Japanese guideline[17]			
(MINDS manual)**		(MINDS manual)**	
A	Strongly confident in effect estimates	1	Strongly recommended
B	Medium confidence in the estimated effect	2	Recommended
C	Confidence in effect estimates is limited		
D	The effect estimate is almost uncertain		
UK guideline[20]			
(GRADE)‡		(None)	
High	Further research is very unlikely to change our confidence in the estimate of effect	No explicit grading of the level of recommendation	
Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate		
Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate		
Very low	Any estimate of effect is very uncertain		
German guideline 2015[15]			
(CEBMC)§		(CEBMC)§	
High	SR (meta-analysis) or RCT or cohort studies of high quality	Strong recommendation	High evidence strength of effectiveness
Moderate	RCT or cohort studies of a lower quality	Recommendation	Moderate evidence strength of effectiveness
Weak	RCT or cohort studies of poor quality, all other study designs, expert opinion	Open recommendation	Weak evidence strength of effectiveness
None	No or negative results	No recommendation	
German guideline 2021[14]			
(CEBMC)§		(AWMF)†††	
High	SR (meta-analysis) or RCT(s) or cohort study of high quality	Strong recommendation	High evidence strength of effectiveness
Moderate	RCT or cohort study of limited quality	recommendation	Moderate evidence strength of effectiveness
Weak	RCT or cohort study of bad quality, all other study designs, experimental studies.	Open recommendation	Weak evidence strength of effectiveness

Continued

Table 2 Continued

Classification for level of evidence (used grading system)		Classification for grade of recommendation (used grading system)	
None	Negative outcomes or no outcome	No recommendation	None
1 a	SR or RCTs		
1b	Individual RCTs		
1c	All or none effects		
2a	SR (with homogeneity) of cohort studies		
2b	Individual cohort study		
Danish guideline[18]			
No classification system or grading system used or reported			
Swedish Guideline[21]			
No classification system or grading system used or reported			
Swiss guideline[22]			
No classification system or grading system used or reported			

*AAP classification scheme updated for consistency with current level of evidence definitions.
†Adapted version of CEBMC by the German scientific associations (AWMF).
‡Based on GRADE method.[28]
§Guided by the CEBMC.[27]
¶Based on AAP classification for clinical practice guidelines,[29] updated with CEBMC.[27]
**Based on Minds manual version 2.0 (strength of evidence).[30]
††Recommendation grading in the program for national health care guidelines (German Medial Association *et al,* 2017).
AAP, American academy of Pediatrics; CEBMC, Oxford Center of Evidence-Based Medicine criteria; GRADE, Grading Recommendations Assessment, Development and Evaluation; RCT, randomised controlled trial; SR, systematic review.

difference in level of recommendation (from 'recommendation' to 'strong recommendation').[13–17 19–21]

Tinnitus retraining therapy

Eight out of the guidelines reported on TRT.[13–15 17–21] The recommendation for TRT varied by guideline. In 2 out of 10 guidelines, TRT was recommended.[17 18] In 3 out of 10, an open recommendation/option was given.[13 14 21] The reason for these open recommendations was that the variety in types of TRT was too high to come to an evidence-based recommendation. In 3 out of 10, it was stated that no recommendation could be made because of the limited quantity of SRs or RCTs on this topic[19 20] or the limited evidence for the effectiveness of TRT.[15]

Sound therapy

In 7 out of 10 guidelines, information about sound therapy was provided.[13–16 19–21] In 5 out of 10 guidelines, no recommendation was made because of the lack of evidence[13 20] or by the risk of bias of outcomes for its effectiveness.[14 15 19] In the UK guideline, the authors did not make a clinical recommendation but stated that more research was needed before conclusions could be made on the effectiveness of sound therapy on tinnitus.[20] In the USA guideline, sound therapy was recommended as 'an option'. They stated that, even though there is a lack of evidence, sound therapy is 'possibly effective in some cases'.[16] In the Swedish guideline, sound therapy was also regarded as an option but there was no statement included on the evidence on which they based their recommendation.[21]

Hearing aids

Eight out of 10 guidelines reported on hearing aids.[13–17 19–21] In 5 out of 10 guidelines,[14 16 17 19 20] recommendations were made for the use of hearing aids in tinnitus patients with hearing loss, even though 3 guidelines out of these made this recommendation despite the lack of evidence on its effectiveness.[14 17 20] In the German guideline of 2015,[15] the authors did not recommend hearing aids substantiated by the lack of evidence for the effectiveness of hearing aids in normal hearing tinnitus patients. In the Dutch guideline,[13] a hearing aid was stated as being an option but without a clarification on which evidence this recommendation was based.

Cochlear implantation

Five out of 10 included guidelines reported on CI.[13–15 17 19] CIs were recommended in the Japanese guideline[17] and the German 2021 guideline,[14] in which in the latter it was stated that this was only for those tinnitus patients with severe hearing loss.[14] In three guidelines cochlear, implants were not recommended based on the risk of bias of outcomes,[13] lack of evidence on the effectiveness for normal hearing tinnitus patients[15] or the low quality of the found evidence.[19]

Table 3 Guideline design

Guideline, year	Aimed study design to be included studies	Design of included studies (when reported)	Electronic literature database searched	Search date
Sweden 2011[21]				
Tinnitus severity	NR	NR	NR	NR
QoL-Tinnitus specific		NR		
QoL general		NR		
Harm/risks		NR		
USA 2014[16]				
Tinnitus severity	SR and RCTs*	SR, Cochrane review, case–control, prospective study	Medline, EMBASE, CINAHL, Cochrane, NICE, country-specific databases	Till 2008–2013
QoL-Tinnitus specific		Cochrane review, AHRQ CER		
QoL general		NR		
Harm/risks		Meta-analysis		
Germany 2015[15]				
Tinnitus severity	When available SR and RCTs were used	Meta-analysis, Cochrane reviews, observational studies, RCTs, single-arm studies.	Pubmed, Cochrane	1980–2014†
QoL-Tinnitus specific		NR		
QoL general		NR		
Harm/risks		Cochrane review, single-arm trail		
NL 2016[13]				
Tinnitus severity	The guideline authors preselected treatments of which an SR or MA existed	SR, RCT	Medline, EMBASE, Cochrane	1979–2016
QoL-Tinnitus specific		Meta-analysis		
QoL general		Meta-analysis		
Harm/risks		RCT		
Denmark 2017[18]				
Tinnitus severity	NR	NR	NR	NR
QoL-Tinnitus specific		NR		
QoL general		NR		
Harm/risks		NR		
Switzerland 2019[22]				
Tinnitus severity	NR	NR	NR	NR
QoL-Tinnitus specific		NR		
QoL general		NR		
Harm/risks		NR		
Europe 2019[19]				
Tinnitus severity	The guideline authors made their recommendations based on existing tinnitus guidelines	SR, RCT, scoping review, meta-analysis	Medline, Pubmed, CINAHL, guideline.gov, NICE, GIN, google.	Till 05–2016
QoL-Tinnitus specific		RCT		
QoL general		NR		
Harm/risks		RCT, clinical trails		
Japan 2020[17]				
Tinnitus severity	SR, meta-analysis, RCTs	SR, RCTs, Guideline	Cochrane, Medical Journal web, PubMed	1980–31 December 2016
QoL-Tinnitus specific		NR		
QoL general		NR		
Harm/risks		NR		
UK 2020[20]				

Continued

Table 3 Continued

Guideline, year	Aimed study design to be included studies	Design of included studies (when reported)	Electronic literature database searched	Search date
Tinnitus severity	RCTs and SR which consist of RCTs. If there is an inadequate amount of RCT data, non-randomised studies were considered.	RCTs, Cochrane review	Medline, EMBASE, Cochrane, CINAHL	Till 2004–2019
QoL-Tinnitus specific		RCTs, Cochrane review		
QoL general		RCTs, Cochrane review		
Harm/risks		RCTs, Cochrane review		
Germany 2021[14]				
Tinnitus severity	SR, RCT, observational studies	SR, RCTs, case–control studies, feasibility study	PubMed, Cochrane	01–2014 to 12–2020
QoL-Tinnitus specific		Cohort study, randomised trial		
QoL general		NR		
Harm/risks		RCTs		

*SR and RCTs. (Where data were lacking, a combination of clinical experience and expert consensus was used).
†Search data depended per subject. (1980–2014 widest search range).
AHRQ CER, Agency for Healthcare Research and Quality Comparative effectiveness Research; CINAHL, Cumulative Index to Nursing and Allied Health Literature; EMBASE, Excerpta Medica Database; HUI, Health Utilities Index; NICE, National Institute for Health and Care Excellence; NR, not reported; QoL, quality of life; RCT, randomised controlled trial; SR, systematic review.

Other treatments

Acupuncture (6 out of 10 guidelines),[13–17 19] dietary supplements (4 out of 10 guidelines),[13 15 16 19] drug therapy (7 out of 10 guidelines),[13–17 19 20] acoustic CR neuromodulation (4 out of 10 guidelines),[13 15 19 20] rTMS (7 out of 10 guidelines),[13–17 19 20] TDCS (5 out of 10)[13–15 19] and NVS (3 out of 10 guidelines)[14 19 20] were consistently not recommended by any guideline, with minimal differences in level of recommendation.

DISCUSSION

In this SR of the literature, we compared the design, development and recommendations in guidelines on treatment options for chronic tinnitus in adults. A total of 10 guidelines were identified and included, published between 2011 and 2021.[13–21] Recommendations for 13 types of tinnitus treatments were compared. Counselling and CBT were the only treatments which were recommended for treating tinnitus by all guidelines that reported on these topics. Other treatment options were not unanimously recommended, either due to the lack of evidence, a high risk of bias or judgement of no beneficial effect of the specific treatment.

Within our study, we found that recommendations between guidelines varied more when the quality and quantity of the evidence was low, which is in line with guideline comparisons in other fields.[6 7] Some of the included guidelines gave no recommendation when the level of evidence was judged as too low, whereas other guidelines gave a recommendation against the treatment or stated that the treatment was 'optional' on the same basis. This could explain the found differences in recommendations and the stated level of recommendation for TRT, CI and sound therapy. Due to poor reporting the rationale behind these choices was not always clear. One should keep in mind that there is a difference between 'no recommendation' and 'recommendation against'. 'No recommendation' can be reported by a guideline due to the lack of evidence. A recommendation against a treatment option can be given because of a lack of evidence, but also because the evidence points out that a treatment does not work. Differences in recommendations between guidelines could also be explained by the fact that newer guidelines relied on more recent evidence for the specific topic. For example; in the updated German guideline of 2021,[14] recommendations against rTMS and TDCS were made, while in the original German guideline of 2015[15] an uncertain recommendation was provided for these treatments. Also, TRT was not recommended in the original German guideline, whereas in the updated guideline an open recommendation was given for the long-term outcome effects.[14 15]

Ideally, recommendations in clinical guidelines are based on SRs of the available evidence. If those are not yet available at the time of writing of the guideline, guideline developers should conduct a SR themselves. In 7 out of 10 included guidelines in our study a SR of literature was performed as part of the guideline development[13–17 19 20] and in 3 guidelines the source on which they based their recommendations on was not reported.[18 21 22] Out of those seven guidelines in which a SR was described, the Dutch guideline[13] only selected treatment types for their recommendations for which an SR or MA already existed. Besides this, the European guideline[19] based its recommendations on outcomes of existing guidelines. However, a systematic assessment of the available evidence on topics is essential for the development of a guideline.[9] Only by this, the potential of current and new therapies and their evidence can be assessed in terms of possible benefits as well as harms and alternative care options to be able to provide the patient with the best advice.[3] Unfortunately, it has been found that over half of clinical

practice guidelines do not base their evidence synthesis in SRs which results in misleading and untrustworthy recommendations.[31]

A rigid SR of the literature can yield high quality, trustworthy evidence, very low quality evidence or something in between. It is essential for clinicians to be informed about the quality of evidence on which recommendations are made. Therefore, appraisal of the evidence is an important step in the development of a guideline.[32] This is especially true for the field of tinnitus treatment, where high-quality RCTs are scarce. Most guidelines that were included in our study used either GRADE method[28] or CEBMC[27] as framework for this appraisal. However, some guidelines applied these tools in different ways then was intended by the creators of the frameworks. For example, GRADE was used in the EU guideline to classify the level of recommendation instead of the level of evidence. Other guidelines applied their own adapted version of commonly used methods or combined two different frameworks.[14 16] This makes comparison of the provided levels of evidence or levels of recommendation between the guidelines difficult, if not impossible, and complicates the judgement of the reader on this. Beside the adequate use of appraisal tools, also a predefined definition of the outcome measure to rely the recommendation on is essential to find the best available evidence. Remarkably, only 1 out of 10 guidelines included harms of treatment as a predefined outcome measure.[13] Three other guidelines did also report this outcome in their final evidence synthesis but were inconsistent in their reporting.[14 16 19] This needs attention in future guidelines to help physicians and patients in their decision-making. Performing a SR of available evidence takes time and we need to consider that developing and publishing a (national) guideline is a costly process. One could argue if, in times of rapid medical advancements in a field, recommendations are still up to date at the time of final publication. Also as discussed in Langguth *et al*,[1] the current methods for guideline development can cause a delay of up to 10+ years before a new treatment option is recommended by a guideline. A more dynamic, digital and open access (international) guideline could be of value to solve this limitation and needs to be considered for the next future.

Besides appraisal of the evidence, clear reporting in guidelines is essential to create a trustworthy outcome. The EQUATOR network, a network that specialises in writing reporting guidelines for biomedical research, recommends using the AGREE or RIGHT statements or checklists to reach high-quality reporting.[12 33] However, using a guideline checklist does not imply that the guideline is of sufficient quality.[34] The Swedish, Swiss and Danish guidelines did not report the use of a reporting tool.[18 21 22] While this does not necessarily mean they did not use it, these guidelines lacked transparency and clear reporting. This lack of adequate reporting is not unique for tinnitus research and guidelines. Previously, reporting quality in guidelines of specialty societies was found to be generally of low quality.[35] Adherence to reporting guidelines should be advocated to ensure the provided statements in a guideline are trustworthy, reproducible and applicable for the stated patient and setting.

In line with the low level of reporting, reporting on possible conflicts of interest, funding and group membership was lacking in several guidelines.[16–18 21] Also interests of involved patient associations, the medical industry and specialty societies were sometimes unclear and only in a minority of the guidelines it was stated if different opinions existed on the recommendations to be made and how this was handled.[14] Conflicts of interest can be financial but can also arise from a personal, political, academic or professional role.[36] Financial conflict of interest is a known problem in guideline development but remains largely hidden.[37 38] These conflicts of interest may cause bias in the given recommendations and can ultimately be harmful to patients and the healthcare system.[39 40] For this reason, editorial independence and transparency is important and should be promoted and pursued.[36 37 41] Integration of the expertise of all involved specialties is essential in the development of clinical guidelines. In tinnitus guidelines, multiple different clinical specialties were involved, but none reported collaboration of an epidemiologist or methodologist. This while these competencies are crucial for evaluating the evidence.[42]

The measures of effectiveness that were used in clinical practice guidelines could also hinder applicability. In most guidelines, outcomes on effectiveness of treatments were expressed in terms of tinnitus severity, tinnitus-related quality of life or general quality of life. However, it is debatable if these outcomes are the most important for tinnitus patients. As described in previous studies, tinnitus patients mostly seek reduction of tinnitus loudness and elimination of their tinnitus in treatment, whereas healthcare workers such as audiologists described that a decreased awareness and anxiety relief would be the most important to determine treatment success.[43 44] These differences in expectations of tinnitus treatment could hinder the applicability of outcomes of tinnitus guidelines made by experts for patients, which is also noticed in other fields of research.[45] Therefore, integrating patient and patient representatives in future guideline development is of utmost importance. To provide patients and patient representatives even better information one could also consider to publish a shortened patient focused guideline together with the newly developed guideline.

One could debate if all included guidelines in our study can be considered as clinical practice guidelines by the lack of a systematic assessment or reporting of this assessment in several of those,[13 18 19 21 22] and to be compared with the other (evidence based) published tinnitus guidelines in the current study. Also, in this study, we included clinical guidelines without a publication date restriction. This choice on inclusion of guidelines and publication date was made because even when guidelines are maybe ‘outdated’, or do not adhere to formal definitions of

guidelines, they are sometimes still in use in the country in which they were published and findable for patients and healthcare workers on websites. We used predefined inclusion and exclusion criteria and used the PRISMA reporting guideline for SRs of literature and the AGREE checklist to investigate the reporting of the included guidelines.[11 12] We chose to use the AGREE checklist to report on reporting of the guidelines instead of the AGREE-II tool.[12] The AGREE checklist does not require the researcher to determine a score for each domain, which makes it less dependent on the opinion of the researchers. Besides these strengths, there is a limitation to our study that has to be taken into account. The lack of a published research protocol for this study could in theory cause publication bias and makes it impossible for the readership to check our predefined study outcomes.

Future tinnitus guideline development could profit from the use of specialised reporting tools (like AGREE[12] or RIGHT[33]) to improve reporting and transparency and the help of guideline development specialists. Second, it is questionable if it is feasible and advisable to develop new and update existing national guidelines on a topic for countries that have similar healthcare settings. Additionally, tinnitus patients and specialists in guideline development should be more involved in future guideline development to optimise the investigated outcomes of research.

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