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Original Article

A systematic review of techniques and effects of self-help interventions for tinnitus: Application of taxonomies from health psychology

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The British Society of Audiology



The International Society of Audiology



Abstract

Objective: Self-help interventions are followed by people independently with minimal or no therapist contact. This review aims to assess the effectiveness of self-help interventions for adults with chronic tinnitus and systematically identify the self-help techniques used. **Design:** Systematic review and application of health psychology taxonomies. Electronic database searches were conducted, supplemented by citation searching and hand-searching of key journals. Prospective controlled trials, which used measures of tinnitus distress, functional management, anxiety, depression, and quality of life, were included. Michie et al's behaviour change techniques (BCTs) taxonomy and Taylor et al's PRISMS taxonomy of self-management components were applied to describe interventions. **Study sample:** Five studies were included, providing low-to-moderate levels of evidence. **Results:** Randomized controlled trial studies were too few and heterogeneous for meta-analysis to be performed. Studies comparing self-help interventions to therapist-guided interventions and assessing non tinnitus-specific psychosocial outcomes and functional management were lacking. Fifteen BCTs and eight self-management components were identified across interventions. **Conclusions:** A lack of high-quality and homogeneous studies meant that confident conclusions could not be drawn regarding the efficacy of self-help interventions for tinnitus. Better reporting and categorization of intervention techniques is needed for replication in research and practice and to facilitate understanding of intervention mechanisms.

Key Words: Tinnitus; self-help; interventions; systematic review; health psychology

Self-help interventions involve individuals working through a set of therapeutic materials either on their own ('unguided' self-help) or with minimal guidance from a therapist ('therapist-guided' or 'minimal contact' self-help). Interventions can be delivered using printed books (bibliotherapy), the internet, computer packages, DVDs, or smartphone applications. In therapist-guided interventions, contact is typically provided over the phone or by email. Traditionally, self-help interventions have been advocated as a relatively low-cost way of improving access to psychological services and thus reduce the health disparities associated with any inequitable access. As such, self-help tends to be aimed at those patients experiencing mild-to-moderate distress, with more time- and resource-intensive face-to-face services being reserved for those with the

most complex needs (National Institute for Health and Care Excellence, 2011).

Meta-analyses have demonstrated the positive effects of self-help interventions for several long-term conditions, including mental health (Spek et al, 2007), chronic pain (Macea et al, 2010), and insomnia (van Straten & Cuijpers, 2009). Several authors have suggested additional advantages of self-help interventions over traditional face-to-face therapeutic services. Individuals can work through self-help materials at their own pace and in a comfortable and private environment (i.e. their own home; Williams & Whitfield, 2001; Griffiths et al, 2006). Users can easily revisit self-help materials to reinforce or consolidate learning or deal with relapse (Williams & Whitfield, 2001). Self-help also offers an alternative for those unwilling to access traditional

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Abbreviations

ACT	Acceptance and commitment therapy
BCT	Behaviour change technique
CBT	Cognitive behaviour therapy
GHQ-12	General health questionnaire - 12
HADS	Hospital anxiety and depression scale
NRCT	Non-randomized controlled trial
PHQ-D	German version of patient health questionnaire
PICOS	Participants, intervention, control, outcomes and study design
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
PRISMS	Practical systematic review of self-management support
PROSPERO	International prospective register of systematic reviews;
RCT	Randomized controlled trial
TEQ	Tinnitus effects questionnaire
THI	Tinnitus handicap inventory
TQ	Tinnitus questionnaire
TRQ	Tinnitus reaction questionnaire

psychotherapeutic interventions due to an anticipated stigma associated with doing so, and improves access for those with hearing loss or unable to travel to clinical consultations (Williams & Whitfield, 2001; Griffiths et al, 2006). In the context of self-management, people with long-term conditions can be empowered by the autonomous nature of self-help that promotes self-efficacy and allows them to take responsibility for their own care (Williams & Whitfield, 2001; Bendelin et al, 2011). Specifically, digital interventions, using delivery mediums such as the internet or smart phone applications, have the potential for greater reach, interactivity, and tailoring to individual users' needs than printed material (Griffiths et al, 2006). Communications features, such as online discussion forums, may also reduce feelings of isolation that many people with chronic conditions experience (Mo & Coulson, 2013).

On the other hand, self-help interventions may not be suitable for everyone. Individuals who undertake self-help interventions must have a high level of motivation and ability to work on their own (Macea et al, 2010; Bendelin et al, 2011). The intervention's reliance on internet delivery and/or written materials may also pose barriers to those with poor literacy and those without access to the internet or adequate computer skills (Williams & Whitfield, 2001; Carlbring & Andersson, 2006). Self-help interventions have also been criticized for being particularly prone to drop-out or attrition. However, some researchers have demonstrated that this drop-out is no greater than in traditional psychological therapy (Kaltenthaler et al, 2006; Cuijpers et al, 2010; Lewis et al, 2012).

What makes a successful self-help intervention?

Most research has focused on the efficacy of self-help and, as such, we know little about what makes a self-help intervention successful. Researchers have suggested several broad intervention features that are associated with better outcomes from self-help interventions, including therapist contact, provision of cognitive behaviour therapy (CBT) techniques, and tailoring the intervention (Gellatly et al, 2007; Andersson et al, 2009; Baguley et al, 2010).

Further work is needed to identify the self-help techniques contained within these interventions (i.e. what are the 'active ingredients' that make them work?) and explain how these techniques bring about successful changes in intervention outcomes (i.e. how do these 'active ingredients' work?). An understanding of these factors is important for two reasons. First, identifying the 'active ingredients' of an intervention allows better replication in research or clinical practice (Michie & Abraham, 2004). Second, it can contribute to our understanding of *why* an intervention worked, failed to work as intended, or led to unexpectedly small effect sizes (Michie & Abraham, 2004; Craig et al, 2008). Such an explanation is helpful for improving failed interventions or developing new interventions with improved chances for success.

In health psychology, taxonomies are used to systematically and reliably describe an intervention's 'active ingredients'. Several taxonomies have been developed that provide an agreed list of intervention techniques, components, or modes of delivery (Webb et al, 2010; Michie et al, 2013; Taylor et al, 2014). Researchers can use taxonomies to rigorously describe the content of new interventions as part of an evaluation to facilitate study or intervention replication (Greenwell et al, 2015). Alternatively, taxonomies can be applied in systematic reviews to identify the most effective techniques in a given intervention. For example, in their meta-analysis of internet-based health behaviour change interventions, Webb et al (2010) identified 31 behaviour change techniques using an augmented version of Abraham and Michie's (2008) behaviour change techniques taxonomy. Through meta-analysis, they found that the use of stress management or communication skills training techniques were most effective for behaviour change.

Once the unique intervention techniques have been identified, researchers can then link them to particular theoretical constructs (e.g. knowledge, skills, beliefs) and thus explain how these interventions bring about changes in outcome. The underlying psychological processes can then be tested through exploratory randomized controlled trials (e.g. Yardley et al, 2010).

Self-help interventions and tinnitus

In audiology, self-help interventions have relevance for the management of tinnitus and have been recommended within a recently published clinical practice guideline for tinnitus (Tunkel et al, 2014). Tinnitus is experienced by approximately 10% of the population (Davis & El Refaie, 2000) and is defined as the conscious perception of sound in the absence of any corresponding external stimuli. The majority of individuals with tinnitus do not find it bothersome with little impact on their everyday lives. However, for approximately 20% of this population, tinnitus can be extremely bothersome and, for 5% of people, this is at a level that severely affects their ability to lead a normal life (Davis & El Refaie, 2000). For some, tinnitus can have a negative impact on their everyday lives, including sleep disturbances, concentration difficulties, emotional strain (e.g. irritation, depression, frustration, anxiety), and have a negative impact on social and work life (Tyler & Baker, 1983; Hoffman et al, 2004; Andersson & Edvinsson, 2008). In research and clinical practice, tinnitus impact is typically evaluated using questionnaire measures of tinnitus-specific quality of life or 'tinnitus distress'. Popular tinnitus distress measures include the tinnitus questionnaire (Hallam, 1996), the tinnitus handicap inventory (Newman et al, 1996), and the tinnitus reactions questionnaire (Wilson et al, 1991).

In the absence of any biomedical cure, clinical guidelines recommend various approaches to management including neurophysiological approaches, such as tinnitus retraining therapy (Jastreboff & Hazell, 2004), and psychological approaches, which focus on reducing the associated psychological distress and the impact tinnitus has on an individual's quality of life (Department of Health, 2009). Specifically, the use of CBT is recommended and there is evidence that it can successfully reduce tinnitus distress and depression and improve quality of life in people with tinnitus (Martinez-Devesa et al, 2010; Hoare et al, 2011). CBT for tinnitus aims to reduce the associated psychological distress through the application of techniques that facilitate habituation, alter maladaptive thoughts and emotions, and reduce physiological arousal. Such techniques include applied relaxation, imagery, cognitive restructuring, gradual exposure to feared situations, advice regarding sound enrichment, concentration management, and sleep hygiene (Andersson, 2002). Acceptance-based therapies, such as acceptance and commitment therapy and mindfulness-based cognitive therapy, have also been shown to significantly reduce tinnitus distress and improve psychological well-being, sleep, and self-efficacy (Westin et al, 2011; Philippot et al, 2012). These therapies use acceptance-based strategies to reduce an individual's efforts to control or avoid internal experiences and pose an alternative to traditional CBT approaches.

However, in the UK few audiology services have regular access to psychological services as part of their tinnitus pathway. In a survey of English National Health Service audiology departments, 65% of clinicians indicated that they were not able to refer outside of their service to a clinical psychologist or other health professional qualified in providing psychological therapy (Gander et al, 2011). In a more recent evaluation of audiology services in the four countries of the UK, only services in England reported ever having a clinical psychologist in their team (7%) and access to a member of staff trained in CBT (48%), with a third of all services offering CBT as part of standard care (37%; Hoare et al, 2015). Self-help interventions can provide a way of improving access to psychological services for tinnitus. However, before self-help interventions can be recommended as a valid alternative or complementary form of therapy, we must first establish whether they are effective for this target population.

Nyenhuis et al (2013a) carried out a systematic review and meta-analysis, focusing specifically on the evidence for CBT-based self-help interventions for tinnitus delivered with minimal or no therapist contact. They identified ten randomized controlled trials (RCTs) of CBT-based self-help interventions delivered via books or the internet. Nyenhuis et al demonstrated that self-help interventions were associated with significantly reduced tinnitus distress and depression compared to passive control conditions (waiting list, information only, online support forums). Furthermore, they observed no difference in outcomes between self-help interventions and active controls (face-to-face counselling or group therapies). Nyenhuis et al's review was limited to CBT self-help interventions and included both therapist-guided and unguided interventions. Although Nyenhuis et al's review points to there being a positive impact of self-help interventions for tinnitus, we still do not know what makes a self-help intervention for tinnitus successful.

The primary aim of this review was to assess the effects of self-help interventions on levels of tinnitus distress, functional management, depression, anxiety, or quality of life of adults with chronic tinnitus. We included studies that explored self-help interventions

delivered without therapist contact only. We deemed these interventions as most relevant for a tinnitus population as they have the scalability necessary for equitable access. We also wanted to explore the quality of the available research on this topic. Unlike the review from Nyenhuis et al, we had no exclusions on the intervention approach used.

The second aim of this review was to systematically identify what intervention techniques are used within these self-help interventions. We applied taxonomies from health psychology to address this question, a methodology that has not been applied to the tinnitus self-help literature previously.

Methods

The review protocol was registered with PROSPERO, the international prospective register of systematic reviews (Greenwell et al, 2014). Our reporting was guided by the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement (Moher et al, 2009).

Inclusion criteria

We screened and selected studies based on the following inclusion criteria. Consistent with the PRISMA statement, the inclusion criteria are reported with reference to participants, intervention, control, outcomes, and study design (PICOS):

- (1) Participants: Adults (aged 16+ years) with chronic tinnitus.
- (2) Intervention: Self-help interventions that aim to reduce tinnitus handicap and are delivered without clinician contact. Clinicians, such as audiologists, ear nose and throat specialists, psychologists, and therapists, might refer patients to the self-help interventions but must not be involved in its delivery. Interventions had to be implemented from a standardized manual that can be followed independently by people with tinnitus.
- (3) Control: Passive (no treatment group, usual care, waiting list control) and active (self-help interventions delivered in different formats or clinician- or therapist-guided interventions) controls.
- (4) Outcomes: Questionnaire measures of tinnitus distress, functional management, depression, anxiety, or quality of life.
- (5) Study design: Prospective controlled trials, including randomized controlled trial (RCTs) and non-randomized controlled trial (NRCT) studies.

We included publications from peer-reviewed journals that were written in English.

Exclusion criteria

We excluded studies where the intervention group received any form of treatment or therapy alongside the self-help intervention.

Search strategy

We carried out searches in January 2014 and updated them in March 2015 using the following electronic databases: OVID (MEDLINE, EMBASE, PsycINFO), ESBCOhost (CINAHL), Cochrane Library and Proquest (ASSIA), using the search terms tinnitus AND self-help OR self-manag* OR self-care OR self-treatment OR self-therapy OR self-direct* OR self-act* OR self-admin* OR unguid* OR self-guid* OR bibliotherapy OR internet OR online OR computer

OR web OR “minimal contact” OR “short-term therapy” OR training OR education. An example full search strategy is available in the Supplementary Material. We complemented the primary searches by searching reference lists from the included primary studies, citation searching of the same studies using Web of Science, and hand searching the last six months of key audiology, ear nose and throat, and psychology journals. Clinicaltrials.gov and the World Health Organization trial search were searched to identify potentially relevant ongoing or unpublished studies.

Study selection

Two authors (KG, DJH) independently screened the titles and abstracts of 2077 articles for potential inclusion using the PICOS criteria outlined above (Figure 1). We retrieved full text articles where the study appeared suitable for inclusion or where there was insufficient information in the title or abstract to exclude the study. The same authors retrieved and independently assessed forty-eight full text articles for inclusion. Five studies were included in the final review. No relevant ongoing or unpublished studies were identified.

Data extraction

At least two members of the review team (DJH, MS, AER) independently carried out data extraction and additional team members were consulted to resolve any disagreements. For each study, data were extracted using a data extraction form (available from corresponding author on request), which was developed for purpose and piloted before use.

Quality assessment

We measured the quality of included studies using Downs and Black’s (1998) quality checklist. This checklist describes 27 quality criteria and is scored according to responses options of ‘yes/no’ (criteria 1–4, 6–10), ‘yes/partially/no’ (criteria 5), ‘yes/no/unable to determine’ (criteria 11–26), 0–5 (criterion 27). Criterion 27 is normally scored according to the power (i.e. sufficient sample size) of the study to detect a clinically meaningful change. As there is no defined or universally agreed clinically significant change score for many tinnitus questionnaires (Fackrell et al, 2014), we simply considered whether or not a power calculation was performed (scored ‘yes/no/unable to determine’).

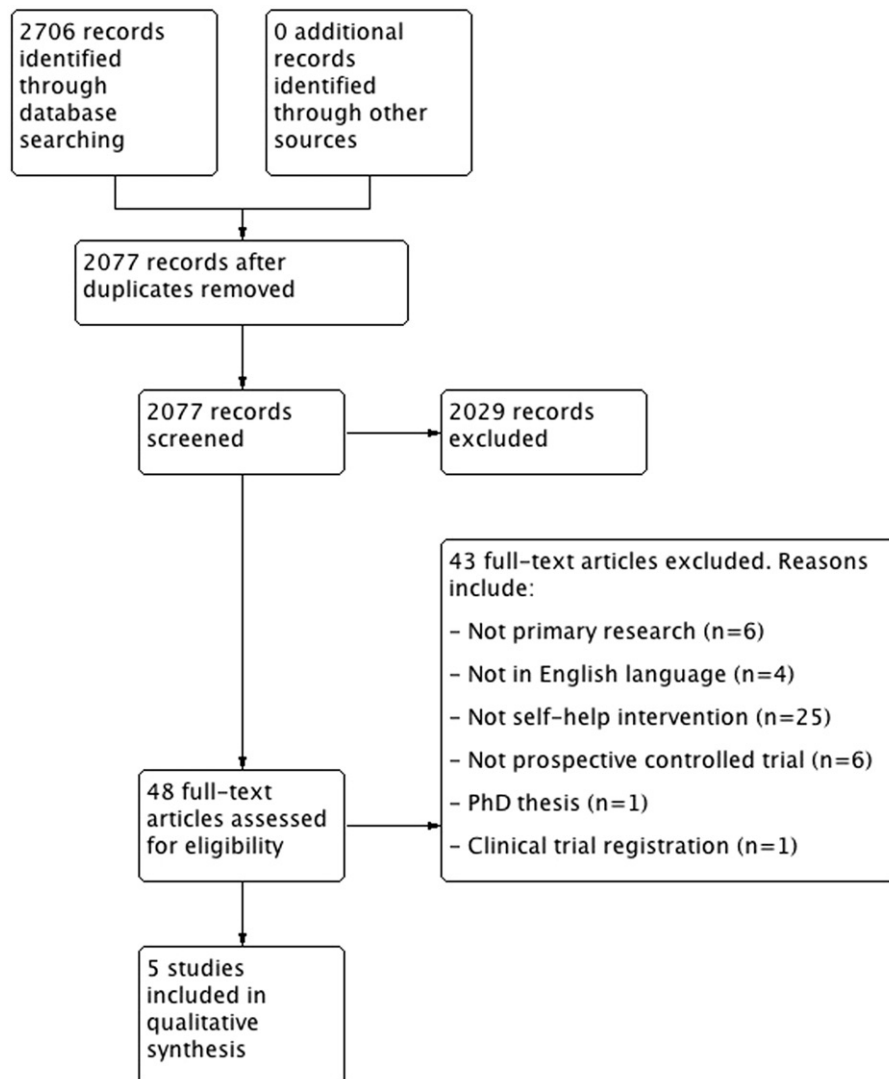


Figure 1. PRISMA flow chart of study selection process.

Risk of bias assessment

We used the Cochrane collaboration risk of bias tool (Higgins & Green, 2011) to assess the risk of bias in the included RCT studies. Bias was judged as 'high risk', 'low risk', or 'unclear' across seven domains (Figure 2) using the criteria for judgements specified in the Cochrane handbook (Higgins & Green, 2011). We provided an overview on the general quality of studies and risk of bias in the field, and considered these aspects when interpreting the results of the data synthesis.

Primary review aim: Effects of self-help interventions on levels of tinnitus distress, functional management, depression, anxiety, or quality of life

DATA SYNTHESIS

Meta-analyses were not performed as the interventions, control groups, and outcome measures of the three RCT studies were not sufficiently similar for the results to be combined. Data were therefore synthesized using a narrative approach. Only the results from intention-to-treat analyses were reported unless the results from the complete case analysis differed significantly.

Secondary review aim: Identifying what intervention techniques are used within the interventions

We used intervention taxonomies to identify and describe the 'active ingredients' of the interventions. In the absence of a well-established self-help taxonomy, we used Michie et al's behaviour change techniques (BCT) taxonomy (v1; 2013) to code intervention content into intervention techniques from a list of 93 items.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Kaldo et al. 2007	+	?	+	?	+	+	+
Malouff et al. 2010	?	?	?	?	?	?	+
Nyenhuis et al. 2013	+	+	?	?	+	+	+

Figure 2. Cochrane risk of bias summary table including risk of bias judgements across studies for each criterion. Key: ? unclear risk of bias; + low risk.

Behaviour change techniques are defined as 'the smallest components of behaviour change interventions that on their own in favourable circumstances can bring about change' (Michie et al, 2014b, p. 2). Example BCTs include 'instruction on how to perform the behaviour', 'self-monitoring of behaviour', and 'goal setting (behaviour)'. We deemed the focus on behaviour change to be appropriate given that behaviour change is a key component of CBT, which the majority of e-mental health and tinnitus self-help interventions are based on.

As the BCT taxonomy was not designed specifically for self-help interventions, it is likely that this taxonomy may not be able to detect all techniques that are present in the included self-help interventions. For example, some intervention techniques, such as cognitive restructuring, can be used to either promote behaviour change or improve psychological outcomes. Additional techniques that are unique to self-help interventions or are used for purposes other than behaviour change were summarized using narrative synthesis.

The practical review of self-management support (PRISMS) taxonomy of self-management components (Taylor et al, 2014) provided a framework for this synthesis. This taxonomy lists 14 self-management components directed at patients and/or carers, five indirect components aimed at health or social care professionals, and five components directed at the organizational level. These self-management components are broader than the techniques used in the BCT taxonomy and may comprise several techniques. For example, 'training/rehearsal for psychological strategies' may include providing instructions on how to perform the psychological strategy, practicing the psychological strategy, and goal setting and action planning for this strategy. The PRISMS taxonomy was selected as it is designed for use in systematic reviews, addresses some of the broader forms of self-management techniques, and is not restricted to one particular intervention outcome. However, the PRISMS taxonomy only allows the identification of broad *components* of the interventions rather than the more specific and smaller *techniques*, which are useful to understand. Taylor et al (2014) recommend using both the PRISMS and BCT taxonomies in systematic reviews.

We coded intervention content using the intervention descriptions in the publication and, if insufficient information was available in the publication, we requested the intervention protocol or original self-help material from the study authors. The original self-help material was available for four studies in this review (Loumidis et al, 1991; Kaldo et al, 2007; Malouff et al, 2010; Nyenhuis et al, 2013b) and the intervention protocol was available for the remaining study (Kaldo et al, 2013). One of the self-help manuals (Nyenhuis et al, 2013b) was only available in German and was translated into English by one of the review authors (MS) who is fluent in German. Kaldo et al (2007) were able to provide a translated version of their original Swedish manual.

Results

Study characteristics

Table 1 outlines the key characteristics of the five studies that met our inclusion criteria and included in this review. All five studies recruited from audiology and ear nose and throat departments, with three studies also recruiting from community samples where participants were approached via media releases (i.e. newspapers, internet, radio) and tinnitus support groups (Kaldo et al, 2007; Malouff et al, 2010; Nyenhuis et al, 2013b). Self-help interventions were delivered via books (n=3), the internet (n=2), or an

Table 1. Study characteristics and quality assessment for included studies.

Reference	Country	Sample size	Study design; Trial type	Intervention	Control	Assessment points			Outcome measures		Quality assessment
						BL	P-I	FU	Primary	Other	
Loumidis et al (1991)	UK	33 ^a	NRCT; Parallel	Information Leaflet	Waiting list*	×	1 month	×	TEQ	–	13
Kaldo et al (2007)	Sweden	72	RCT; Parallel, cross-over	Self-help book	Therapist-guided self-help book**	✓	6 weeks	1 year	TRQ	THI, HADS, ISI	17
Malouff et al (2010)	Australia	162	RCT; Parallel, cross-over	Self-help book	Waiting list*	✓	2 months	***	TRQ ^b	GHQ-12	14
Nyenhuis et al (2013b)	Germany	304	RCT; Parallel	Self-help book; Internet intervention	Information leaflet*; Group therapy**	✓	3 months	1 year	TQ	PHQ-D	19
Kaldo et al (2013)	Sweden	374	NRCT; Effectiveness trial	Internet intervention	Therapist-guided internet intervention**	✓	ns	×	TRQ	–	13

Note: Quality assessment was carried out using Downs and Black's (1998) quality checklist. The reported score is out of a total score of 28.

Key: ^aOnly post-intervention sample size was given; ^bPrimary outcome not stated; *Passive control; **Active control; ***Only within-group comparisons made at follow-up; RCT: Randomized controlled trial; NRCT: Non-randomized controlled trial; BL: Baseline; P-I: Post-intervention; FU: Follow-up; ns = not specified; TEQ: Tinnitus effects questionnaire (Hallam et al, 1988); TRQ: Tinnitus reaction questionnaire (Wilson et al, 1991); TQ: Tinnitus questionnaire (German version; Goebel & Hiller, 1998); THI: Tinnitus handicap inventory (Newman et al, 1996); HADS: Hospital anxiety and depression scale (Zigmond & Snaith, 1983); ISI: Insomnia severity index (Bastien et al, 2001); GHQ-12: General health questionnaire (Goldberg & Williams, 1988); PHQ-D: Patient health questionnaire (Gräfe et al, 2004).

information leaflet (n = 1). Intervention durations ranged from one to three months. All interventions, except the information leaflet, were based on a CBT approach, focusing on helping individuals to change their negative thoughts about tinnitus and adopt new behaviours to reduce tinnitus distress.

Quality assessment

Scores on the Downs and Black checklist ranged from 13 to 19 for the five studies (Table 1), which suggests a low-to-moderate level of quality. We found several common items associated with lower quality ratings across studies. For example, none of the studies attempted to blind participants to the intervention they received. Only one of the five studies (Nyenhuis et al, 2013b) reported carrying out a power calculation to determine sample size, although this study did not meet its estimate at post-assessment or follow-up due to a high drop-out rate (39%). External validity of the included studies was questionable. Either the samples were generally not representative of the target or source population or generalizability of findings could not be determined due to limited reporting.

Risk of bias assessment

Risk of bias in RCTs is summarized in Figure 2. None of the studies were rated as being at high risk of bias on any of the seven criteria. For several criteria, risk of bias was unclear. For one criterion (blinding of outcome assessment), risk of bias was unclear in all three RCTs. Information relevant to this quality criterion is consistently under-reported in the literature.

Attrition

Drop-out attrition (i.e. loss to follow-up) rates for the intervention group at post-assessment ranged from 34–37%, but were clearly reported for three studies only. Drop-out attrition at post-assessment for the passive controls ranged from 10–25% (n = 2), and 9–37% for the active controls (n = 3). At one-year follow-up, drop-out attrition was 42–48% (n = 2) for self-help interventions, 36% for passive controls (n = 1), and 12–34% for active controls (n = 2).

Primary review aim: Effects of self-help interventions on levels of tinnitus distress, functional management, depression, anxiety, or quality of life

SELF-HELP INTERVENTIONS VS. PASSIVE CONTROLS

Two RCTs (Malouff et al, 2010; Nyenhuis et al, 2013b) and one NRCT (Loumidis et al, 1991) evaluated the effects of self-help interventions compared to passive controls, including one information-only control and two waiting list controls. Such comparisons allow us to assess the unique effects of self-help interventions (see Table 2 for summary).

Tinnitus distress. Only Nyenhuis et al found a significant between-group effect for their self-help intervention at post-intervention. They demonstrated that tinnitus distress was significantly lower at post-intervention in the internet self-help intervention group, compared to the information-only control group. In contrast, there was no significant effect for the self-help book at post-intervention using the same control group. At one-year follow-up, the internet self-help intervention and self-help book intervention demonstrated a significantly lower tinnitus distress at follow-up. Within group effect sizes for their internet self-help intervention were

large at post-intervention ($d=1.04$) and medium at follow-up ($d=0.66$). Within group effect sizes for the self-help book were small at post-intervention ($d=0.24$) and follow-up ($d=0.39$).

Malouff et al found no significant between-group effects for their self-help book when compared to a waiting list control at post-intervention. In contrast, when complete case analysis was used, the authors observed a small ($d=0.28$) but significant between-group effect. Given the large amount of missing data present in this study, it is possible that the authors may have found an effect if more complete data was collected. Loumidis et al found no significant difference in tinnitus distress at post-intervention between their leaflet intervention and their waiting list control. However, this result should be interpreted with caution given this study's small sample size ($n=33$), poor quality rating (13), and lack of attempt to collect and account for the participants' pre-intervention scores.

Two of the studies explored the number of people in the self-help intervention groups reaching a clinically significant change in tinnitus distress, but results were mixed. Malouff et al found no significant difference in the percentage of people reaching a clinically significant reduction in tinnitus distress (defined as a reduction in tinnitus distress score of at least 50%) at post-intervention between the intervention (17%) or control group (13%). In contrast, Nyenhuis et al's internet and book intervention groups demonstrated a greater number of people reporting a clinically significant improvement in tinnitus distress compared to the information-only control at both post-intervention and follow-up.

Across the five included studies, only Nyenhuis et al explored potentially negative effects of self-help interventions by measuring the number of participants demonstrating a clinically significant worsening of tinnitus distress scores. Fewer people in the self-help interventions ($n=0$) and group therapy ($n=1$) groups had deteriorated at post-intervention, compared to the information-only group ($n=2$). At follow-up, none of the participants in the self-help book intervention and group therapy groups had deteriorated. Two people had deteriorated in both the internet self-help intervention group and the information-only control group.

Depression. Malouff et al measured general psychological distress and found a small but significant between-group effect post-intervention ($d=0.26$), in favour of using a self-help book over a waiting list control. The authors used complete case data only; intention-to-treat analyses may have produced different results. Neither Nyenhuis et al's internet or book interventions resulted in significant effects on depressive symptoms at post-intervention or follow-up, when compared to their information-only control.

Functional management, anxiety, and quality of life. None of the studies in this comparison measured quality of life, anxiety, or measures of functional management.

SELF-HELP INTERVENTIONS VS. ACTIVE CONTROLS

Two RCTs (Kaldo et al, 2007; Nyenhuis et al, 2013b) compared the effects of self-help interventions with active controls, either use of a therapist-guided self-help book or group therapy. One NRCT (Kaldo et al, 2013) evaluated the effects of an unguided and therapist-guided internet intervention. Such comparisons allow us to assess whether the effects of self-help interventions differ significantly to therapist-led psychological interventions. Table 3 provides a summary of these intervention effects.

Tinnitus distress. Only Kaldo et al (2007) carried out a between-group comparison of self-help interventions and active controls. They found no significant difference in the tinnitus distress between groups who used a self-help book, with (active control) or without (intervention) therapist guidance, at post-intervention or one-year follow-up. They did, however, see a greater reduction in the therapist-guided group when tinnitus distress was measured using the tinnitus handicap inventory (THI; Newman et al, 1996). However that difference was not maintained at one-year follow-up. There were no significant differences in the percentage of people reaching what they defined as a clinically significant reduction in tinnitus reactions questionnaire (TRQ; Wilson et al, 1991) scores for the self-help intervention or active control group at post-intervention (28%; 32%, respectively) or at one-year follow-up (29%; 26%, respectively).

Table 2. Presence of between-group effects for studies comparing levels of tinnitus distress and depression between self-help interventions and passive controls.

Reference	Intervention	Control	Tinnitus distress		Depression	
			P-I	FU	P-I	FU
Loumidis et al (1991)	Information leaflet	Waiting list	No effect ^a	–	–	–
Malouff et al (2010)	Self-help book	Waiting list	No effect ^b	–	Effect ^c	–
Nyenhuus et al (2013b)	Self-help book	Information leaflet	No effect	Effect ^b	No effect	No effect
	Internet intervention		Effect	Effect ^b	No effect	No effect

Key: P-I: Post-intervention; FU: Follow-up; ^aOnly post-intervention scores compared between groups. No pre-intervention scores collected;

^bThese results should be interpreted with caution as complete case analysis showed opposite effect; ^cComplete case analysis. Intention-to-treat not reported.

Table 3. Presence of between-group effects for studies comparing levels of tinnitus distress, depression, anxiety, and sleep quality between self-help interventions and active controls.

Reference	Intervention	Control	Tinnitus distress ^a		Depression		Anxiety		Sleep quality	
			P-I	FU	P-I	FU	P-I	FU	P-I	FU
Kaldo et al (2007)	Self-help book	Therapist-guided self-help book	No effect	No effect	No effect	No effect	Effect	No effect	No effect	No effect

Key: P-I: Post-intervention; FU: Follow-up; ^aOnly effects for primary outcome measure of tinnitus distress are reported.

Although Nyenhuis et al did not specifically aim to compare self-help interventions with an active control, they did include both self-help interventions (book and internet) and an active control (group therapy) in a four-arm trial that allowed a comparison of within group effect. The internet intervention within group effect size at post-intervention was 1.04, which was slightly larger than that for the active control ($d=0.89$). Conversely, the internet intervention within group effect size at follow-up ($d=0.66$) was slightly smaller than that for the active control ($d=0.74$). Comparatively, the within group effect sizes for the self-help book intervention were small at post-intervention ($d=0.24$) and follow-up ($d=0.39$).

Kaldo et al (2013) evaluated both unguided (intervention) and therapist-led (active control) internet interventions but did not perform any between-group comparisons. For the internet self-help intervention group, tinnitus distress significantly reduced post-intervention, although the size of the effect was very small ($d=0.1$). This effect size was smaller than those for the active control ($d=0.32$), suggesting that therapist presence may be an important mediator of intervention outcome. However, this study's lack of between-group comparisons meant that this could not be confirmed.

Depression and anxiety. Kaldo et al (2007) demonstrated that their therapist-guided self-help book led to a significantly greater reduction in anxiety (but not depression), than using the unguided self-help book. However, between-group differences were not significant at one-year follow-up.

Table 4. Number of self-management components and behaviour change techniques across studies.

<i>Behaviour change techniques taxonomy</i>	<i>Number of studies</i>
1.4. Action planning	4 ^{b-e}
4.1. Instruction on how to perform the behaviour	4 ^{b-e}
8.1. Behavioural practice/rehearsal	4 ^{b-e}
1.1 Goal setting (behaviour)	3 ^{b,c,e}
2.3. Self-monitoring of behaviour	3 ^{b-d}
2.4. Self-monitoring of outcome(s) of behaviour	2 ^{b,c}
3.2. Social support (practical)	2 ^{b,c}
5.6. Information about emotional consequences	2 ^{b,c}
12.5. Adding objects to the environment	2 ^{b,e}
1.2. Problem solving	1 ^b
1.5. Review behaviour goal(s)	1 ^c
7.1. Prompt/cues	1 ^b
8.3. Habit formation	1 ^b
8.6. Generalization of target behaviour	1 ^b
8.7. Graded tasks	1 ^b
<i>PRISMS Self-management components taxonomy</i>	<i>Number of studies</i>
Education about condition and management	5 ^{a-e}
Training/rehearsal for psychological strategies	4 ^{b-e}
Lifestyle advice and support	4 ^{b-e}
Information about available resources	3 ^{a,c,e}
Provision of / agreement on specific action plans and/or rescue medication	2 ^{b,d}
Monitoring of condition with feedback to the patient	1 ^c
Practical support with adherence (medication or behavioural)	1 ^b
Provision of equipment	1 ^c

Key: ^aLoumidis et al (1991); ^bKaldo et al, (2007); ^cMalouff et al, (2010); ^dKaldo et al, (2013); ^eNyenhuis et al, (2013b).

Functional management and quality of life. Kaldo et al (2007) compared levels of sleep quality but found no significant between-group differences at post-intervention or one-year follow-up. None of the studies in this comparison measured quality of life.

Secondary review aim: Identifying what intervention techniques were used within the interventions

Table 4 lists the behaviour change techniques and self-management components identified across studies. Only the four CBT-based studies (Kaldo et al, 2007; Malouff et al, 2010; Nyenhuis et al, 2013b; Kaldo et al, 2013) contained any behaviour change techniques. These techniques tended to be targeted at the intervention 'tools', mainly directed at relaxation behaviour. Most techniques functioned to encourage enablement (i.e. increase an individuals' capability or opportunity for performing behaviour) or to impart skills through behavioural training (Michie et al, 2014a). The most popular enablement techniques included 'action planning' (n=4), 'goal setting (behaviour)' (n=3), and 'self-monitoring of behaviour' (n=3). Regularly used skills training techniques included 'instruction on how to perform the behaviour' (n=4) and 'behavioural practice/rehearsal' (n=4).

The PRISMS self-management components taxonomy could describe some of the additional self-help specific intervention content that was not directed specifically at behaviour change. 'Education about condition [tinnitus] and management' was the only consistent component across all five self-help interventions. 'Training/rehearsal for psychological strategies' and 'lifestyle advice and support' were components of the four CBT-based interventions. One study (Nyenhuis et al, 2013b) included knowledge self-assessments throughout to check material comprehension.

Interventions provided training/rehearsal in various psychological strategies including: (1) *cognitive restructuring* to identify, examine and challenge negative thoughts; (2) *applied relaxation* or *positive imagery*; (3) *sound enrichment*; (4) *attention control*, which utilizes positive imagery or focus exercises to increase one's ability to control their attention; (5) *exposure to tinnitus* where individuals actively and repeatedly focus on their tinnitus in a controlled and gradual way to improve their tolerance to it; (6) *behavioural activation*, which encourages individuals to re-introduce or increase pleasant activities that may have been avoided as a result of tinnitus; (7) *action planning*; (8) *goal setting*; (9) *problem solving*; and (10) *self-instructions* in which people internally give themselves instructions to motivate themselves and change how they respond to tinnitus (e.g. 'Do not panic. I can handle my tinnitus.').

Lifestyle advice and support was either general (e.g. handling life stressors, sleep management, concentration management, physical activity) or tinnitus-specific (e.g. hearing tactics) and tended to be more informational in nature rather than training around specific self-management or psychological skills. This intervention content tended to be passive in nature, offering advice regarding specific self-management behaviours (e.g. avoid caffeine before bed), without any supporting BCTs.

Social support components were not provided in any of the interventions. Two studies used practical social support as a behaviour change technique. However, this technique was brief and limited to providing advice on how social support can be used to facilitate behaviour (e.g. 'ask someone to read the relaxation script for you') rather than being explicitly provided as part of the intervention.

Discussion

The primary aim of this systematic review was to assess the effects of self-help interventions on levels of tinnitus distress, functional management, depression, anxiety, and quality of life of adults with chronic tinnitus. Our secondary aim was to systematically identify what techniques are used in these interventions. This review was the first, to our knowledge, to apply taxonomies from health psychology to achieve this aim.

We identified only five studies, including three RCTs, that assessed the effects of self-help interventions delivered via books, the internet, and an information leaflet. Regarding the primary aim of this review, our narrative synthesis found mixed results for the effect of self-help interventions on tinnitus distress when compared to passive controls. Only one of the three studies exploring this comparison found a significant between-group effect for their self-help intervention. The other two studies found no between-group effects of self-help interventions, but issues of poor quality called into question the accuracy of these findings. We found that the findings for the effects of self-help on psychological distress were also mixed and limited. Only one of the two studies in this comparison that assessed depression found significant between-group effects for their self-help intervention.

Comparison between the efficacy of self-help interventions with traditional face-to-face therapies or therapist-guided self-help interventions allowed us to assess whether they can provide comparable benefit to people with tinnitus. In this review, we could not draw confident conclusions regarding this as only one study carried out a between-groups comparison of self-help interventions with active controls. Other meta-analyses of different long-term conditions have demonstrated that effect sizes for unguided interventions are smaller than those for therapist-guided self-help interventions (Spek et al, 2007; Baumeister et al, 2014). However, using meta-analysis, Nyenhuis et al (2013a) found that the findings for self-help CBT interventions for tinnitus are somewhat mixed. They found that the presence of therapeutic contact did not influence the effect sizes for tinnitus distress and depressiveness outcomes, with one exception. The presence of therapeutic contact was demonstrated to be a predictor of larger effect sizes for depressiveness when comparing self-help interventions to passive controls. However, similar to our review, their conclusions were based on limited number of studies.

We found there was a considerable variability regarding outcome measures. The four tinnitus questionnaires used across the studies have a different level of sensitivities to different aspects of tinnitus (Fackrell et al, 2014), which can make comparisons between studies difficult. Moreover, these questionnaires tend to focus on the emotional aspects of tinnitus (Fackrell et al, 2014), with the social and functional aspects of tinnitus represented to a lesser extent. Other, more sensitive, measures of treatment-related change, such as the tinnitus functional index (Meikle et al, 2012), which also measure functional and social domains (e.g. sleep, sense of control, and quality of life), may better capture changes resulting from self-help interventions. Generic quality of life measures would also provide an insight into how self-help interventions may reduce the impact of tinnitus on an individual's everyday life, but this outcome was not assessed in any of the studies. Moreover, such measures would allow comparisons of intervention effects to be made with other long-term conditions, which can be helpful when considering allocation of healthcare resources (Kennedy et al, 2004).

Regarding the secondary review aim, we previously knew very little about the 'active ingredients' of self-help interventions for

tinnitus, which makes it difficult to replicate these interventions in research and practice, and determine what works, for whom, and how the intervention works. In this review, we were able to identify several behaviour change techniques and self-management components used in the tinnitus self-help interventions evaluated in the literature so far. With the exception of one information leaflet intervention, most self-help interventions contained multiple techniques and components. This understanding of the ingredients of self-help intervention can guide the replication of these established interventions or development of new interventions. This work provides insight into the 'active ingredients' of self-help interventions for tinnitus and, in turn, the potential processes by which they lead to changes in outcome. Many of the intervention techniques identified in this review functioned to provide education and skills training and promote enablement. Processes relating to knowledge gain, changes in cognitions (i.e. attitudes, beliefs), self-efficacy, and skills building may be worth further investigation.

Despite the lack of therapist contact, we also found that these interventions were still able to provide many techniques and components traditionally provided in face-to-face therapy (e.g. education about tinnitus, training in psychological strategies, action planning, goal setting). Peck (2010) argued that the therapeutic relationship is not a common factor of therapy, but merely a channel through which important therapeutic factors (e.g. cognitive mastery, behavioural regulation) can be delivered. Self-help materials, including books and internet, provide an alternative channel. Similar to a therapist, these channels may vary in their effectiveness, depending on their ability to deliver these factors.

One point of interest was the lack of explicit social support components in these interventions, which has been identified as a key part of self-management interventions for long-term conditions (Taylor et al, 2014). The need for social support provision may be even greater in self-help interventions where there is no therapist contact. Specifically, Thompson et al, (2011) provided evidence to suggest that the peer support provided in group therapy can facilitate coping with tinnitus through information exchange, validation of experience, and social comparison. In the context of self-help, online support groups have also shown to provide many benefits to people with chronic health conditions (Mo & Coulson, 2013), such as the sharing of useful information and provision of emotional and social support to others with shared experiences. Although they may produce only small effect sizes on their own (Jasper et al, 2014), online support groups may be beneficial as part of a multi-faceted intervention. Alternatively, the use of patient stories can be a powerful self-management tool (Greenhalgh et al, 2011) and can be easily adapted for use in self-help interventions, as was done by Malouff et al (2010) in this review.

Despite being inclusive of all unguided self-help interventions, we only identified one study that used an approach other than CBT (i.e. information only). Hesser et al (2012) demonstrated that self-help based on acceptance and commitment therapy (ACT) can be as efficacious as CBT, if delivered with guidance from a therapist. An interesting and, as yet, unexplored avenue for research therefore is to examine whether ACT is effective if delivered without therapist contact.

Conclusions and future directions

There are three main issues to consider when interpreting the findings of this review. First, we only identified five studies that met our inclusion criteria and they all used different outcomes,

assessment measures, controls, and intervention delivery mediums, making them unsuitable for meta-analysis. The use of measures that assess quality of life and the social and functional, as well as the emotional, impact of tinnitus is recommended. As well as exploring positive outcomes of self-help interventions, there is also a need to explore any potential adverse effects and how these compare with active controls and between self-help interventions. We found such comparisons to be lacking for this review.

Second, the included studies provided a low-to-moderate level of evidence and the quality and risk of bias assessment highlighted several concerns. Specifically, none of the studies attempted to blind participants to the intervention they received. However, this is not always possible when using active or passive controls. It may be more appropriate to use self-help interventions with fewer intervention techniques as controls, such as information-only interventions or online support groups. Participants could be blinded to which intervention arm they are in and this would partially control for any placebo/non-specific effects (e.g. time spent on self-management, knowledge gain).

Finally, the lack of a well-established taxonomy for self-help interventions limited the process by which the intervention techniques were identified and reported. Better reporting and categorization of self-help intervention techniques is needed for study replication and furthering our understanding of the processes by which these components and techniques mediate any changes in outcomes.

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