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# Music-based interventions to address wellbeing in people with a visual impairment: a scoping review

| Journal:                      | BMJ Open  |
|-------------------------------|---|
| Manuscript ID                 | bmjopen-2022-067502   |
| Article Type:                 | Original research   |
| Date Submitted by the Author: | 18-Aug-2022   |
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| Keywords:                     | Rehabilitation medicine < INTERNAL MEDICINE, MENTAL HEALTH,<br>Paediatric ophthalmology < OPHTHALMOLOGY   |
|                               | ·   |





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**Title:** Music-based interventions to address wellbeing in people with a visual impairment: a scoping review

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Word Count: 5,227

**Key words:** scoping review; vision impairment; music interventions; therapeutic outcomes; wellbeing.

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# Abstract

**Objectives:** The objective of this review was to identify the types of music-based interventions previously used for people with a VI and their effect on wellbeing. **Design**: A scoping review was developed according to the Joanna Briggs Institute methodology and reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews checklist and guidelines. A narrative synthesis was conducted to map out the types of music-based interventions undertaken and to compare the therapeutic outcomes. The studies were evaluated according to the music reporting checklist.

**Results**: In total 5,082 records were identified, 69 full-text articles were screened, and 13 studies were included in this review. Eleven of the studies were targeted at younger children and teenagers and two focussed on adults with acquired VI. Ten of the studies involved active music therapy strategies and three studies involved passive music listening. Eleven of the studies focused on social outcomes and two focussed on mental health outcomes. Although the studies reported that music-based intervention strategies improved psychosocial wellbeing in people with a VI, conclusions could not be drawn as robust outcome measures were not generally used and only four of the studies included any statistical analysis.

**Conclusions**: Only 13 studies, of which 10 were case reports have evaluated the effect of music-based interventions to improve psychosocial wellbeing in people with a VI. Although potential was demonstrated, further high-quality evidence-based studies are required.

# Article summary:

# Strengths and limitations of this study:

- This study used best practice methods to conduct a scoping review.
- Publications written in all languages were considered for inclusion.
- Any type of clinical trials, comparative, evaluative and observational studies were eligible.
- In this study there were inconsistencies in the way outcomes were measured that made it difficult to synthesise results in proportionate detail across the studies.
- This study found there is a limited volume of literature which has explored the effects of music-based interventions on wellbeing for people with vision impairment, particularly with adults.
- This review found, there is a lack of detail regarding music and music therapy protocols and whether specific skills are required to deliver them.

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# <u>Introduction</u>

A visual impairment (VI) impacts all aspects of a person's life and is associated with reduced functional ability. The effects may vary depending on the level of visual impairment, but often include difficulties with reading, writing, comprehending nonverbal cues and following conversations in social situations.<sup>1-3</sup> Such difficulties may impact an individual's mental health, causing depression,<sup>4-7</sup> emotional distress,<sup>6</sup> anxiety,<sup>8-</sup> <sup>11</sup> feelings of loneliness, <sup>12</sup> social isolation<sup>12</sup> and a loss of a sense of belonging. <sup>13, 14</sup> Together with addressing the visual difficulties, improving the wellbeing of those with a VI should be prioritised<sup>15-17</sup> as both psychological and social factors influence mental health and impact psychosocial wellbeing.<sup>18</sup> Some ways to address psychosocial wellbeing could be through physical activity <sup>19</sup>, arts activities<sup>20</sup> and mindfulness.<sup>21</sup> Another approach to addressing the psychosocial wellbeing of people with a VI can be through music-based interventions. Music can create feelings of physical and mental relaxation by disguising environmental noises and transferring an individual's attention to a more pleasant emotional state.<sup>22-26</sup> Music-based interventions can be regarded as multifunctional, i.e., they may involve purposeful musical activities, music listening, making music, playing musical instruments, or singing. In the literature there is a distinction between musicbased interventions run by a music therapist and those by other health care professionals. Interventions involving a music therapist are characterised by the presence of a therapeutic process and the use of personal music experiences.<sup>27-30</sup> Interventions in a music therapy context may involve active music listening, such as interacting with music live, music listening, music playing, composing, song writing or improvisation (creating music using instruments, music-based activities).<sup>31</sup> In contrast, when the music-based intervention is offered by a medical or healthcare professional, this can be defined as a

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purposeful music activity such as passively listening to pre-recorded music and has been referred to as music medicine.<sup>32</sup>

Several studies suggest that listening to music can induce pleasant and positive feelings by the activation of the limbic system.<sup>33, 34</sup> Music has also been shown to have a broad range of therapeutic effects, such as giving individuals a sense of connection, which fosters feeling of community, and promotes feelings of interpersonal attachment which can offset loneliness.<sup>35-38</sup> Engaging in musical activity leads to a decrease in cortisol<sup>39</sup> which may in turn alleviate anxiety, promote relaxation, improve mood and decrease agitation.<sup>40</sup> Studies have been conducted in VI populations to promote social cohesion, interpersonal communication<sup>12 13</sup> and for relaxation. Listening to calming music has been used during medical treatment for open-angle glaucoma<sup>45-47</sup> and during cataract surgery.<sup>48</sup> In addition, people with a VI rely on other means of communication such as sound and touch to compensate for their vision loss.<sup>41</sup> Research indicates, people with a VI prefer auditory mediums, such as listening to music or the radio,<sup>42</sup> children preferring musical toys <sup>43</sup> and in general enjoy engaging in music a means of expression.<sup>38</sup> The most recent review of music-based interventions for people with a VI was conducted by Park et al.<sup>51</sup>Although this study added value in terms of music-based intervention trends for educational purposes, it excluded studies that used music for relaxation and did not focus on the therapeutic outcomes of those studies to promote psychosocial well-being. In addition, there may have been other music-based intervention studies conducted with people who have a VI since the review was published. To date, no study has attempted to identify the volume of literature on music-based interventions aimed at improving wellbeing in people who have a VI, thus indicating a need for an up-to-date review.

A scoping review was selected for this study as it is the most useful tool to examine and investigate a new research topic that has not been fully established in the literature.<sup>44</sup> It allowed for mapping literature across disciplines that are relevant for this study. Unlike

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other types of reviews such as systematic, a scoping review is broad and allows the researchers to formulate their own research questions.

The aims of this review were to investigate and map the literature on how music-based interventions have been used with people with a VI to promote their psychosocial wellbeing and any accessibility challenges that may have hindered people with VI taking part in the intervention at locations away from their home. This is important to highlight, as often people with VI are not always able to access face-to-face interventions because of constraints related to transport, geographical location of clinics and/or finances.<sup>45</sup> Similarly, the review investigated if special arrangements and/or accessibility technologies were utilised in the intervention setting and during the treatment to address specific challenges regarding participants navigating unfamiliar settings (both online and in-person).<sup>46</sup>

# Objectives

The scoping review questions were categorised into three aspects as described below: *1. Description (Types of interventions):* 

- What types of music-based intervention studies have been conducted to date that have addressed wellbeing among people with VI?
- What is the geographical scope of the conducted studies?
- In what ways was the intervention made accessible for people with a VI?

# 2. Population groups:

- What participant demographics were recorded? (e.g., age, gender, ethnicity, and nationality)
- Was the intervention targeted at specific ocular pathologies? (e.g., congenital or acquired)
- 3. Therapeutic outcomes of the intervention:
  - What therapeutic outcomes and outcome measures were used?
  - What were the main intervention findings?

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# **Methods**

# Protocol and registration

As presented in the published protocol,<sup>47</sup> this review follows the methodology manual published by the Joanna Briggs Institute for scoping reviews<sup>48</sup> and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.<sup>49</sup> A search on Cochrane Reviews, JBI Evidence Synthesis and Prospero showed no current or ongoing review on this topic.

# Eligibility criteria:

The PCC format (P—participants/population, C—context, C—concept) was used to formulate the inclusion criteria.<sup>50, 51</sup>

#### Participants:

This review considered studies that included people of any age with a VI, with or without additional health-related problems.

# Context:

This scoping review identified music interventions used therapeutically in people with a VI to improve wellbeing. It also analysed the contexts in which the music-based interventions have been used, including music therapy, music listening and other music-based activities. Therapeutic outcomes and treatment characteristics were examined. The therapeutic outcome domains included quality of life (any health-related quality of life measures), physiological outcomes/health related outcomes (such as blood pressure/heart rate), mental health (for example well-being, anxiety, or depression) and communication and social outcomes (including social engagement).

Concept:

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Interventions delivered in all settings were included if they addressed the therapeutic outcome domains outlined above.

#### Information sources:

The review included all types of published studies such as clinical trials, case studies, comparative, evaluative and observational. Publication types included peer-reviewed journal publications, postgraduate theses, and conference papers. There was no publication date restriction. This wide approach to data gathering provided an extensive and comprehensive selection of sources to address the research question. Studies that have investigated music for non-therapeutic purposes or with short-term wellbeing objectives, opinion papers, preconference abstracts, preprints and undergraduate theses were not included.

# Adaptations to the original protocol:

To better capture the most relevant aspects of the included studies, the original inclusion criteria: PCC (P—participants/population, C—context, C—concept) in the protocol were modified.<sup>47</sup> For the context, therapeutic wellbeing outcomes during ophthalmic treatments/procedures were excluded. This includes ophthalmic procedures such as (i) cataract surgery, (ii) routine eye health check-up, (iii) retinal eye laser treatments, (vi) treatment for glaucoma and (v) eyelid surgeries. This decision was due to the outcome only measuring therapeutic outcome domains whilst undergoing the procedure, rather than a wellbeing shift in the individual's overall life across the selected therapeutic outcome domains of interest. Subsequently, by refining the area of interest, interventions conducted in hospital/medical operation setting/environment were excluded. This is because, the outcome measures were only relevant to ophthalmic treatment or procedure rather than for those people living with long term VI (non-irreversible vision loss that is rectifiable by surgical procedures).

Search strategy and selection of sources of evidence

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The databases searched were as follows: EMBASE (Ovid interface, 1974 onwards), MEDLINE (Ovid interface, 1948 onwards), CINAHL Plus (EBSCOhost) PsycINFO (EBSCOhost) and Web of Science (Clarivate Analytics). Further search strategies will include free-text hand searches in Google Scholar for grey literature and screening reference lists of all relevant studies. The searches were conducted on: 14 December 2021 and again on 11 April 2022. The purpose of using a variety of major databases was to ensure adequate and efficient coverage related to health, life sciences, nursing, and psychology.<sup>52</sup> The detailed search terms can be found in *supplemental data 1.* The retrieved studies were exported into Mendeley, and duplicates were automatically removed. One reviewer (NS) first screened the titles and abstracts for eligibility for fulltext analysis. This was then cross-checked by a second reviewer (RL). The reviewers independently classified the eligible articles for inclusion for the scoping review into one of the following groups:

1. Therapeutic wellbeing outcomes: Interventions with a *short-term* therapeutic wellbeing outcome(s) to improve wellbeing in VI populations.

2. Therapeutic wellbeing outcomes: Interventions with a *long-term* therapeutic wellbeing outcome(s) to improve wellbeing in VI populations.

Where there was a disagreement between the two reviewers at any stage of the study selection process, a final agreement was sought by mutual consensus with input from a third reviewer (PMA). When the full text of an article was not available in English language (n = 2), a professional translation service was used.

#### Data charting process and data items

Data extraction tables were developed using the JBI scoping review template<sup>57</sup> and the Checklist for Reporting Music-based Interventions<sup>53</sup> to capture the information necessary for data synthesis. Two reviewers (NS, RL) independently performed a pilot data extraction on a random sample of three articles and consequently refined the extraction

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table accordingly. The purpose of the reviewers to independently perform the pilot data extraction was to minimise reflexivity, that is both researchers involved acknowledge prior experiences, assumptions and beliefs may influence the research process, hence, checking for appropriateness. Any disagreements were resolved through the involvement of the third reviewer. This procedure limited subjectivity in the reviewing process. To ensure quality assurance during the data charting process, both reviewers read and continued to refer to the JBI review checklist in the reviewer's manual.<sup>59</sup> The agreed data extracted by the authors was: (1) author and year of publication and country) (2) participant demographics (mean age, sample size, ocular pathologies, gender, and nationality (ethnicity)) (3) description and findings of the review studies (study design, intervention description (strategies used, setting, length and duration of the intervention and who delivered the intervention), accessibility adaptations and main study findings) (4) therapeutic outcomes of interest (e.g. change in behaviour, social engagement, psychological wellbeing) and (5) corresponding therapeutic outcome measures (e.g. physiological parameters, questionnaires, observations, interviews), The data items were grouped into sub tables to present the data.

# Critical appraisal of individual sources of evidence

A critical appraisal of the sources of evidence was not conducted as part of this review. The primary goal was to enquire what has been investigated to date and to understand the scope for future research, rather than to assess the reliability of study findings. However, the Music-based intervention reporting checklist sections were reported as per guidelines by Robb et al (2011).<sup>53</sup> Further to this, Robb et al.<sup>53</sup> recommends a specific set of guidelines. Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Therefore, the purpose of the checklist is to improve the transparency and specificity of reporting music-based interventions. The checklist consists of seven different sections of music-based interventions including intervention theory, intervention content, intervention delivery schedule, interventionist, treatment fidelity, setting, and unit of delivery. These sections are intended to support Consolidated Standards of Reporting

Trials (CONSORT) and Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statements for transparent reporting of interventions while taking into account the variety, complexity, and uniqueness of music-based interventions.<sup>53</sup> The checklist has been used in previous studies as a tool to report the quality of the music intervention research in terms of clinical relevance and rigour. For this review, the checklist was used to evaluate the individual sources of evidence. <sup>54-56</sup>

# Synthesis of results

 PRISMA-ScR guidelines were followed to report the results from the extracted data.<sup>60</sup> This allowed us to identify the characteristics of sources and map the existing literature. For data presentation, the results were categorised by its study designs (non-experimental and experimental) and extracted data was grouped and tabulated with a descriptive numerical analysis to identify comparative data. In addition, to synthesise the data, it is presented as tables to summarise the key findings addressing the research questions in the three broad categories. Existing gaps in the research were determined on the evaluation of the interventions to improve wellbeing in people with a VI.

# Patient and public involvement:

No patient involved.

### <u>Results</u>

# Selection of sources of evidence

The database search yielded 5,082 citations after removal of duplicates (*See Figure 1*). Screening of titles and abstracts resulted in a first classification, after which 69 papers were included for full-text review. Thirteen studies met the final inclusion criteria for this review.<sup>47</sup>

**INSERT HERE: Figure 1.** PRISMA Flow diagram of study inclusion process

# Characteristics of sources of evidence

# Summary of the study characteristics

The geographical scope of the studies included in the review was restricted to America (n = 7), Australia (n = 1), Canada (n = 1), Brazil (n = 2), Germany (n = 1), and China (n = 1). From the studies included the first music intervention study in a VI population was undertaken in 1982 and the most recent in 2016. Three out of the 13 studies were conducted with adults, the remaining 10 studies' participants were young children and teenagers under the age of 18 years. One study took place at the participant's home, the rest took place in an external location, such as a school or clinical environment.

# Synthesis of results

A narrative synthesis of the results that supplements the tabulated results is separated by the following four sections:

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- (i) participant demographics
- (ii) description of the studies
- (iii) therapeutic outcomes
- (iv) Checklist for Reporting Music-based Interventions

This was done, by their respective study designs (non-experimental and experimental), identifying the gaps in the literature and scope for future music-based interventions.

# (1) Participant demographics

# Non-experimental studies

A total of 28 participants were included in the non-experimental studies. The range of the sample size of each study varied from 1 to 10 participants with six studies having one participant, one study had two participants and two studies had 10 participants respectively. All the case studies were performed on children (age range was 2-18 years; mean: 8.5 years, SD:  $\pm$ 5.3) of which half *n* = 14 (50%) were female. The nationality was

stated, but no ethnicity was disclosed. The vision impairment of the participants was mainly congenital or acquired at a very young age (See Table 1).

| Author<br>(year,<br>country)   | Sample size | Mean age       | Gende<br>r                     | Nationality<br>(Ethnicity) | Vision impairments  |
|--|-------------|----------------|--------------------------------|----------------------------|---|
| Rogow, S<br>(1982,<br>Canada) <sup>58</sup>                            | 10          | 4 years        | 6<br>Femal<br>es<br>4<br>Males | Canadian<br>(Chinese)      | Anophthalmia, cortical blindness, partial sight impairmen<br>several sight impaired and total blindness   |
| Salas, J <i>et</i><br><i>a</i> l.(1988,<br>USA) <sup>59</sup>          | 1           | 4 years old    | Femal<br>e                     | American/Itali<br>an       | Bilateral optic atrophy   |
| Shoemark<br>, H (1991,<br>Australia)<br><sub>60</sub>                  | 1           | 8 years old    | Male                           | Australian                 | Detached retina (blind)   |
| Silliman,<br>LM. <i>et al.</i><br>(1994,<br>USA) <sup>61</sup>         | 1           | 10 years old   | Male                           | American                   | Blind   |
| Kern P et<br>al. (2001,<br>USA) <sup>62</sup>                          | 1           | 3 years old    | Male                           | American<br>(African)      | Bilateral congenital anophthalmia/microphthalmia  |
| Villaseno<br>r, R. <i>et al.</i><br>(2012,<br>USA) <sup>63</sup>       | 2           | 14.5 years     | 1<br>Femal<br>e<br>1 Male      | American                   | Retinopathy of prematurity  |
| Desroche<br>r, M. <i>et</i><br><i>al.</i> (2014,<br>USA) <sup>64</sup> | 1           | 13 years old   | Femal<br>e                     | American                   | Bilateral congenital anophthalmia   |
| Metell, M<br>(2015,<br>Norway) <sup>6</sup><br>5                       | 10          | 2.5 years      | 5<br>Femal<br>es<br>5          | Brazilian                  | Optic nerve atrophy, septo-optic dysplasia, chorioretiniti<br>coloboma of optic papilla, chorioretinitis, microphthalmi<br>corectopia-clara, optic nerve atrophy, toxoplasmosis, agene<br>ocular, optic nerve atrophy, anophthalmia |
| Villas<br>Boas, D.<br><i>et al.</i><br>(2016,<br>Brazil) <sup>66</sup> | 1           | 5 years of age | Males                          | South<br>American          | Nystagmus and blind   |
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# Experimental studies

A total of 134 participants were included in the four experimental design studies. The range of the sample size of each study varied from 1 to 80 participants, the rest of the studies had more than six. The age range was 5-55 years (mean: 32.2 years, SD:  $\pm$ 21.68). The age range of the two studies with children, was 5-17 years. Slightly more participants n = 75 (56%) were female. All had congenital vision impairments (See *Table 2*).

| Author                                  | Sample size   | Mean age     | Gende       | Nationality | Vision impairments                                     |
|---|---------------|--------------|-------------|-------------|--|
| (year,<br>country)                      |               |              | r           | (Ethnicity) |  |
|   |               |              |             |             |  |
| Hill, J. et                             | 1             | 17 years old | Femal       | American    | Blind  |
| <i>al.</i> (1989,<br>USA) <sup>67</sup> |               |              | e           |             |  |
| Robb, S                                 | 12 (6         | 5 years      | 1           | American    | Blindness ranging from: one prosthetic eye, bi-lateral |
| (2003,<br>USA) <sup>2</sup>             | completed the |              | Femal       |             | retinoblastoma nystagmus, cortical visual impairment   |
| ,                                       | ;;            |              | 5 Male      |             |  |
| Zhao, L.                                | 80            | 51 years     | 40          | Chinese     | Diabetic retinopathy                                   |
| <i>et al.</i><br>(2005                  |               |              | Femal       |             |  |
| China)68                                |               |              | 40          |             |  |
|   |               |              | Male        |             |  |
| Bertelma                                | 41            | 55.8 years   | 17<br>Femal | German      | Open angle glaucoma                                    |
| al. (2015,                              |               |              | e           |             |  |
| Germany                                 |               |              | 14          |             |  |
| )69                                     |               |              | Male        |             |  |
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# (2) Description of the studies

# Non-experimental studies

Six out of the nine non-experimental studies were a single subject case study<sup>59-62,64,66</sup> and three were case series<sup>58,63,65</sup>. Four of the studies were led by a music therapist<sup>59,60,62,64</sup>, three by schoolteachers<sup>63,65,66</sup> and two were undertaken by researchers<sup>58,61</sup>. In terms of music therapy strategies used, improvisation, which included playing instruments to create music and accompanied with singing was used in four studies<sup>59,60,65,66</sup>, three used music-based activities such as playing with musical toys,<sup>61,62,64</sup> one study used passive music listening<sup>63</sup> and one used singing nursery rhymes.<sup>58</sup>

The average music listening time and duration was 30 minutes per day over a period of two-months. Seven out of the nine studies were conducted in a school setting<sup>58,60,61,62,63,64,66</sup> and the other two were undertaken in a private clinical setting<sup>59</sup> and university research centre<sup>65</sup> respectively. Four studies did not report any accessible adaptations made for people with a VI.<sup>58,60,61,64</sup> Two studies reported the study sessions were lead and guided by the researchers or teachers as a means of making the intervention more accessible, by being present to offer support.<sup>63,66</sup> One study reported training was provided to the parents/carers of the participating children to make it more accessible by offering assistance.<sup>65</sup> Only two studies reported making adaptations to the intervention setting environment to make it more accessible, for example, one study made adaptations to the layout of the playground<sup>62</sup> and the other made changes to the lighting of the therapy room<sup>59</sup> (See *Table 3*). All five studies refer to accessibility and adaptations made; however they lack specific detail on how barriers were addressed, and support provided. This illustrates a deficit in reporting, if barriers and resolutions are not reported then best practiced cannot be implemented in future research. This is particularly important as often people with VI are unable to access face-to-face interventions because of constraints related to the location, intervention setting <sup>45</sup> and/or participants navigating the unfamiliar settings.<sup>46</sup>

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| Author<br>(year,<br>country)                      | Study<br>design | Strategies<br>used  | Length and<br>duration of<br>the<br>intervention  | Who<br>delivered/<br>facilitated the<br>intervention | Intervention<br>setting/patient<br>population        | Accessible<br>(Yes/No) and what<br>accessibility<br>adaptations were<br>made?                           | What are the<br>main findings  |
|---|-----------------|---|---|--|--|---|--|
| Rogow, S<br>(1982,<br>Canada)                     | Case<br>reports | Singing<br>nursery<br>rhymes<br>researcher  | 30 minutes<br>daily over a<br>period of 2<br>months                                       | Researcher   | School/very<br>young<br>multihandicapped<br>children | None stated   | Nursery<br>rhythms can<br>help develop<br>communicativ<br>behaviours.  |
| Salas, J <i>et</i><br><i>a</i> l.(1988,<br>USA)   | Case<br>study   | Music<br>therapy:<br>improvisation  | Twice a<br>month, 30-<br>minute<br>sessions for<br>10 months                              | Music<br>therapist                                   | Clinical<br>setting/private<br>clinic                | Yes. Lights in the<br>room were<br>switched off to<br>create a restful and<br>semi dark<br>environment. | Long term<br>positive<br>changes in<br>physical and<br>mental<br>capabilities,<br>expressive and<br>creative<br>aspects were<br>identified in<br>the<br>participant's<br>personality.  |
| Shoemark,<br>H (1991,<br>Australia)               | Case<br>study   | Music<br>therapy:<br>improvisation,<br>singing, and<br>learning to<br>play the piano                            | 30-minute<br>sessions,<br>twice a<br>week for 9<br>months                                 | Music<br>therapist                                   | Residential<br>educational<br>facility (school)      | None stated   | Basic music<br>skills<br>developed, ,<br>spontaneous<br>interaction an<br>increased<br>participation :<br>classroom<br>activities was<br>recognised.   |
| Silliman,<br>LM. <i>et al.</i><br>(1994,<br>USA)  | Case<br>study   | Music based<br>activity:<br>involving<br>playing music<br>as a reinforcer<br>to help<br>improve<br>motor skills | 30-to-40-<br>minute<br>sessions,<br>three times<br>a day for 10<br>days                   | Researcher   | School   | None stated   | All four gross<br>motor skills<br>increased<br>noticeably<br>when music<br>was introduce<br>as a reinforcer<br>The authors<br>also conclude:<br>such skills ma<br>be maintainee<br>with regular<br>use of them.  |
| Kern P et<br>al. (2001,<br>USA)                   | Case<br>study   | Music based<br>activity:<br>different<br>music<br>instruments<br>to play with,<br>located in the<br>play area   | Daily for 35<br>days (period<br>daily not<br>specified)                                   | Music<br>therapist and<br>schoolteacher              | School   | Yes. Adaptations<br>were made<br>specifically for the<br>participant in the<br>playground. †            | The playground<br>adaptation<br>resulted in no<br>changes in the<br>child's social<br>interactions<br>with peers or<br>adults and no<br>change in<br>movement on<br>the<br>playground, a<br>well as a<br>decrease in<br>stereotypical<br>responses. Th<br>findings<br>suggest that<br>musical<br>adaptations of<br>physical<br>environments:<br>may be helpfi<br>but not<br>sufficient for<br>promoting<br>desired<br>outcomes |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA) | Case<br>reports | Passive music<br>listening<br>(nature<br>sounds)  | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks | Teacher  | School   | Yes.<br>Teacher/assistant<br>present to support<br>the students   | outcomes.<br>Both students<br>body<br>awareness an<br>movement,<br>listening skill<br>and tactile<br>processing  |

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| Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA)             | Case<br>study   | Music based<br>activity:<br>musical play<br>with musical<br>toy‡                      | Two 8-<br>minute<br>sessions<br>separated by<br>a 10-minute<br>break were<br>held during<br>three days<br>within a<br>period of a<br>week | School<br>teachers | School  | None stated  | Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours and<br>increasing<br>desirable<br>behaviour of<br>an adolescent<br>who is blind<br>with multiple<br>intellectual<br>disabilities<br>durine a |
|--|-----------------|---|---|--------------------|---|--|---|
|  |                 |   |   |                    |   |  | reinforcer<br>assessment.   |
| Metell, M<br>(2015,<br>Norway)                               | Case<br>reports | Music<br>therapy:<br>improvisation<br>and singing<br>Brazilian<br>children's<br>songs | Each session<br>lasted<br>around<br>25min and<br>number of<br>sessions<br>varied from<br>one to<br>Seven over<br>a period of<br>10-weeks  | Music<br>therapist | University<br>Research Centre<br>(pedagogical<br>institution) | Yes. The sessions<br>were lead and<br>guided by the<br>researcher and<br>training was<br>provided to the<br>parents/carers of<br>the children. | Positive<br>bonding<br>patterns and<br>enhances early<br>interaction by<br>providing<br>experiences of<br>togetherness,<br>joint attention,<br>and happiness<br>was identified.   |
| Villas<br>Boas, D. <i>et</i><br><i>al.</i> (2016,<br>Brazil) | Case<br>study   | Music<br>therapy:<br>improvisation<br>and singing<br>rhymes                           | Analysis<br>was<br>observed<br>over 7 days<br>(period was<br>not stated)  | Teachers.          | Educational<br>services provider<br>(school)                  | Yes.<br>Teacher/researcher<br>present to offer<br>support  | Attention<br>seeking<br>behaviour<br>towards<br>teachers and<br>children in the<br>classroom<br>occurred more<br>in the body<br>contact<br>activities,<br>music, and<br>singing and<br>rhythm.                            |

† Six multisensory musical stations with a connecting path (a 10 cm drainage pipe) were added to the playground. To assist navigation the participant was also provided with a pushcart which made a sound when pushed along the path.

‡ Musical toy wad used to reinforce the participant raising their head from their chest, as this was considered socially desirable behaviour.

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# Experimental studies

Two out of the four experimental studies were randomised control trials,<sup>68,69</sup> the other two were quasi (repeated measures)<sup>2</sup> and ABA reversal and stimulation treatment design<sup>67</sup>, respectively. Two of the studies were led by researchers,<sup>68,69</sup> one study conducted by a teacher<sup>67</sup> and one by a music therapist.<sup>2</sup> The music-based intervention strategies used in two out the four studies was music listening,<sup>68,69</sup> one study used improvisation,<sup>2</sup> which included playing with instruments to create music accompanied with singing and one study used a music-based activity that involved listening to prerecorded music.<sup>67</sup> The average music listening time was 30 minutes per day over a period of 15 days. The intervention setting varied from a university research centre<sup>69</sup> to the participants' home<sup>68</sup>, or a school.<sup>67</sup> Three out of the four studies reported on the intervention accessibility adaptation. One study made adaptations to the classroom,<sup>67</sup> one study provided instructional training to those participanting,<sup>2</sup> the third study conducted home visits and did weekly check in calls with the participants,<sup>68</sup> and the fourth study did not state any accessibility adaptations<sup>69</sup>, as seen in *Table 4*.

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| Author<br>(year,<br>country)                      | Study<br>design   | Strategies<br>used  | Length and<br>duration of<br>the<br>intervention   | Who<br>delivered/<br>facilitated<br>the<br>intervention | Intervention<br>setting/patient<br>population                                 | Accessible<br>(Yes/No)<br>and what<br>accessibility<br>adaptations<br>were made?   | What are the<br>main findings?   |
|---|---|---|--|---|---|--|--|
| Hill, J. <i>et al.</i><br>(1989, USA)             | ABA<br>reversal and<br>stimulation<br>treatment<br>design (case<br>study) | Music based<br>activity that<br>involved<br>playing pre-<br>recorded<br>music in the<br>background<br>and with the<br>music<br>stopping<br>when the<br>student gets<br>up from their<br>chair) The<br>music<br>selection<br>included: rap,<br>classical, rock<br>and jazz | Approx. 28<br>sessions,<br>varying<br>from 5 to 20<br>minutes<br>each (exact<br>information<br>not<br>specified) | Teacher   | Special needs<br>university/classroom   | Yes.<br>Adaptations<br>were made<br>in the<br>classroom                            | There were<br>higher rates of<br>in-seat<br>behaviour<br>during the<br>music phase.<br>There was also<br>clear reversal<br>effects withour<br>a music<br>reinforcement   |
| Robb, S<br>(2003, USA)                            | Quasi –<br>(repeated<br>measures)   | Music<br>therapy:<br>Improvisation<br>(including<br>singing)  | 4 x 30-<br>minute<br>sessions: 2<br>music-based<br>sessions, 2<br>play-based<br>sessions<br>without<br>music     | Music<br>therapist                                      | Children's Centre<br>for the Visually<br>Impaired<br>(nursery/play<br>school) | Yes.<br>Instructional<br>training was<br>conducted<br>prior to the<br>intervention | Attentive<br>behavior was<br>significantly<br>higher during<br>music based-<br>sessions $t(5) =$<br>5.81; p = .002).<br>Mean scores fo<br>the remaining<br>group<br>participation<br>behaviours we<br>higher in the<br>music<br>condition, but<br>these<br>differences we<br>not statistically<br>significant.   |
| Zhao, L. <i>et</i><br><i>al.</i> (2005,<br>China) | Randomised<br>control trial   | Passive music<br>listening<br>(happy,<br>cartoon<br>music, sad<br>song<br>selection)  | 30 minutes,<br>twice daily<br>for 28 days  | Researchers   | At home   | Yes. Home<br>visits were<br>done and<br>weekly<br>"check in"<br>calls              | Significant<br>differences we<br>found betwees<br>somatization,<br>interpersonal,<br>anxiety,<br>depression,<br>phobia, and<br>positive score<br>values ( $p$<br><0.05). There<br>a positive score<br>values ( $p$<br><0.05). There<br>a positive score<br>values ( $p$<br><0.05). There<br>function of th<br>diseased<br>patients' quali<br>of life-specific<br>scale and the<br>physical<br>function, socia<br>function, socia<br>function, and<br>mental functio<br>the quality-of<br>life scale of<br>patients with<br>ophthalmopat<br>( $p$ < 0.05). Thi<br>is a positive<br>correlation<br>between the<br>social function<br>and mental ar |

|  |               |   |                              |     |              | c<br><<br>t           | of life scale ( <i>p</i><br><0.05); the<br>creatment<br>dimension is         |
|--|---------------|---|------------------------------|-----|--------------|-----------------------|--|
|  |               |   |                              |     |              | I<br>c<br>t           | positively<br>correlated wit<br>the social                                   |
|  |               |   |                              |     |              | f<br>c<br>s           | function of th<br>quality-of-life<br>scale of patier                         |
|  |               |   |                              |     |              | i<br>«                | with visual<br>mpairment (¿<br><0.05). Menta                                 |
|  |               |   |                              |     |              |                       | dimension is<br>negatively<br>correlated wit                                 |
|  |               |   |                              |     |              | c<br>c<br>a           | compulsion,<br>depression,<br>anxiety,                                       |
|  |               |   |                              |     |              | l<br>l<br>I           | hostility,<br>horror,<br>paranoia, and                                       |
|  |               |   |                              |     |              | s<br>S                | spirit (p < 0.05<br>Social<br>dimension is                                   |
|  |               |   |                              |     |              | I                     | negatively<br>correlated wi<br>compulsion,                                   |
|  |               |   |                              |     |              | i<br>c<br>a           | interpersonal<br>depression, a<br>anxiety ( <i>p</i> <                       |
|  |               | <b>.</b>  |                              | D 1 | TT 1 1 1 1 1 | (                     | 0.05).   |
| T. <i>Et al.</i><br>(2015,<br>Germany) | control trial | listening<br>(treatment<br>group<br>listened to<br>relaxation | session daily<br>for 10 days | 0   | research lab | c<br>a<br>i<br>F<br>s | corrected vis<br>acuity, daily<br>intraocular<br>pressure, and<br>short-term |
|  |               | music)  |                              |     |              | (<br>(<br>)<br>S      | (KAB)<br>development<br>were<br>significantly                                |
|  |               |   |                              |     |              | t<br>i                | better ( $p < 0.0$<br>in the treatm<br>group in<br>comparison t              |
|  |               |   |                              |     |              | c<br>f<br>l           | controls. Visu<br>field testing,<br>long-term                                |
|  |               |   |                              |     |              |                       | mental well-<br>being (profile<br>mood states),                              |
|  |               |   |                              |     |              |                       | and adrenalir<br>cortisol, and<br>endothelin-I                               |
|  |               |   |                              |     |              | I I I S               | blood levels on<br>not differ<br>significantly                               |
|  |               |   |                              |     |              | t                     | between both   |

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# (3) Therapeutic outcomes

# Non-experimental studies

All nine studies investigated only social therapeutic domains<sup>58-66</sup>. These included outcomes such as, social engagement, bonding, and interaction, change in behaviour (e.g., attentiveness), develop interpersonal/social skills (e.g., communication) and participation skills. The corresponding outcome measures used to assess the therapeutic outcomes were qualitative methods, such as observation, note taking, videotaping, and interviews with participants/caregivers. The studies suggested the potential of music-based interventions to improve wellbeing, but these findings are generally based on observations and not on the use of robust experimental designs or the use of validated outcome measures. None of the studies conducted statistical analysis, so it was not possible to draw any definitive conclusions. (See Table 5).

| Author<br>(year,<br>country)                    | Therapeutic<br>Domain of<br>Interest † | Therapeutic<br>Outcomes   | Therapeutic<br>Outcome<br>Measures   | Frequency of when the outcome measures were observed/ Follow up pe   |
|---|--|---|--|--|
| Rogow, S<br>(1982,<br>Canada)                   | Social                                 | Social signals<br>and engaging<br>behaviour   | Note taking<br>and<br>observation  | Data was collected during the 30-minute sessions daily over a period of 2 months.  |
| Salas, J, <i>et</i><br><i>al</i> ,1988,<br>USA) | Social                                 | Improve<br>interpersonal<br>skills and<br>behaviour   | Note taking<br>and<br>observation  | Data was collected during all phases of the study: phase one-October 198<br>January 1989,<br>phase two- February to May 1989 (Bi-monthly sessions) and phase three<br>1989.  |
| Shoemark,<br>H (1991,<br>Australia)             | Social                                 | Communication<br>and social skills,<br>interactive<br>behaviour/<br>enhance self<br>esteem                            | Note taking<br>and<br>observation  | Data was collected during all periods of the study: initial period- twice w<br>sessions,<br>exploratory period- twice weekly sessions, control period- not specified.  |
| Silliman,<br>LM. <i>et al.</i><br>(1992, USA)   | Social                                 | Increase<br>compliant<br>behaviour ‡  | Note taking observation  | Data was collected 24 hours before baseline<br>24 hours after the intervention phase<br>2 weeks and 3 months following treatment to determine if learning had<br>maintained.   |
| Kern P et al.<br>(2001, USA)                    | Social                                 | Social<br>interaction and<br>engagement in<br>play.   | Note taking,<br>observation<br>and video<br>recording  | Data was gathered daily during the 7 months period.  |
| Villasenor,<br>R. <i>et al.</i><br>(2012, USA)  | Social                                 | Improve<br>functional<br>skills: attention,<br>speech and<br>language, self-<br>regulation,<br>sensory<br>integration | Observation,<br>video<br>recording and<br>interviews   | One interview during the intervention phase of (up to 20 weeks) and one interview after the intervention phase.  |
| Desrocher,<br>M. <i>et al.</i><br>(2014, USA)   | Social                                 | Improve<br>problem<br>behaviour §   | Observation<br>and video<br>recording  | Data was collected during all six sessions over three days   |
| Metell, M<br>(2015,<br>Norway)                  | Social                                 | Bonding and<br>interaction  | Note taking,<br>observation,<br>video<br>recordings<br>and<br>interviews<br>with<br>caregivers | Data was collected through 48 session notes, 29 field notes, three intervie<br>with caregivers, and one interview with two special teachers were condu   |
| Villas Boas,<br>D. <i>et al.</i><br>(2016)      | Social                                 | Improve<br>attention and<br>communicative<br>behaviours   | Observation<br>and video<br>recording  | Data was collected from the 119:04 (minutes: seconds) recordings of<br>interaction between the teacher and the child. The tapes were transcribe<br>(82:02) and the<br>recordings time was encoded, which<br>allowed the marking and location of<br>behaviours to facilitate analysis<br>of the data. |

+ Social- includes social engagement, bonding, and interaction, change in behaviour and social skills (e.g., communication), mental health- includes well-being, anxiety, depression, psychological stress, physiological/health related outcomes- includes blood pressure/ heart rate, Quality of lifeincludes any health-related quality of life measures

‡ Behaviour measured as improving compliance to perform four gross motor skills: walking, stairclimbing, standing, and sitting.

§ Problem behaviours included standing up, hand hitting, and mouth tapping.

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# Experimental studies

# Outcomes

The outcomes domains investigated in the included studies were, psychological/mental wellbeing, quality of life, reduced psychological stress for two studies namely Zhao et al. <sup>68</sup> and Bertelmann et al.<sup>69</sup> Two further studies investigated the social domains, namely changes in behaviour (e.g., increased attentiveness and compliance)<sup>67</sup> and a further study, participation skills<sup>2</sup> (See *Table 6*).

# Outcome measures

Mental health and stress were investigated using the Diabetes Quality of Life Specific Scale (DQOL), Visual Quality of Life (VQOL) and Symptom Check list (SCL-90) by Zhao et al.<sup>68</sup> and Bertelmann et al<sup>69</sup> used Profile of mood states (POMS) questionnaire for mental health and a German questionnaire measuring stress, namely the Kurzfragebogen zur aktuellen Beanspruchung (KAB) by Bertelmann et al.<sup>69</sup>Physiological measures used were physiological parameters including adrenalin concentration (pg/mL), cortisol concentration (µg/dL), endothelin concentration (pg/mL) and intraocular pressure (IOPmmHg). Vision outcomes included best Corrected Visual Acuity (BCVA), and 30° Visual Field (VF), testing by Bertelmann et al.<sup>69</sup>

## Findings

They study by Bertelmann et al.<sup>69</sup> was a randomised clinical trial where the experimental group received relaxation music for 10 days and the control group did not. The main finding from this study indicated, best corrected visual acuity, daily intraocular pressure, and short-term mental state (KAB) development were significantly better in the treatment group (TG) in comparison to controls. Visual field scores, mental well-being POMS and adrenalin, cortisol, and endothelin-I blood levels did not differ significantly between both groups. The conclusive finding from this study suggest additive of relaxing music on a daily basis can positively impact various physiological and psychological parameters as stated above in the short term.<sup>69</sup>

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Zhao et al.<sup>68</sup> compared two groups of patients (n = 40 per group) with diabetic retinopathy receiving music relaxation therapy or not while undergoing a fixed drug treatment simultaneously. The quantitative methods to measure the outcomes were the following validated wellbeing questionnaires: Quality of Life Specific Scale (QOL), Visual Quality of Life (VQOL) and Symptom Check list (SCL-90). The main finding from this study indicated that the experimental group showed significant improvements when compared to the control group for psychological wellbeing measures, including somatization anxiety, and depression.<sup>68</sup>

The other two experimental studies,<sup>2,67</sup> in this review used qualitative methods such as, observation, note taking and video recordings. Robb<sup>2</sup> conducted a pilot study to inform and compare attentive and participation behavior during music and play-based group instructional sessions in preschoolers with visual impairments. The main finding from the Robb<sup>2</sup> study was that attentive behaviour was significantly higher during music therapy sessions. Mean scores for the remaining groups' behaviours were higher in the music condition, but these differences were not statistically significant.<sup>2</sup> Whereas, Hill et al.<sup>67</sup> was single-subject case study looked at improving attentive behaviour in the classroom with music as a reinforcer in a young woman with visual and mental impairment. The main finding from this study was higher rates of in-seat behavior during the music phase and there was also a clear reversal of effects without a music reinforcement. However this study did not conduct any statistical analysis (See *Table 6)*.

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| Author<br>(year,<br>country)                                    | Therapeutic<br>Domain of<br>Interest †                        | Therapeutic<br>Outcomes  | Therapeutic<br>Outcome<br>Measures   | Frequency of when the outcome measures were observed/ Follow up periods   |
|---|---|--|--|---|
| Hill, J. <i>et al.</i><br>( 1989,<br>USA)                       | Social  | Improve<br>compliant<br>behaviour ‡  | Note taking,<br>videotaping<br>and<br>observation  | Data was collected from the 28 video recordings taken during the intervention period  |
| Robb, S<br>(2003, USA)  | Social  | Attentive<br>behaviour<br>and<br>participation<br>skills                             | Note taking,<br>observations<br>and completing<br>non validated<br>assessment<br>forms   | Data was gathered from 4 sessions that were videotaped to facilitate<br>the collection of behavioural data (a time sampling data collection<br>method, with 10-second observe/5-second record intervals).<br>Observations forms were used to evaluate data from the videotapes.     |
| Zhao, L. <i>et</i><br><i>al.</i> (2005,<br>China)               | Mental<br>health and<br>quality of<br>life                    | Improve<br>psychological<br>wellbeing<br>and quality<br>of life                      | Validated<br>questionnaires<br>(Quality of Life<br>Specific Scale<br>(DQOL), Visual<br>Quality of Life<br>(VQOL) and<br>Symptom<br>Check list<br>(SCL-90)  | Data was collected before the intervention and after the intervention period of 28 days.  |
| Bertelmann,<br>T. <i>et al.</i><br>(2015,<br>Germany)           | Mental<br>health,<br>physiological<br>parameters              | Reduce<br>psychological<br>stress and<br>improve<br>overall<br>mental well-<br>being | Profile of mood<br>states (POMS)<br>questionnaire<br>and<br>Kurzfragebogen<br>zur aktuellen<br>Beanspruchung<br>(KAB) and<br>physiological<br>parameters<br>(intraocular<br>pressure, visual<br>field, adrenalin<br>concentration<br>(pg/mL),<br>cortisol<br>concentration<br>(µg/dL) and<br>endothelin<br>concentration | Data was collected daily before the 30-minute intervention for all 10<br>days during the core study phase. The physiological parameters:<br>adrenalin concentration (pg/mL), cortisol concentration (µg/dL) and<br>endothelin concentration (pg/mL) were measured at 4 time points. |
| Social- include<br>nxiety, depress<br>teasures<br>Behaviour was | es social engageme<br>ion, psychologica<br>defined as sitting | ent, bonding, and ir<br>ıl stress, physiologic<br>g when instructed t                | nteraction, change i<br>cal/health related ou<br>o do so by the teach  | n behaviour and social skills (e.g., communication), mental health- includes well-being,<br>ttcomes- includes blood pressure/ heart rate, Quality of life- includes any health-related qua<br>er.   |

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# Music reporting checklist

Further data were extracted in accordance with the Checklist for Reporting Music-based Interventions<sup>53</sup>, including adherence and fidelity (Refer to *Table 7*) to inform on the transparency and specificity of the included music-based interventions in this review.

# Non-experimental studies

Non-experimental studies reported 100% on items B3- Music Delivery Method (Live or Recorded), B-5- Intervention Strategies, Materials, C- Intervention Delivery Schedule, G-Unit of Delivery and reported 50% or less on A -Rationale for Music Selection/Intervention Theory, B2- Music selection, B4- Intervention Materials, C-Intervention Delivery Schedule, D- Interventionist, E- Treatment Fidelity.

# Experimental studies

Experimental studies reported 100% on items, B1- Intervention Content, B2- Music selection, B3- Music Delivery Method (Live or Recorded), B4- Intervention Materials, B-5- Intervention Strategies, C- Intervention Delivery Schedule and G- Unit of Delivery and reported on less than 100% on items D- Interventionist and E- Treatment Fidelity. Hence, the experimental studies were more rigorously reported compared to the non-experimental studies (See *Table 7*).

|               |   | Ves  | No  |
|---------------|---|--|---|
|               |   | Total  | Total   |
|               |   | non-experimental designs n = 9 (%)                     | non-experimental designs n = 9 (%)            |
|               |   | experimental designs $n = 4$ (%)                       | experimental designs n = 4(%)                 |
| A Rationale   | for Music   | non-experimental designs: 1(10)65                      | non-experimental designs: 8 (90)58-64,66      |
| Selection/In  | tervention Theory   |  |   |
| -             | What was the rationale<br>for the music used and<br>intervention? | <i>experimental designs:</i> 3 (90) <sup>2,68,69</sup> | experimental designs: 1 (10) <sup>67</sup>    |
| B1: Interver  | ntion Content   | non-experimental designs. 9 (100)58-66                 | n/a   |
| -             | Was it specified who  | experimental designs, 4 (100) <sup>2,67-69</sup>       | n/a   |
|               | selected the music (e.g.:<br>pre-selected by                      |  |   |
|               | investigator, participant<br>selected)?                           |  |   |
| B.2: Music    | beleteta).  | n/a  | non-experimental designs: 9 (100)58-66        |
| -             | Was this is an original   |  |   |
|               | piece of music or a pre-  | experimental designs: 4 (100) <sup>2,67-69</sup>       | n/a   |
|               | existing musical  |  |   |
| -             | If a pre-existing musical   |  |   |
|               | composition was used,   |  |   |
|               | then was the name of the  |  |   |
|               | composer and title of the   |  |   |
|               | stated?   |  |   |
| -             | Was there a description   |  |   |
|               | of the music's overall  |  |   |
|               | structure (e.g.: form,<br>elements instruments or                 |  |   |
|               | other)?   |  |   |
|               |   |  |   |
| B.3. Music D  | Delivery Method   | non-experimental designs: 9 (100)5866                  | n/a   |
| (LIVE OF IEC  | If the music was played   | experimental designs: 4 (100) <sup>2,67-69</sup>       | n/a   |
| -             | live, was it specified who  |  |   |
|               | delivered the music and   |  |   |
|               | performance?  |  |   |
| -             | Was the size of the   |  |   |
|               | specified for the live  |  |   |
|               | music (e.g.:  |  |   |
|               | interventionist only,   |  |   |
|               | interventionist and   |  |   |
| -             | If recorded music was   |  |   |
|               | used, was placement of  |  |   |
|               | playback equipment  |  |   |
|               | and/or the use of   |  |   |
|               | speakers specified?   |  |   |
| -             | If recorded music was   |  |   |
|               | used, was the decibel   |  |   |
|               | level of music delivered  |  |   |
|               | controls to limit decibels  |  |   |
|               | specified?  |  |   |
| B.4: Interve  | ntion Materials   | non-experimental designs: 3 (30) <sup>56,57,60,</sup>  | non-experimental designs: 4 (40) 54,55,58,59, |
| -             | Which musical and other materials were specified?                 | experimental designs: 4 (100) <sup>2,67-69</sup>       | n/a   |
| -             | What music-based  | 1  |   |
|               | intervention strategies   |  |   |
|               | were used (e.g.: listening,                                       |  |   |
|               | re-creating music by  |  |   |
|               | instrument,   |  |   |
|               | instrument/vocal play,  |  |   |
|               | improvisation,  |  |   |
|               | movement, song writing<br>or other)?                              |  |   |
| B.5: Interver | ntion Strategies  | non-experimental designs: 9 (100) 58-66                | n/a   |
|               | II/Lat month to a t   |  |   |
| -             | w nat music-based<br>intervention strategies                      | experimental designs: 4 (100) <sup>2,67-69</sup>       | n/a   |
|               | were used (e.g.: listening,                                       |  |   |
|               | re-creating music by  |  |   |
|               | singing/playing an  |  |   |
|               | instrument,   |  |   |
|               | improvisation.  |  |   |
|               | movement, song writing  |  |   |
|               | or other)?  |  |   |

| C: Intervention Delivery Schedule   | non-experimental designs: 2(30)62,63               | non-experimental designs: 7 (60) 58-61,62,64,65,        |
|---|--|---|
| - What was the duration,  |  |   |
| frequency, and intensity of the treatment?  | experimental designs: 3 (100) <sup>2,68,69</sup>   | experimental designs. 1(10)67                           |
| D: Interventionist  | non-experimental designs 1 (10) <sup>62</sup>      | non-experimental designs: 9(90) <sup>58-61, 63-66</sup> |
| <ul> <li>Were the qualifications<br/>and credentials of<br/>interventionist(s)<br/>reported?</li> <li>If more than one<br/>interventionist, from</li> </ul>                     | experimental designs: 3 (90) <sup>2,68,69</sup>    | experimental designs: 1 (10) <sup>57</sup>              |
| which discipline/what<br>qualifications and<br>training details were<br>reported?   |  |   |
| E: Treatment Fidelity   | non-experimental designs 1 (10) <sup>65</sup>      | non-experimental designs: 9(90) <sup>58-64,66</sup>     |
| used to ensure that<br>treatment and/or control<br>conditions were<br>delivered as intended<br>(e.g.: interventionist<br>training, manualised<br>protocols, and<br>intervention |  | experimental designs: 1(10)"                            |
| F: Setting  | n/a  | non-experimental designs: 9(100) <sup>58-66</sup>       |
| <ul> <li>where was the intervention delivered?</li> <li>What boundaries were reported (e.g., time and location)?</li> <li>What ambient noise levels were reported in</li> </ul> | n/a  | experimental designs: 4 (100) <sup>2, 67-69</sup>       |
| the environment?<br>- What boundaries were<br>reported (e.g., time and<br>location)?  |  |   |
| G: Unit of Delivery   | non-experimental designs: 9 (100) <sup>58-66</sup> | n/a   |
| - Was the intervention<br>delivered to individuals<br>or groups of individuals?   | experimental designs: 4 (100) <sup>2, 67-69</sup>  | n/a   |

† Music-based Intervention Reporting Checklist was reproduced with permission. Robb, S. L., Carpenter, J. S., Burns, D. S. (2011). Reporting guidelines for music-based interventions. Journal of Health Psychology, DOI: 10.1177/1359105310374781.

# Evidence Gaps

As well as reporting the available evidence, this review also identified key gaps in the evidence for future scope related to music-based interventions to promote wellbeing in people living with a VI. The following gaps were identified (Refer to *Tables 1-6*):

- Limited studies in participants aged over 18 years- only three of the 13 studies were conducted in adults (*Table 1-2*).
- Restricted diversity in patient demographics and geographical scope- seven out 13 studies were single subject cases, conducted in America (*Table 1-2*).

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- Limited investigation on the benefits of passive music listening- only three out the 13 studies explored passive music listening, the rest of the 10 studies used active music listening such as improvisation or music-based activities (*Table 3-4*).
- Inadequate experimental studies with validated outcome measures that can provide quantifiable data. There were, two studies<sup>68,69</sup> that utilised psychological questionnaires (*Table 5-6*).
- More investigation is required into the mental health domain- only 11 of the 13 studies were interested in the social domain (*Table 5-6*).

# Discussion

 This scoping review has highlighted that to date, there has been little research on musicbased interventions for improving wellbeing for people with VI, particularly adults. The literature that does exist is inconclusive. Robust experimental research that reports on dosage, training requirements and treatment fidelity is required to understand the effects on people with a VI.

Although this scoping review has demonstrated music listening interventions have potential to improve psychosocial wellbeing in people with a VI in the social domain, evidence for the psychological domain is still lacking. Music listening research with other populations have shown improved psychological wellbeing, for example preferred music listening has been effective in older adult populations with insomnia,<sup>70</sup> post-stroke rehabilitation,<sup>71</sup> poor mental health<sup>72, 73</sup> and patients with long-term chronic conditions that require intensive care, such as cancer.<sup>74</sup> Older adults with VI experience similar psychological and psychosocial symptoms to stroke survivors<sup>71</sup> and cancer patients in recovery.<sup>74</sup> These symptoms include stress, social anxiety, insomnia, depression, and poor quality of life.<sup>75-79</sup> In developed countries, acquired VI, such as age-related macular degeneration, is highly correlated with poor psychosocial wellbeing.<sup>75-77</sup> A music-based intervention with the specific aim of promoting wellbeing in individuals living with irreversible, acquired VI has not been conducted.

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The studies in this review report on areas such as music protocol, cultural influences for music choice, dosage, and frequency, but not in great detail. It is also not clear what specialist training requirements are needed for music listening protocol delivery in any setting, including the home environment. Future studies should consider the development of interventions which can be adapted to ensure that participants' cultural preferences are considered. This could be important as it is plausible that music-based interventions which reflect the cultural identity of participants might be more effective at creating meaning for the participant and promoting enjoyment through preferred music listening.<sup>80, 81</sup>

There were no significant differences reported in studies aimed at adults and children, other than the latter were facilitated by teachers with caregivers' consent. Therapeutic interventions can have different approaches dependent on the participants' age group. There is evidence that the effects of music on aspects of wellbeing may differ dependent on age.<sup>82</sup> Further research is required to understand how to optimise outcomes across age groups.

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Overall, in this review five studies were facilitated by a music therapist. Music therapists are highly trained allied health professionals that are registered with a licence to practice, who have undergone training to use music therapy strategies/techniques,<sup>27-30</sup> for example, music improvisation. Based on the included literature, it is likely that wherever music improvisation and a therapeutic relationship are central, a music therapist would be optimal.

Twelve out of the thirteen interventions were conducted in a clinical or school setting. It can be argued that research under such conditions may be convenient and allow researchers to obtain comparative results, which may not be possible to replicate in the participant's home as each home environment presents different variables. <sup>83</sup> However,

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one study found that participants reported being in a better emotional state and less stressed when doing a music listening intervention from home, in comparison to a clinical setting.<sup>84</sup> Future research should examine the feasibility of a music listening intervention in a home-based setting for people with a VI.

In terms of therapeutic outcomes, two of the studies used validated outcome measures for wellbeing, the rest were all single-subject case reports that utilised qualitative methods such as observation or informal interviews. Although these may make the data richer, they also make it difficult to use within a meta-analysis. On the other hand, the use of validated outcome measures or use of standardised patient reported outcome instruments, validated for the population of interest, may contribute to the internal validity and effectiveness of observational interventions.<sup>85</sup> It would be of merit to test a wellbeing music-based intervention in adults with a VI using validated outcome measures to ascertain if a music-based intervention could also be appropriate for people with a VI to improve their wellbeing.

Whilst the scoping review provides a broad exploration of studies which have used music-based interventions to improve wellbeing among people with VI, there are limitations which should be considered. Firstly, we may have missed evidence of interventions due to the general focus required for a scoping review. Furthermore, studies were not appraised, thus limiting the capacity of the review to make judgements regarding the efficacy of music-based interventions for people with VI. In addition, the exclusion of studies which were not peer-reviewed may have excluded evidence of interventions which have been used in practice and continue to be used.

This study highlighted that there is a limited volume of literature which has explored the effects of music-based interventions on wellbeing among people with VI, particularly with adults. The most common therapeutic outcome domain investigated was social outcomes and the most widely used strategy was improvisation. There is a lack of detail

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regarding music and music therapy protocols and whether specific skills are required to deliver them. Listening to preferred music for wellbeing has not been reported for the VI population to the same degrees as with other populations such as stroke and intensive care patients. Further robust experimental research is required to understand the effect of music-based intervention on adults with an acquired VI and feasibility of delivery in the home environment.

Author contributions: NS: conceptualisation-lead, methodology-lead, literature search, literature screening, data extraction, data curation, formal analysis-lead, writing-original draft, writing-review and editing. RL: literature screening, writing-review and editing. PMA, EB and AS: conceptualisation-support, methodology-support, supervision, writingreview and editing. LS: writing-review and editing-support.

**Funding:** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

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# Patient and public involvement:

No patient involved.

# Data availability statement:

Data is available on request.

# **Ethics statements:**

icable. Patient consent for publication was not applicable.

**Ethics approval:** 

Not applicable.

# Competing interests:

None declared.

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION   | ITEM | PRISMA-ScR CHECKLIST ITEM   | REPORTED<br>ON PAGE #         |
|---|------|---|-------------------------------|
| TITLE   |      |   |                               |
| Title   | 1    | Identify the report as a scoping review.  | 1                             |
| ABSTRACT  | 1    |   |                               |
| Structured summary  | 2    | Provide a structured summary that includes (as<br>applicable): background, objectives, eligibility criteria,<br>sources of evidence, charting methods, results, and<br>conclusions that relate to the review questions and<br>objectives.   | 2                             |
| INTRODUCTION  |      |   |                               |
| Rationale   | 3    | Describe the rationale for the review in the context of<br>what is already known. Explain why the review<br>questions/objectives lend themselves to a scoping<br>review approach.   | 4                             |
| Objectives  | 4    | Provide an explicit statement of the questions and<br>objectives being addressed with reference to their key<br>elements (e.g., population or participants, concepts,<br>and context) or other relevant key elements used to<br>conceptualize the review questions and/or objectives.                                     | 4 to 5                        |
| METHODS   |      |   |                               |
| Protocol and registration                                   | 5    | Indicate whether a review protocol exists; state if and<br>where it can be accessed (e.g., a Web address); and if<br>available, provide registration information, including<br>the registration number.   | 5                             |
| Eligibility criteria  | 6    | Specify characteristics of the sources of evidence<br>used as eligibility criteria (e.g., years considered,<br>language, and publication status), and provide a<br>rationale.   | 5                             |
| Information<br>sources*                                     | 7    | Describe all information sources in the search (e.g.,<br>databases with dates of coverage and contact with<br>authors to identify additional sources), as well as the<br>date the most recent search was executed.  | 6                             |
| Search  | 8    | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.   | (see<br>supplement<br>data 1) |
| Selection of<br>sources of<br>evidence†                     | 9    | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.   | 7                             |
| Data charting process‡                                      | 10   | Describe the methods of charting data from the<br>included sources of evidence (e.g., calibrated forms or<br>forms that have been tested by the team before their<br>use, and whether data charting was done<br>independently or in duplicate) and any processes for<br>obtaining and confirming data from investigators. | 7                             |
| Data items  | 11   | List and define all variables for which data were sought and any assumptions and simplifications made.  | 7                             |
| Critical appraisal of<br>individual sources<br>of evidence§ | 12   | If done, provide a rationale for conducting a critical<br>appraisal of included sources of evidence; describe<br>the methods used and how this information was used<br>in any data synthesis (if appropriate).  | 8                             |



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| SECTION   | ITEM |   | REPORTED<br>ON PAGE <u>#</u> |
|---|------|---|------------------------------|
| Synthesis of<br>results                         | 13   | Describe the methods of handling and summarizing the data that were charted.  | 9                            |
| RESULTS   |      |   |                              |
| Selection of<br>sources of<br>evidence          | 14   | Give numbers of sources of evidence screened,<br>assessed for eligibility, and included in the review, with<br>reasons for exclusions at each stage, ideally using a<br>flow diagram.           | 9 (Figure 1)                 |
| Characteristics of<br>sources of<br>evidence    | 15   | For each source of evidence, present characteristics for which data were charted and provide the citations.   | 10                           |
| Critical appraisal within sources of evidence   | 16   | If done, present data on critical appraisal of included sources of evidence (see item 12).  | n/a                          |
| Results of<br>individual sources<br>of evidence | 17   | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.   | 10 (Tables 1<br>to 3)        |
| Synthesis of<br>results                         | 18   | Summarize and/or present the charting results as they relate to the review questions and objectives.  | 11                           |
| DISCUSSION                                      |      |   |                              |
| Summary of evidence                             | 19   | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 17                           |
| Limitations                                     | 20   | Discuss the limitations of the scoping review process.  | 19                           |
| Conclusions                                     | 21   | Provide a general interpretation of the results with<br>respect to the review questions and objectives, as well<br>as potential implications and/or next steps.                                 | 19                           |
| FUNDING   |      |   |                              |
| Funding   | 22   | Describe sources of funding for the included sources<br>of evidence, as well as sources of funding for the<br>scoping review. Describe the role of the funders of the<br>scoping review.        | 20                           |

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

<sup>+</sup> A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

<sup>‡</sup> The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

*From:* Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. <u>doi: 10.7326/M18-0850</u>.



Search strategies

Records after duplicates removed (n = 5,082)

# Medline (Ovid) [searched on 14/12/21 AND 11/04/22\*]

| #  | Search                           | Result   |
|----|----------------------------------|----------|
| 1  | exp Vision Disorders/            | 73199    |
|    |                                  | 254778*  |
| 2  | exp Glaucoma, Angle-Closure/ or  | 53879    |
|    | exp Glaucoma/ or exp Glaucoma,   |          |
|    | Open-Angle/                      | 89698*   |
|    |                                  |          |
| 3  | exp Conjunctivitis/              | 19313    |
|    |                                  |          |
| 4  |                                  | 41202*   |
| 4  | exp Uveitis/                     | 31408    |
|    |                                  | 58961*   |
| 5  | exp Macular Edema/ or exp        | 25216    |
|    | Macular Degeneration/ or exp Wet | tangan t |
|    | Macular Degeneration/ or exp     | 42082*   |
|    | Maculai Figment                  | 2        |
| 6  | exp Edema/ or exp Diabetic       | 68748    |
|    | Retinopathy/                     |          |
|    |                                  | 358896*  |
| 7  | exp Strabismus/                  | 16097    |
|    |                                  | 25242*   |
|    |                                  | 25243*   |
|    |                                  |          |
| 8  | exp Astigmatism/                 | 7215     |
|    |                                  | 14022*   |
|    |                                  | 14925*   |
| 9  | exp Myopia/                      | 18402    |
|    |                                  |          |
|    |                                  | 26669*   |
| 10 | exp Hyperopia/                   | 3235     |
|    |                                  |          |

|    |   | 6925*             |
|----|---|-------------------|
| 11 | exp Trachoma/   | 3976              |
|    |   | 3562*             |
| 12 | exp Cataract/   | 29440             |
|    |   | 62187*            |
| 13 | exp Vision, Low/  | 3483              |
|    |   | 3739*             |
| 14 | (glaucoma or conjuncti* or uveitis<br>or macula* or oedema or edema or<br>strabismus or squint or astigmati*<br>or myopi* or hypermetropia or<br>trachoma or cataract or visual<br>impairment or low vision or  | 585375<br>940226* |
|    | diabetic retinopath*)   |                   |
| 15 | exp Music Therapy/ or exp Music/  | 17468             |
|    | chip include inclupy, of the include,   | 26125*            |
| 16 | Singing/  | 961               |
|    |   | 3802*             |
| 17 | (Music or song or singing or Piano<br>or guitar or saxophone or ukulele or<br>violin or cello or trumpet or<br>accordion or clarinet or flute or  | 48357<br>61236*   |
|    | xylophone or mandolin or<br>harmonica or drum or harp or oboe<br>or trombone or bassoon or viola or<br>French horn or tuba or theremin or<br>banjo or bass or bagpipes or<br>tambourine or lyre or lute or<br>ocarina or harpsichord or cajon or<br>didgeridoo or sitar or oud or<br>marimba or melodica) | 32                |
| 18 | exp Blindness/  | 45773*            |
| 19 | exp Visually Impaired Persons/  | 9088*             |
| 20 | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or<br>9 or 10 or 11 or 12 or 13 or 14 or   | 654042            |
|    | 18 or 19  | 1101151*          |

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| 21 | 15 or 16 or 17 | 48357  |
|----|----------------|--------|
|    |                | 61500* |
| 22 | 20 and 21      | 618    |
|    |                |        |

# EMBASE

# [searched on 14/12/21 AND 11/04/22\*]

| #  | Search  | Result  |
|----|---|---------|
| 1  | exp visual impairment/  | 101268  |
|    | 0   | 105086* |
| 2  | exp glaucoma/   | 86447   |
|    |   | 89698*  |
| 3  | exp conjunctivitis/   | 39710   |
|    |   | 41202*  |
| 4  | exp uveitis/  | 56876   |
|    |   | 58961*  |
| 5  | exp age related macular   | 24596   |
|    | degeneration/ or exp macular<br>degeneration/ or exp diabetic<br>macular edema/ | 27037*  |
| 6  | exp strabismus/   | 24407   |
|    |   | 25243*  |
| 7  | exp astigmatism/  | 14343   |
|    |   | 14923*  |
| 8  | exp myopia/   | 25485   |
|    |   | 26669*  |
| 9  | exp hypermetropia/  | 6683    |
|    |   | 6925*   |
| 10 | exp trachoma/   | 3505    |
| -  | -   | ·       |

|     |   | 3562*    |
|-----|---|----------|
| 11  | exp cataract/                           | 60312    |
|     |   | 00312    |
|     |   | 62187*   |
| 12  | exp visual disorder/ or exp low         | 244916   |
| 12  | vision/                                 |          |
|     |   | 254778*  |
|     |   |          |
| 13  | (glaucoma or conjuncti* or uveitis      | 905903   |
|     | or macula* or oedema or edema or        |          |
|     | strabismus or squint or astigmati*      | 940226*  |
|     | or myopi* or hypermetropia or           |          |
|     | trachoma or cataract or visual          |          |
|     | impairment or low vision or             |          |
|     | diabetic retinopath*)                   |          |
| 14  | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or | 1040312  |
|     | 9 or 10 or 11 or 12 or 13               |          |
| 1.5 |   | 1078989* |
| 15  | exp music therapy/ or exp music/        | 25069    |
|     |   | 26125*   |
| 16  | exp singing/                            | 3680     |
|     |   |          |
|     |   | 3802*    |
|     |   |          |
| 17  | Music or song or singing or Piano       | 58099    |
|     | or guitar or saxophone or ukulele or    |          |
|     | violin or cello or trumpet or           | 61236*   |
|     | accordion or clarinet or flute or       | 7        |
|     | xylophone or mandolin or                |          |
|     | ar trombong or bassoon or viole or      |          |
|     | French horn or tube or theremin or      |          |
|     | hanio or hass or hagpines or            |          |
|     | tambourine or lyre or lute or           |          |
|     | ocarina or harpsichord or caion or      |          |
|     | didgeridoo or sitar or oud or           |          |
|     | marimba or melodica).                   |          |
| 18  | 15 or 16 or 17                          | 58345    |
|     |   |          |
|     |   | 61500*   |
| 19  | 14 and 18                               | 1196     |
|     |   |          |
|     |   |          |
|     |   |          |

# CHNL PLUS (EBSCO) [searched on 14/12/21 AND 11/04/22\*]

| #  | Search                             | Result   |
|----|------------------------------------|----------|
| 1  | MH "Eye Diseases+") OR (MH         | 104,565  |
|    | "Eye Diseases, Hereditary+") OR    |          |
|    | (MH "Diagnosis, Eye+") OR (MH      | 110,827* |
|    | "Eye Hemorrhage+") OR (MH          |          |
|    | "Eye Abnormalities+") OR (MH       |          |
|    | "Eve Infections, Viral+") OR (MH   |          |
|    | "Dry Eye Syndromes+                |          |
|    |                                    |          |
| 2  | MH "Glaucoma+''                    | 9,001    |
|    |                                    | 0.451*   |
| 2  |                                    | 9,451*   |
| 3  | MH "Conjunctivitis+"               | 3,041    |
|    |                                    | 2 150*   |
|    |                                    | 3,130    |
| 4  | MH "Uveitis+"                      | 5 332    |
| •  |                                    | 0,002    |
|    |                                    | 5.731*   |
| 5  | (MH "Macular Degeneration+")       | 7,412    |
|    | OR (MM "Stargardt Disease")        |          |
|    |                                    | 7,844*   |
|    |                                    |          |
| 6  | MM "Diabetic Retinopathy"          | 4,239    |
|    |                                    |          |
|    |                                    | 4,546*   |
| 8  | MM "Strabismus"                    | 997      |
|    |                                    |          |
|    |                                    | 1,072*   |
| 0  |                                    | 007      |
| 9  | MM "Trachoma"                      | 297      |
|    |                                    | 21.4*    |
|    |                                    | 314*     |
| 10 | MM "Cataract"                      | 2.010    |
| 10 | WIWI Catalact                      | 2,019    |
|    |                                    | 2 250*   |
|    |                                    | 2,230    |
| 11 | MH "Deaf-Blind Disorders+"         | 529      |
|    |                                    |          |
|    |                                    | 558*     |
|    |                                    |          |
| 11 | MH "Rehabilitation of Vision       | 2,296    |
|    | Impaired+                          |          |
|    | -                                  | 2,325*   |
| 13 | glaucoma or conjuncti* or uveitis  | 104,391  |
|    | or macula* or oedema or edema or   |          |
|    | strabismus or squint or astigmati* | 110,452* |
|    | or myopi* or hypermetropia or      |          |
|    | of myopi of mypermed option        |          |

|    | impairment or low vision or<br>diabetic retinopath*  |                          |
|----|--|--------------------------|
| 13 | S1 OR S2 OR S3 OR S4 OR S5<br>OR S6 OR S7 OR S8 OR S9 OR<br>S10 OR S11 OR S12 OR S13   | 158,338<br>167.220*      |
| 15 | MM "Music Therapy (Iowa NIC)")<br>OR (MM "Music") OR (MM<br>"Singing"  | 8,371<br>8,707*          |
| 15 | Music or song or singing or Piano<br>or guitar or saxophone or ukulele or  | 54,415                   |
|    | violin or cello or trumpet or<br>accordion or clarinet or flute or<br>xylophone or mandolin or<br>harmonica or drum or harp or oboe<br>or trombone or bassoon or viola or<br>French horn or tuba or theremin or<br>banjo or bass or bagpipes or<br>tambourine or lyre or lute or<br>ocarina or harpsichord or cajon or<br>didgeridoo or sitar or oud or<br>marimba or melodica | 59,780*                  |
| 16 | S14 OR S15   | 54,415<br><b>59,780*</b> |
| 17 | S14 AND S17  | 1,072                    |

# PSYCHINFO (EBSCO) [searched on 14/12/21 AND 11/04/22\*]

| # | Search                         | Result  |
|---|--------------------------------|---------|
| 1 | DE "Vision Disorders" OR DE    | 18,073  |
|   | "Balint's Syndrome" OR DE      |         |
|   | "Blind" OR DE "Blindsight" OR  | 18,580* |
|   | DE "Eye Disorders" OR DE       |         |
|   | "Hemianopia" OR DE "Partially  |         |
|   | Sighted" OR DE "Eye Disorders" |         |
|   | OR DE "Amblyopia" OR DE        |         |
|   | "Cataracts" OR DE "Color       |         |
|   | Blindness" OR DE "Glaucoma" OR |         |
|   | DE "Nystagmus" OR DE           |         |
|   | "Refraction Errors" OR DE      |         |

|   | "Strabismus" OR DE "Tunnel<br>Vision"                              |         |
|---|--|---------|
| 2 | MM "Glaucoma"  | 422     |
|   |  | 440*    |
| 3 | MM "Myopia" OR DE "Refraction<br>Errors" OR DE "Myopia"            | 707     |
|   |  | 731*    |
| 4 | MM "Cataracts"   | 251     |
|   |  | 263*    |
| 5 | (glaucoma or conjuncti* or uveitis                                 | 42,061  |
|   | strabismus or squint or astigmati*                                 | 43,235* |
|   | trachoma or cataract or visual                                     |         |
|   | diabetic retinopath*)  |         |
| 6 | DE "Music" OR DE "Musical  | 29,499  |
|   | Instruments" OR DE "Rock Music"<br>OR MM "Rock Music" OR MM        | 30,494* |
|   | "Music Therapy" OR MM "Music<br>Dercention" OR MM "Music           |         |
|   | Pitch" OR MM "Music Education"                                     | 2       |
|   | "Pitch Perception" OR MM   | O,      |
|   | "Musical Instruments" OR MM<br>"Musical Ability"                   | 2/      |
| 7 | Music or song or singing or Piano                                  | 67,007  |
|   | violin or cello or trumpet or<br>accordion or clarinet or flute or | 69,751* |
|   | xylophone or mandolin or   |         |
|   | or trombone or bassoon or viola or                                 |         |
|   | French horn or tuba or theremin or banjo or bass or bagpipes or    |         |
|   | tambourine or lyre or lute or ocarina or harpsichord or cajon or   |         |
|   | didgeridoo or sitar or oud or<br>marimba or melodica               |         |

| 8  | S1 OR S2 OR S3 OR S4 OR S5 | 50,315  |
|----|----------------------------|---------|
|    |                            | 51,708* |
| 9  | S6 OR S7                   | 69,057  |
|    |                            | 71,835* |
| 10 | (S6 OR S7) AND (S8 AND S9) | 674     |

# WoS

# 14/12/21 AND 11/04/22\*

| # | Search                               | Results  |
|---|--------------------------------------|----------|
| 1 | glaucoma or<br>conjuncti* or uveitis | 663,084  |
|   | or macula* or                        | 699.965* |
|   | oedema or edema or                   |          |
|   | strabismus or squint                 |          |
|   | or astigmati* or                     |          |
|   | myopi <sup>*</sup> or                |          |
|   | hypermetropia or                     | 6        |
|   | trachoma or cataract                 |          |
|   | or visual impairment                 |          |
|   | or low vision or                     |          |
|   | diabetic retinopath*                 |          |
|   | 1                                    |          |
| 2 | Music or song or                     | 309,383  |
|   | singing or Piano or                  |          |
|   | guitar or saxophone                  |          |
|   | or ukulele or violin or              | 323,449* |
|   | cello or trumpet or                  |          |
|   | accordion or clarinet                |          |
|   | or flute or xylophone                |          |
|   | or mandolin or                       |          |
|   | harmonica or drum or                 |          |
|   | harp or oboe or                      |          |
|   | trombone or bassoon                  |          |
|   | or viola or French                   |          |
|   | horn or tuba or                      |          |
|   | theremin or banjo or                 |          |
|   | bass or bagpipes or                  |          |
|   | tambourine or lyre or                |          |
|   | lute or ocarina or                   |          |
|   | harpsichord or cajon                 |          |
|   | or didgeridoo or sitar               |          |
|   | or oud or marimba or                 |          |
|   | melodica                             |          |

| 3 | 1 AND 2 | 1,717 |
|---|---------|-------|

# Google scholar [searched on 14/12/21 AND 11/04/22\*]

("music"|"music therapy"|"singing"|"musical") + (blindness|"low vision"|"reduced vision"|"subnormal vision"|"diminished vision"|"visual impaired"|"vision disorder"|"visual disorder"|"visual disabled"|"vision loss"|"loss of vision"|retina|retinal|cornea|corneal|vision|visual|visually|glaucoma|cataract)

or oper teries only

Relevant google scholar searches found = 245

# **BMJ Open**

# The effectiveness of music-based interventions to address well-being in people with a vision impairment: a scoping review.

| Journal:                             | BMJ Open  |
|--------------------------------------|---|
| Manuscript ID                        | bmjopen-2022-067502.R1  |
| Article Type:                        | Original research   |
| Date Submitted by the<br>Author:     | 13-Mar-2023   |
| Complete List of Authors:            | Somani, Nurbanu; Anglia Ruskin University, Vision and Hearing Sciences<br>Research Centre,<br>Beukes, Eldre; Anglia Ruskin University, Vision and Hearing Sciences<br>Research Centre,<br>Street, Alexander ; Anglia Ruskin University, Cambridge Institute for<br>Music Therapy Research<br>Lindsay, Rosie; Anglia Ruskin University, Vision and Hearing Sciences<br>Research Centre,<br>Smith, Lee; Anglia Ruskin University<br>Allen, Peter; Anglia Ruskin University, Vision and Hearing Sciences<br>Research Centre, |
| <b>Primary Subject<br/>Heading</b> : | Ophthalmology   |
| Secondary Subject Heading:           | Mental health   |
| Keywords:                            | MENTAL HEALTH, Medical ophthalmology < OPHTHALMOLOGY, SOCIAL MEDICINE   |
|                                      |   |

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Title: The effectiveness of music-based interventions to address well-being in people with a vision impairment: a scoping review

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Word Count: 4,095

**Key words:** scoping review; vision impairment; music interventions; therapeutic outcomes; wellbeing.

# Abstract

**Objectives:** The objectivess of this review were to identify the types of music-based interventions and associated accessibility challenges for people who have visual impairment (VI) and their reported effects on psychological, physiological, and social wellbeing. **Design**: A scoping review was developed according to the Joanna Briggs Institute methodology and reported according to the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews checklist and guidelines. A narrative synthesis was conducted to map out the types of music-based interventions undertaken and to compare the therapeutic outcomes. The studies were evaluated according to the music reporting checklist.

**Results**: In total 5,082 records were identified, 69 full-text articles were screened, and 13 studies were included. Eleven studies included younger children and teenagers, two focussed on adults with acquired VI. Ten studies involved active music therapy strategies and three used passive music listening. Eleven of the studies focused on social outcomes and two reported mental health. Although the studies reported that music-based intervention strategies improved psychosocial wellbeing in people with a VI, conclusions could not be drawn as robust outcome measures were not generally used and only four of the studies included any statistical analysis.

**Conclusions**: Although potential was evident, details of intervention protocols and training requirements were not sufficiently reported and further, high-quality evidence-based studies are required.

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# Strengths and limitations of this study:

- This study used best practice methods as set out by the Joanna Briggs Institute (JBI) Scoping Review Methodology manual to conduct a scoping review.
- Publications written in any language were considered for inclusion.
- Clinical trials, comparative, evaluative and observational studies were considered eligible for inclusion.
- A limitation of this study was that Patient and Public Involvement (PPI) was not undertaken to advise on identifying objectives, research questions and types of wellbeing domains.
- The research team, with expertise in vision and music therapy, devised the eligibility criteria.

# Introduction

A visual impairment (VI) impacts all aspects of a person's life and is associated with reduced functional ability. The effects may vary depending on the level of visual impairment, but often include difficulties with reading, writing, comprehending non-verbal cues and following conversations in social situations.[1-3] Such difficulties may impact an individual's mental health, causing depression,[4-7] emotional distress,[6] anxiety,[8-12] feelings of loneliness,[12] social isolation [12] and loss of a sense of belonging.[13,14] Together with addressing the visual difficulties, improving the wellbeing of those with a VI should be prioritised [15-17] as psychological, physiological and social factors influence mental health and impact psychosocial wellbeing.[18]

Wellbeing does not have one single definition, but there is a general agreement that, it includes the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), satisfaction with life, positive functioning, feeling healthy and full of energy.[19] Researchers from different disciplines may refer to wellbeing, depending on their area of interest in that domain, which can include physical, social, developmental and activity-based, emotional, psychological, life satisfaction, domain specific satisfaction, engaging activities and work. This review will include all the listed areas, psychological, physiological and social factors impacting on wellbeing.[19-21]

Some ways to address wellbeing could be through physical activity [22], arts activities [23] and mindfulness.[24] Another approach with people who have a VI can be through musicbased interventions. Music can create feelings of physical and mental relaxation by disguising environmental noises and transferring an individual's attention to a more pleasant emotional state.[25-29] Music-based interventions can be regarded as multifunctional, i.e., they may involve purposeful musical activities, music listening, and making music through playing musical instruments or singing. In the literature, there is a distinction between music-

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based interventions run by a music therapist and those by other health care professionals. Interventions involving a music therapist are characterised by the presence of a therapeutic process and the use of personal musical experiences where the therapeutic relationship is central.[30-33] Interventions in a music therapy context may involve active or passive music listening, improvisation, composing and song writing.[34] In contrast, when the music-based intervention is offered by a medical or healthcare professional, this can be defined as a purposeful music activity such as passively listening to pre-recorded music, which has been referred to as music medicine.[35]

Several studies suggest that listening to music can induce pleasant and positive feelings by the activation of the limbic system. [36, 37] Music has also been shown to have a broad range of therapeutic effects, such as giving individuals a sense of connection, which fosters a sense of community and promotes feelings of interpersonal attachment which can offset loneliness.[38-41] Engaging in musical activity leads to a decrease in cortisol[42] which may alleviate anxiety, promote relaxation, improve mood and decrease agitation.[43] Studies have been conducted in VI populations to promote social cohesion, interpersonal communication[12,13] and for relaxation. Listening to calming music has been used during medical treatment such as cataract surgery. [44] In addition, people with a VI rely on other means of communication such as sound and touch to compensate for their vision loss.[45] Research indicates that people with a VI prefer auditory mediums, such as listening to music or the radio.[45] Children with VI prefer musical toys[46] and enjoy engaging in music as a means of expression.[38] The most recent review of music-based interventions for people with a VI[46] informed on the use of music-based interventions for educational purposes, but excluded studies that used music for relaxation and did not focus on the therapeutic outcomes of those studies to promote psychosocial well-being. In addition, there may have been other music-based intervention studies conducted with people who have a VI since the review was published. To date, no study has attempted to identify the volume of literature on musicbased interventions aimed at improving wellbeing in people who have a VI, thus indicating a need for an up-to-date review.

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Therefore, the aims of this review were to investigate and map the literature on how musicbased interventions have been used with people with a VI to promote their psychological, physiological and social wellbeing and any accessibility challenges that may have hindered people with VI taking part in the intervention at locations away from their home. This is important to highlight, as often people with VI are not able to access face-to-face interventions because of constraints related to transport, geographical location of clinics and/or finances.[47] Similarly, the review investigated if special arrangements and/or accessibility technologies were utilised in the intervention setting and during the treatment to address specific challenges regarding participants navigating unfamiliar settings (both online and in-person).[48]

# **Objectives**

The scoping review questions were categorised into three aspects as described below:

- 1. Description (Types of interventions):
  - What types of music-based intervention studies have been conducted to date that have addressed psychological and/or physiological and/or social wellbeing among people with VI?
  - What is the geographical scope of the conducted studies?
  - In what ways was the intervention made accessible for people with a VI?
- 2. Population groups:
  - What participant demographics were recorded? (e.g., age, gender, ethnicity, and nationality)
  - Was the intervention targeted at specific ocular pathologies? (e.g., congenital or acquired)
- 3. Therapeutic domains of the intervention:
  - What therapeutic outcome domains were identified and outcome measures used to report treatment related effects?
  - What is the effectiveness of music therapy for psychological, physiological and social wellbeing?

#### Methods

## Patient and public involvement (PPI):

We did not conduct any PPI for this review.

#### Study Design

A scoping review was selected for this study because it is an inclusive and flexible approach where specific questions can be posed and addressed that have not already been established in the literature.[49]Due to the limited body of literature in this area, a systematic review was not appropriate. For example, the pooled sample size from the included studies would be too small to make any meaningful inferences within the confines of a systematic review.[49-51]

# Protocol and registration

As presented in the published protocol,[52] this review follows the methodology manual published by the Joanna Briggs Institute for scoping reviews[53] and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.[54] A search on Cochrane Reviews, JBI Evidence Synthesis and Prospero showed no current or ongoing review on this topic.

#### Eligibility criteria:

The PCC format (P—participants/population, C—context, C—concept) was used to formulate the inclusion criteria.[49,53] The inclusion criteria were devised with input from experts in the fields of VI and music therapy. A music therapist helped to identify the most pertinent information, including: interventionist (music therapist, teacher, carer), method, frequency and duration of delivery, group or individual, whether active or passive music therapy was used. The music reporting checklist added further rigor to the review.

#### Participants:

People of any age with a VI were included, with or without additional health-related problems. Visual impairment was defined as people living with long-term, irreversible vision loss that is not rectifiable by surgical procedures.

#### Context:

This scoping review identified music interventions used therapeutically in people with a VI to improve wellbeing. It reports on the contexts in which music-based interventions have been used, including music therapy, music listening and other music-based activities. Therapeutic outcome domains and treatment characteristics were examined. The therapeutic outcome domains included quality of life (any health-related quality of life measures), physiological outcomes/health related outcomes (such as blood pressure/heart rate), mental health (for example wellbeing, anxiety, or depression) and communication and social outcomes (including social engagement).

## Concept:

Interventions delivered in all settings were included if they addressed the therapeutic outcome domains outlined above.

# Adaptations to the original protocol:

To better capture the most relevant aspects of the included studies, the original inclusion criteria: PCC (Participants/population, Context, Concept) in the protocol were modified.[52] For context, therapeutic wellbeing outcomes during ophthalmic treatments/procedures were excluded. This includes ophthalmic procedures such as (i) cataract surgery, (ii) routine eye health check-up, (iii) retinal eye laser treatments, (vi) treatment for glaucoma and (v) eyelid surgeries. This decision was due to the outcome only measuring therapeutic effects whilst undergoing the procedure, rather than a wellbeing shift in the individual's overall life across the therapeutic outcome domains of interest. Subsequently, by refining the area of interest, interventions conducted in hospital/medical operation setting/environment were excluded.

#### Information sources:

The review included all types of published research such as clinical trials, case studies, comparative, evaluative and observational studies. Publication types included peer-reviewed journal publications, postgraduate theses, and conference papers. There was no publication date restriction. This wide approach to data gathering provided an extensive and comprehensive selection of sources to address the research question. In addition to the modifications to the original protocol, studies from the following topics were excluded:

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music for non-therapeutic purposes (i.e. educational interventions), opinion papers, abstracts with no full-text paper written, preprints and undergraduate papers.

## Search strategy and selection of sources of evidence

The databases searched were: EMBASE (Ovid interface, 1974 onwards), MEDLINE (Ovid interface, 1948 onwards), CINAHL Plus (EBSCOhost) PsycINFO (EBSCOhost) and Web of Science (Clarivate Analytics). Further search strategies included free-text hand searches in Google Scholar for grey literature and screening reference lists of all relevant studies. The searches were conducted on: 14 December 2021 and again on 11 April 2022. The purpose of using a variety of major databases was to ensure adequate and efficient coverage related to health, life sciences, nursing, and psychology.[55] The detailed search terms can be found in

*supplemental data 1.* The retrieved studies were exported into Mendeley, and duplicates were automatically removed. One reviewer (NS) first screened the titles and abstracts for eligibility for full-text analysis. This was then cross-checked by a second reviewer (RL). The reviewers independently classified the eligible articles for inclusion for the scoping review into one of the following groups:

1. Therapeutic wellbeing outcomes: Interventions during surgery or treatment that had therapeutic wellbeing outcome(s) to improve wellbeing in VI populations.

2. Therapeutic wellbeing outcomes: Interventions for non-irreversible vision loss that is not rectifiable by surgical procedures

Where there was a disagreement between the two reviewers at any stage of the study selection process, a final agreement was sought by mutual consensus with input from a third reviewer (PMA). When the full text of an article was not available in English language (n = 2), a professional translation service was used.

#### Data charting process and data items

Data extraction tables were developed using the JBI scoping review template<sup>53</sup> and the Checklist for Reporting Music-based Interventions[56] to capture the information necessary for data synthesis. To minimise bias during the review process two independent reviewers were selected with different professional backgrounds[57] (i.e., sports science and dispensing optics). For any disagreements regarding interpretation and critical reflection of studies, a

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third reviewer (from an optometry background) was consulted. This team was appointed to minimise the influence reflexivity or prior assumptions on study selection. To ensure quality assurance during the review process, the research team followed the JBI review checklists[53]

and PRISMA-ScR.[54]

The agreed data extracted by the authors were: (1) author and year of publication and country) (2) participant demographics (mean age, sample size, ocular pathologies, gender, and nationality (ethnicity)) (3) description and findings of the review studies (study design, intervention description (strategies used, setting, length and duration of the intervention and who delivered the intervention), accessibility adaptations and main study findings) (4) therapeutic outcome domains of interest (e.g. change in behaviour, social engagement, psychological wellbeing) and (5) corresponding therapeutic outcome measures (e.g. physiological parameters, questionnaires, observations, interviews). The data items were grouped into sub tables to present the data.

# Critical appraisal of individual sources of evidence

A critical appraisal of the sources of evidence was not conducted as part of this review. The primary goal was to enquire what has been investigated to date and to understand the scope for future research, rather than to assess the reliability of study findings. The Music-based intervention reporting checklist sections were reported according to published guidelines. [56]

The purpose of the checklist is to improve the transparency and specificity of reporting. It consists of seven different sections, including: intervention theory, content and delivery, schedule, interventionist, treatment fidelity, setting, and unit of delivery. These sections are intended to support Consolidated Standards of Reporting Trials (CONSORT) and Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statements for transparent reporting of interventions while taking into account their variety, complexity, and uniqueness.

The checklist has been used in previous studies as a tool to report the quality of the music intervention research in terms of clinical relevance and rigour. For this review, the checklist was used to evaluate the individual sources of evidence.[58-60]

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# Synthesis of results

PRISMA-ScR guidelines were followed to report the results from the extracted data.[54] This allowed us to identify the characteristics of sources and map the existing literature. For data presentation, the results were categorised by its study designs (non-experimental and experimental) and extracted data were grouped and tabulated with a descriptive numerical analysis to identify comparative data. In addition, to synthesise the data, it is presented as tables to summarise the key findings addressing the research questions in the three broad categories. Existing gaps in the research were determined on the evaluation of the interventions to improve wellbeing in people with a VI.

#### **Results**

#### Selection of sources of evidence

The database search yielded 5,082 citations after removal of duplicates (*See Figure 1*). Screening of titles and abstracts resulted in a first classification, after which 69 papers were included for full-text review. Thirteen studies met the final inclusion criteria.[50]

INSERT HERE: Figure 1. PRISMA Flow diagram of study inclusion process

# Characteristics of sources of evidence

#### Summary of the study characteristics

The geographical scope of the included studies was America (n = 7), Australia (n = 1), Canada (n = 1), Brazil (n = 2), Germany (n = 1), and China (n = 1). The first music intervention study in a VI population was undertaken in 1982 and the most recent in 2016. Two out of the 13 studies were conducted with adults, the remaining 10 studies' were with young children and teenagers under the age of 18 years. One study took place at the participant's home, the rest took place in an external location, such as a school or clinical environment.

#### Synthesis of results

A narrative synthesis of the results that supplements the tabulated results is separated by the following four sections:

(i) participant demographics
- (ii) description of the studies
  - (iii) therapeutic outcomes
  - (iv) Checklist for Reporting Music-based Interventions

This was done by their respective study designs (non-experimental and experimental), identifying the gaps in the literature and scope for future music-based interventions.

# (1) Participant demographics

## Non-experimental studies

A total of 28 participants were included in the non-experimental studies. The range of the sample size of each study varied from 1 to 10 participants with six studies having one participant, one study had two participants and two studies had 10 participants respectively. All the case studies involved children. The age range was 2-18 years; mean: 8.5 years, SD:  $\pm 5.3$ ) of which half n = 14 (50%) were female. The nationality was stated, but ethnicity was not consistently reported in the included studies. The visual impairment of the participants was mainly congenital or acquired at a very young age (See *Table 1*).

| Author (year,        | Sample | Mean age   | Gender    | Nationality     | Vision impairments                           |
|----------------------|--------|------------|-----------|-----------------|--|
| country)             | size   | · ·        |           | (Ethnicity)     |  |
| Salas, J <i>et</i>   | 1      | 4 years    | Female    | American/Italia | Bilateral optic atrophy                      |
| <i>a</i> l.(1988,    |        |            |           | n               |  |
| USA)[61]             |        |            |           |                 |  |
| Rogow, S             | 10     | 4 years    | 6 Females | Canadian        | Anophthalmia, cortical blindness, partial    |
| (1982,               |        |            | 4 Males   | (Chinese)       | sight impairment, several sight impaired and |
| Canada)[62]          |        |            |           |                 | total blindness                              |
| Shoemark, H          | 1      | 8 years    | Male      | Australian      | Detached retina (blind)                      |
| (1991,               |        |            |           |                 |  |
| Australia)[63]       |        |            |           |                 |  |
| Silliman, LM.        | 1      | 10 years   | Male      | American        | Blind  |
| <i>et al.</i> (1994, |        |            |           |                 |  |
| USA)[64]             |        |            |           |                 |  |
| Kern P et al.        | 1      | 3 years    | Male      | American        | Bilateral congenital                         |
| (2001,               |        |            |           | (African)       | anophthalmia/microphthalmia                  |
| USA)[65]             |        |            |           |                 |  |
| Villasenor, R.       | 2      | 14.5 years | 1 Female  | American        | Retinopathy of prematurity                   |
| <i>et al.</i> (2012, |        |            | 1 Male    |                 |  |
| USA) [66]            |        |            |           |                 |  |
| Desrocher, M.        | 1      | 13 years   | Female    | American        | Bilateral congenital anophthalmia            |
| <i>et al.</i> (2014, |        |            |           |                 |  |
| USA)[67]             |        |            |           |                 |  |
| Metell, M            | 10     | 2.5 years  | 5 Females | Brazilian       | Optic nerve atrophy, septo-optic dysplasia,  |
| (2015,               |        |            | 5 Males   |                 | chorioretinitis, coloboma of optic papilla,  |
| Norway)[68]          |        |            |           |                 | chorioretinitis, microphthalmia, corectopia- |
|                      |        |            |           |                 | clara, optic nerve atrophy, toxoplasmosis,   |
|                      |        |            |           |                 | agenesis ocular, optic nerve atrophy,        |
|                      |        |            |           |                 | anophthalmia                                 |
| Villas Boas, D.      | 1      | 5 years    | Male      | South           | Nystagmus and blind                          |
| <i>et al.</i> (2016, |        |            |           | American        |  |
| Brazil)[69]          |        |            |           |                 |  |

Table 1. Participant demographics across review studies (non-experimental)

# Experimental studies

A total of 134 participants were included in the four experimental design studies. The range of the sample size varied from, 1, 6, 41 and 80 respectively. The age range was 5-55 years (mean: 32.2 years, SD:  $\pm 21.68$ ). The age range of the two studies with children, was 5-17 years. Slightly more participants *n* = 75 (56%) were female. The visual impairments in the studies ranged from congenital to acquired. (See *Table 2*).

Table 2. Participant demographics across review studies (experimental)

| Mean age | Gender | Nationality | Vision impairments |
|----------|--------|-------------|--------------------|
|          |        | (Ethnicity) |                    |

| 51 years   | 40      | Chinese  | Diabetic retinopathy                              |
|------------|---------|----------|---|
|            | Female  |          |   |
|            | 40 Male |          |   |
| 55.8 years | 17      | German   | Open angle glaucoma                               |
|            | Female  |          |   |
|            | 14 Male |          |   |
| 17 years   | Female  | American | Blind   |
| 5 years    | 1       | American | Blindness ranging from: one prosthetic eye, bi-   |
|            | Female  |          | lateral retinoblastoma nystagmus, cortical visual |
|            | 5 Male  |          | impairment  |

Six out of the nine non-experimental studies were single subject case studies and three were case series. Four of the studies were led by a music therapist [61,63,68,65], two were undertaken by researchers[62,64] and three by schoolteachers.[65-67,69] Music improvisation was used in four studies[61,63,68,69], which involved the music therapist and client/s co-creating and exploring music with different instruments and/or voice.[32] Three studies used music-based activities such as playing with musical toys, one study used passive music listening and one used nursery rhyme singing[64,65,67] (See *Table 3*).

The average music listening time and duration was 30 minutes per-day over a period of two months. Seven out of the nine studies were conducted in a school setting[62,63,64-67,69] and the other two were undertaken in a private clinical setting[61] and university research centre[68] respectively. Four studies did not report any accessible adaptations made for people with a VI.[62,63,64,67] Two studies reported the study sessions were lead and guided by the researchers or teachers as a means of making the intervention more accessible, by being present to offer support.[66,69] One study reported training was provided to the parents/carers of the participating children to make it more accessible by offering assistance.[68] Only two studies reported adaptations to the environment to make it more accessible. One study made adaptations to the layout of the playground[65] and the other made changes to the lighting of the therapy room[61] (See *Table 3*). All five studies refer to accessibility and adaptations made; however they lack specific detail on how barriers were addressed, and support provided.

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| Author                                  | Study   | Strategies     | Length and   | Who          | Intervention    | Accessible            | What are the      |
|---|---------|----------------|--------------|--------------|-----------------|-----------------------|-------------------|
| (vear.                                  | design  | used           | duration of  | delivered/   | setting         | (Yes/No) and what     | main findings?    |
| country)                                | g       |                | the          | facilitated  |                 | accessibility         |                   |
| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |         |                | intervention | the          |                 | adaptations were      |                   |
|   |         |                |              | intervention |                 | made?                 |                   |
| Rogow, S                                | Case    | Singing        | 30 minutes   | Researcher   | School          | None stated           | Nursery           |
| (1982,                                  | studies | nursery        | daily over a |              |                 |                       | rhythms can       |
| Canada)                                 |         | rhymes         | period of 2  |              |                 |                       | help develop      |
|   |         | researcher     | months       |              |                 |                       | communicative     |
|   |         |                |              |              |                 |                       | behaviours.       |
|   |         |                |              |              |                 |                       |                   |
| Salas, J <i>et</i>                      | Case    | Music          | Twice a      | Music        | Clinical        | Yes. Lights in the    | Long term         |
| <i>a</i> l.(1988,                       | study   | therapy:       | month, 30-   | therapist    | setting/private | room were             | positive          |
| USA)                                    |         | Improvisation  |              |              | CIINIC          | switched off to       | changes in        |
|   |         |                | 10 months    |              |                 | create a restitut and | montal            |
|   |         |                | 10 montris   |              |                 | environment           | canabilities      |
|   |         |                |              |              |                 |                       | expressive and    |
|   |         |                |              |              |                 |                       | creative          |
|   |         |                |              |              |                 |                       | aspects were      |
|   |         |                |              |              |                 |                       | identified in the |
|   |         |                |              |              |                 |                       | participant's     |
|   |         |                |              |              |                 |                       | personality.      |
| Shoemark,                               | Case    | Music          | 30-minute    | Music        | Residential     | None stated           | Basic music       |
| H (1991,                                | study   | therapy:       | sessions,    | therapist    | educational     |                       | skills            |
| Australia)                              |         | improvisation, | twice a      |              | facility        |                       | developed, ,      |
|   |         | singing, and   | week for 9   |              | (school)        |                       | spontaneous       |
|   |         | learning to    | months       |              |                 |                       | interaction and   |
|   |         | play the piano |              |              |                 |                       | increased         |
|   |         |                |              |              |                 |                       | participation in  |
|   |         |                |              |              |                 |                       | classroom         |
|   |         |                |              |              |                 |                       | activities was    |
| Cillimon                                | Casa    | Music bood     | 20 to 10     | Desseration  | Cohool          | Nana stated           | recognised .      |
|   | etudy   | activity:      | minute       | Researcher   | School          | None stated           | motor skills      |
| (1994                                   | Study   | involving      | sessione     |              |                 |                       | increased         |
| USA)                                    |         | plaving music  | three times  |              |                 |                       | noticeably        |
|   |         | as a           | a day for 10 |              |                 |                       | when music        |
|   |         | reinforcer to  | days         |              |                 |                       | was introduced    |
|   |         | help improve   | -            |              |                 |                       | as a reinforcer.  |
|   |         | motor skills   |              |              |                 |                       | The authors       |
|   |         |                |              |              |                 |                       | also concluded    |
|   |         |                |              |              |                 |                       | such skills may   |
|   |         |                |              |              |                 |                       | be maintained     |
|   |         |                |              |              |                 |                       | with regular      |
|   |         |                |              |              |                 |                       | use of them.      |

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| al. (2001,  |                                  |   | Daily for 25   | Music                         | School | Vac Adaptations  | The   |
|---|----------------------------------|---|--|-------------------------------|--------|--|---|
| al. (2001,  | case                             |   | Daily for 35   | thereniet                     | School | res. Adaptations   | ne  |
|   | Sludy                            | activity.   | days (period   | therapist                     |        | were made  | playground  |
| 05A)  |                                  | different   |  |                               |        | specifically for the   |   |
|   |                                  | music   | specified)   | teacher                       |        | participant in the   | resulted in no  |
|   |                                  |   |  |                               |        | playground.T   | changes in the  |
|   |                                  | play with,  |  |                               |        |  |   |
|   |                                  | located in the  |  |                               |        |  | interactions  |
|   |                                  | play area   |  |                               |        |  | with peers or   |
|   |                                  |   |  |                               |        |  | adults and no   |
|   |                                  |   |  |                               |        |  | change in   |
|   |                                  |   |  |                               |        |  | movement on   |
|   |                                  |   |  |                               |        |  | the   |
|   |                                  |   |  |                               |        |  | playground, as  |
|   |                                  |   |  |                               |        |  | well as a   |
|   |                                  |   |  |                               |        |  | decrease in   |
|   |                                  |   | •  |                               |        |  | stereotypical   |
|   |                                  |   |  |                               |        |  | responses.  |
|   |                                  |   |  |                               |        |  | The findings  |
|   |                                  |   |  |                               |        |  | suggest that  |
|   |                                  |   |  |                               |        |  | musical   |
|   |                                  |   |  |                               |        |  | adaptations of  |
|   |                                  |   |  |                               |        |  | physical  |
|   |                                  |   |  |                               |        |  | environments  |
|   |                                  |   |  |                               |        |  | may be helpfu   |
|   |                                  |   |  |                               |        |  | but not   |
|   |                                  |   |  |                               |        |  | sufficient for  |
|   |                                  |   |  |                               |        |  |   |
|   |                                  |   |  |                               |        |  | promoting   |
|   |                                  |   |  |                               | 5      |  | promoting<br>desired  |
|   |                                  |   |  | 0                             |        |  | promoting<br>desired<br>outcomes.   |
| Villasenor,   | Case                             | Passive   | 15 or 30   | Teacher                       | School | Yes.   | promoting<br>desired<br>outcomes.<br>Both students'   |
| Villasenor,<br>R. <i>et al.</i>   | Case<br>studies                  | Passive<br>music  | 15 or 30<br>minutes  | Teacher                       | School | Yes.<br>Teacher/assistant  | promoting<br>desired<br>outcomes.<br>Both students'<br>body   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,   | Case<br>studies                  | Passive<br>music<br>listening   | 15 or 30<br>minutes<br>daily, 5 days   | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support                                | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)   | Case<br>studies                  | Passive<br>music<br>listening<br>(nature  | 15 or 30<br>minutes<br>daily, 5 days<br>per week,  | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students                | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)   | Case<br>studies                  | Passive<br>music<br>listening<br>(nature<br>sounds)   | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a   | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students                | promoting<br>desired<br>outcomes.<br>Both students <sup>2</sup><br>body<br>awareness an<br>movement,<br>listening skills,   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)   | Case<br>studies                  | Passive<br>music<br>listening<br>(nature<br>sounds)   | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10   | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students                | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)   | Case<br>studies                  | Passive<br>music<br>listening<br>(nature<br>sounds)   | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks  | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students                | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)   | Case<br>studies                  | Passive<br>music<br>listening<br>(nature<br>sounds)   | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks  | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students                | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,                                       | Case<br>studies                  | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based  | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-  | Teacher                       | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i>                   | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:   | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute  | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,         | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play                         | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions  | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical         | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated   | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-   | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness an<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute   | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute<br>break were   | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours<br>and increasing  |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute<br>break were<br>held during  | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours<br>and increasing<br>desirable   |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute<br>break were<br>held during<br>three days                            | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours<br>and increasing<br>desirable<br>behavior of an                               |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute<br>break were<br>held during<br>three days<br>within a                | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours<br>and increasing<br>desirable<br>behavior of an<br>adolescent                 |
| Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)<br>Desrocher,<br>M. <i>et al.</i><br>(2014,<br>USA) | Case<br>studies<br>Case<br>study | Passive<br>music<br>listening<br>(nature<br>sounds)<br>Music based<br>activity:<br>musical play<br>with musical<br>toy‡ | 15 or 30<br>minutes<br>daily, 5 days<br>per week,<br>for a<br>period of 10<br>to 20 weeks<br>Two 8-<br>minute<br>sessions<br>separated<br>by a 10-<br>minute<br>break were<br>held during<br>three days<br>within a<br>period of a | Teacher<br>School<br>teachers | School | Yes.<br>Teacher/assistant<br>present to support<br>the students<br>None stated | promoting<br>desired<br>outcomes.<br>Both students'<br>body<br>awareness and<br>movement,<br>listening skills,<br>and tactile<br>processing<br>improved.<br>Background<br>music was<br>effective in<br>reducing<br>problem<br>behaviours<br>and increasing<br>desirable<br>behavior of an<br>adolescent<br>who is blind |

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|-----------|---------|---------------|-------------|-----------|--------------|--------------------|------------------|
|           |         |               |             |           |              |                    | disabilities     |
|           |         |               |             |           |              |                    | during a         |
|           |         |               |             |           |              |                    | reinforcer       |
|           |         |               |             |           |              |                    | assessment.      |
| Metell, M | Case    | Music         | Each        | Music     | University   | Yes. The sessions  | Positive         |
| (2015,    | studies | therapy:      | session     | therapist | Research     | were lead and      | bonding          |
| Norway)   |         | improvisation | lasted      |           | Centre       | guided by the      | patterns and     |
|           |         | and singing   | around      |           | (pedagogical | researcher and     | enhances early   |
|           |         | Brazilian     | 25min and   |           | institution) | training was       | interaction by   |
|           |         | children's    | number of   |           |              | provided to the    | providing        |
|           |         | songs         | sessions    |           |              | parents/carers of  | experiences of   |
|           |         |               | varied from |           |              | the children.      | togetherness,    |
|           |         |               | one to      |           |              |                    | joint attention, |
|           |         | Ο.            | Seven over  |           |              |                    | and happiness    |
|           |         |               | a period of |           |              |                    | was identified.  |
|           |         |               | 10-weeks    |           |              |                    |                  |
| Villas    | Case    | Music         | Analysis    | Teachers. | Educational  | Yes.               | Attention        |
| Boas, D.  | study   | therapy:      | was         |           | services     | Teacher/researche  | seeking          |
| et al.    |         | improvisation | observed    |           | provider     | r present to offer | behavior         |
| (2016,    |         | and singing   | over 7 days |           | (school)     | support            | towards          |
| Brazil)   |         | rhymes        | (period was |           |              |                    | teachers and     |
|           |         |               | not stated) |           |              |                    | children in the  |
|           |         |               |             |           |              |                    | classroom        |
|           |         |               |             |           |              |                    | occurred more    |
|           |         |               |             |           |              |                    | in the body      |
|           |         |               |             |           |              |                    | contact          |
|           |         |               |             |           |              |                    | activities,      |
|           |         |               |             |           |              |                    | music, and       |
|           |         |               |             |           |              |                    | singing and      |
|           |         |               |             |           |              |                    | rhythm.          |
|           |         |               |             |           |              |                    |                  |

† Six multisensory musical stations with a connecting path (a 10 cm drainage pipe) were added to the playground. To assist navigation the participant was also provided with a pushcart which made a sound when pushed along the path.
‡ Musical toy was used to reinforce the participant raising their head from their chest, as this was considered socially desirable behaviour.

## Experimental studies

Two out of the four experimental studies were randomised control trials,[70,71] the other two were quasi-randomised (repeated measures),[2] ABA reversal and stimulation treatment design,[72] respectively. Two of the studies were led by researchers,[70,71] one study conducted by a teacher[72] and one by a music therapist.[2] The music-based intervention strategies used in two out the four studies were music listening.[70,71] One study used improvisation using instruments to create music, accompanied with singing.[2] Another study used a music-based activity that involved listening to pre-recorded music.[72] The average

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music listening time was 30 minutes per day over a period of 15 days. The intervention setting varied from a university research centre[71,72]nto a participants' home,[70] and a school.[2]Three out of the four studies reported on the intervention accessibility adaptation, including adaptations to the classroom,[72] provision of instructional training to those participating[2] and one study conducted home visits, together with weekly check in calls to participants.[70] The fourth study did not state any accessibility adaptations,[71] as seen in *Table 4*.

| Author                  | Study        | Strategies     | Length and   | Who          | Intervention setting  | Accessible    | What are the            |
|-------------------------|--------------|----------------|--------------|--------------|-----------------------|---------------|-------------------------|
| (year,                  | design       | used           | duration of  | delivered/   |                       | (Yes/No)      | main findings?          |
| country)                |              |                | the          | facilitated  |                       | and what      |                         |
|                         |              |                | intervention | the          |                       | accessibility |                         |
|                         |              |                |              | intervention |                       | adaptations   |                         |
|                         |              |                |              |              |                       | were made?    |                         |
| Hill, J. <i>et al</i> . | ABA          | Music based    | Approx. 28   | Teacher      | Special needs         | Yes.          | There were              |
| (1989,                  | reversal and | activity that  | sessions,    |              | university/classroom  | Adaptations   | higher rates of         |
| USA)                    | stimulation  | involved       | varying from | 6.0          |                       | were made     | in-seat behavior        |
|                         | treatment    | playing pre-   | 5 to 20      |              |                       | in the        | during the              |
|                         | design       | recorded       | minutes      |              |                       | classroom     | music phase.            |
|                         | (case study) | music in the   | each (exact  |              |                       |               | There was also          |
|                         |              | background     | information  |              |                       |               | a clear reversal        |
|                         |              | and with the   | not          |              |                       |               | of effects              |
|                         |              | music          | specified)   |              |                       |               | without a music         |
|                         |              | stopping       |              |              |                       |               | reinforcement.          |
|                         |              | when the       |              |              |                       |               |                         |
|                         |              | student gets   |              |              |                       |               |                         |
|                         |              | up from their  |              |              |                       |               |                         |
|                         |              | chair) The     |              |              |                       |               |                         |
|                         |              | music          |              |              |                       |               |                         |
|                         |              | selection      |              |              |                       |               |                         |
|                         |              | included: rap, |              |              |                       |               |                         |
|                         |              | classical,     |              |              |                       |               |                         |
|                         |              | rock and jazz  |              |              |                       |               |                         |
| Robb, S                 | Quasi –      | Music          | 4 x 30-      | Music        | Children's Centre for | Yes.          | Attentive               |
| (2003,                  | (repeated    | therapy:       | minute       | therapist    | the Visually          | Instructional | behavior was            |
| USA)                    | measures)    | Improvisation  | sessions: 2  |              | Impaired              | training was  | significantly           |
|                         |              | (including     | music based  |              | (nursery/play         | conducted     | higher during           |
|                         |              | singing)       | sessions, 2  |              | school)               | prior to the  | music based-            |
|                         |              |                | play-based   |              |                       | intervention  | sessions $t(5) =$       |
|                         |              |                | sessions     |              |                       |               | 5.81; <i>p</i> = .002). |

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|   |                             |   |   |             |         | 1   |   |
|---|-----------------------------|---|---|-------------|---------|---|---|
|   |                             |   | without<br>music                          |             |         |   | Mean scores for<br>the remaining<br>group<br>participation<br>behaviours<br>were higher in<br>the music<br>condition, but<br>these<br>differences<br>were not<br>statistically<br>significant.  |
| Zhao, L. <i>et</i><br><i>al.</i> (2005,<br>China) | Randomised<br>control trial | Passive<br>music<br>listening<br>(happy,<br>cartoon<br>music, sad<br>song<br>selection) | 30 minutes,<br>twice daily<br>for 28 days | Researchers | At home | Yes. Home<br>visits were<br>done and<br>weekly<br>"check in"<br>calls | Significant<br>differences<br>were found<br>between<br>somatization,<br>interpersonal,<br>anxiety,<br>depression,<br>phobia, and<br>positive score<br>values ( $p$<br><0.05). There is<br>a positive<br>correlation<br>between the<br>physical<br>function of the<br>diseased<br>patients' quality<br>of life-specific<br>scale and the<br>physical<br>function, social<br>function, social<br>function, social<br>function, and<br>mental function<br>of the visual<br>function<br>impairment of<br>the quality of life<br>scale of patients<br>with<br>ophthalmopathy<br>( $p$ < 0.05).<br>There is a |

| Germany)                                   |  | (treatment<br>group<br>listened to<br>relaxation<br>music)        | days  |   |  |   | Intraocular<br>pressure, and<br>short-term<br>mental state<br>(KAB)<br>development  |
|--|--|---|---|---|--|---|---|
| Bertelmann,<br>T. e <i>t al.</i><br>(2015, | Randomised control trial                               | Passive<br>music<br>listening                                     | 30-minute<br>session<br>daily for 10  | Researchers   | University clinical,<br>research lab   | None stated.  | depression, and<br>anxiety ( <i>p</i> <<br>0.05).<br>The best<br>corrected visual<br>acuity, daily  |
|  |  |   |   | 2   | 0  |   | Social<br>dimension is<br>negatively<br>correlated with<br>compulsion,<br>interpersonal,  |
|  |  |   |   | J.C.  |  |   | anxiety,<br>hostility, horror,<br>paranoia, and<br>spirit ( <i>p</i> < 0.05);   |
|  |  |   |   | D.  |  |   | correlated with<br>compulsion,<br>depression,   |
|  |  | C   | 00  |   |  |   | impairment ( <i>p</i><br><0.05). Mental<br>dimension is   |
|  |  | 5   |   |   |  |   | quality of life<br>scale of patients<br>with visual   |
|  |  | ~   |   |   |  |   | dimension is<br>positively<br>correlated with<br>the social   |
|  |  |   |   |   |  |   | function of the<br>patient's quality<br>of life scale ( <i>p</i><br><0.05); the<br>treatment  |
|  |  |   |   |   |  |   | between the<br>social function<br>and mental and<br>psychological   |
|  | Bertelmann,<br>T. e <i>t al.</i><br>(2015,<br>Germany) | Bertelmann,<br>T. e <i>t al.</i><br>(2015,<br>Germany) Randomised | Bertelmann,       Randomised         T. et al.       control trial         (2015,       Germany)         Randomised       Istening         (reatment group)       istenent or relaxation music) | Bertelmann,       Randomised       Passive       30-minute         T. et al.       control trial       Passive       30-minute         (2015,       Germany)       Fandomised       Passive       30-minute         session       daily for 10       days       days       days | Bertelmann,<br>T. et al.       Randomised<br>control trial       Passive<br>music<br>listering<br>(reatment<br>group<br>listered to<br>relaxation<br>music)       30-minute<br>session<br>daily for 10<br>days | Bertelmann,<br>T. et al.<br>(2015,<br>Germany)       Randomised<br>control trial<br>music<br>listening<br>music       Passive<br>music<br>session<br>daily for 10<br>days       30-minute<br>session<br>daily for 10<br>days       Researchers<br>research lab       University clinical,<br>research lab | Bertelmann,       Randomised       Pasive       30-minute       session       Viversity clinical,       None stated.         C015,       Germanyy       Randomised       Pasive       session       days for 10       research tab       Viversity clinical,       None stated. |

better ( $\rho < 0.05$ ) in the treatment group in comparison to controls. Visual field testing, long-term mental wellbeing (profile of mood states), and adrenalin, cortisol, and endothelin-l blood levels did not differ significantly between both groups (p< 0.05).

# (2) Therapeutic outcomes domains Non-experimental studies

All nine studies investigated social therapeutic domains only.[61-69] These included outcomes such as, social engagement, bonding, and interaction, change in behaviour (e.g., attentiveness), developing interpersonal/social skills (e.g., communication) and participation skills. The corresponding outcome measures used to assess the therapeutic outcomes were qualitative methods, such as observation, note taking, videotaping, and interviews with participants/caregivers. None of the studies conducted statistical analysis, so it was not possible to draw any definitive conclusions, as seen in *Table 5*.

## Table 5. Therapeutic outcomes across the review studies (non-experimental)

| Author   | Therapeutic | Therapeutic    | Therapeutic | Frequency of when the outcome measures were observed/ Follow  |
|----------|-------------|----------------|-------------|---|
| (year,   | Domain of   | Outcomes       | Outcome     | up periods  |
| country) | Interest †  |                | Measures    |   |
| Rogow, S | Social      | Social signals | Note taking | Data was collected during the 30-minute sessions daily over a |
| (1982,   |             | and engaging   | and         | period of 2 months.   |
| Canada)  |             | behaviour      | observation |   |

| Salas, J, <i>et</i><br><i>al,</i> 1988,<br>USA)                             | Social | Improve<br>interpersonal<br>skills and<br>behaviour  | Note taking<br>and<br>observation   | Data was collected during all phases of the study: phase one-<br>October 1988 to January 1989,<br>phase two- February to May 1989 (Bi-monthly sessions) and phase<br>three- July 1989.   |
|---|--------|--|---|--|
| Shoemark,<br>H (1991,<br>Australia)   | Social | Communication<br>and social<br>skills,<br>interactive<br>behaviour/<br>enhance self<br>esteem          | Note taking<br>and<br>observation   | Data was collected during all periods of the study: initial period-<br>twice weekly sessions,<br>exploratory period- twice weekly sessions, control period- not<br>specified.  |
| Silliman,<br>LM. <i>et al.</i><br>(1992,<br>USA)<br>Kern P et<br>al. (2001, | Social | Increase<br>compliant<br>behaviour ‡<br>Social<br>interaction and                                      | Note taking<br>observation<br>Note taking,<br>observation                         | Data was collected 24 hours before baseline<br>24 hours after the intervention phase<br>2 weeks and 3 months following treatment to determine if learning<br>had been maintained.<br>Data was gathered daily during the 7 months period. |
| USA)<br>Villasenor,<br>R. <i>et al.</i><br>(2012,<br>USA)                   | Social | engagement in<br>play.<br>Improve<br>functional skills:<br>attention,<br>speech and<br>language, self- | and video<br>recording<br>Observation,<br>video<br>recording<br>and<br>interviews | One interview during the intervention phase of (up to 20 weeks) and one interview after the intervention phase.  |
| Desrocher,<br>M. <i>et al.</i>  | Social | regulation,<br>sensory<br>integration<br>Improve<br>problem  | Observation<br>and video  | Data was collected during all six sessions over three days   |
| (2014,<br>USA)<br>Metell, M<br>(2015,<br>Norway)                            | Social | Bonding and interaction  | Note taking,<br>observation,<br>video<br>recordings                               | Data was collected through 48 session notes, 29 field notes, three interviews with caregivers, and one interview with two special teachers were conducted.   |
| Villas Boas,  | Social | Improve  | and<br>interviews<br>with<br>caregivers<br>Observation                            | Data was collected from the 119:04 (minutes: seconds) recordings   |
| D. <i>et al.</i><br>(Brazil,<br>2016)                                       |        | attention and<br>communicative<br>behaviours   | and video<br>recording  | of interaction between the teacher and the child The tapes were<br>transcribed (82:02) and the<br>recordings time was encoded, which<br>allowed the marking and location of<br>behaviours to facilitate analysis<br>of the data.         |

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† Social- includes social engagement, bonding, and interaction, change in behaviour and social skills (e.g. communication), mental health- includes well-being, anxiety, depression, psychological stress, physiological/health related outcomes- includes blood pressure/ heart rate, Quality of life- includes any health-related quality of life measures

‡ Behaviour measured as improving compliance to perform four gross motor skills: walking, stairclimbing, standing, and sitting.

§ Problem behaviours included standing up, hand hitting, and mouth tapping.

## Experimental studies

The therapeutic outcome domains investigated in the included studies were, psychological/mental wellbeing, quality of life, and reduced psychological stress for two studies.[70 71] In addition, one of these[71] investigated the physiological domain. Two further studies investigated social domains, namely changes in behaviour (e.g., increased attentiveness and compliance)[72] and participation skills[2] (See *Table 6*).

## Outcome measures

Mental health and stress were investigated using the Diabetes Quality of Life Specific Scale (DQOL), Visual Quality of Life (VQOL) and Symptom Check list (SCL-90).[70] One used the Profile of mood states[71]and a German questionnaire measuring stress, namely the Kurzfragebogen zur aktuellen Beanspruchung (KAB).[71] Physiological parameters included adrenalin concentration (pg/mL), cortisol concentration (µg/dL), endothelin concentration (pg/mL), which were taken at four time points, and intraocular pressure (IOP-mmHg). Vision outcomes included Best Corrected Visual Acuity (BCVA), and 30° Visual Field (VF) testing.[71] Data were collected daily before the 30-minute intervention for all 10 days during the core study phase.

## Findings

Data from a randomised clinical trial where the experimental group received relaxation music for 10 days and the control group did not, indicate significant improvements for the music group in daily intraocular pressure and short-term mental state (KAB).[71] Visual field scores, mental well-being POMS and adrenalin, cortisol, and endothelin-I blood levels did

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not differ significantly between the groups. The conclusive finding from this study suggest the addition of relaxing music on a daily basis, might positively impact some physiological and psychological parameters.

Another study[70] compared two groups of patients (n = 40 per group) with diabetic retinopathy, one receiving music relaxation therapy while undergoing a fixed drug treatment simultaneously. The methods used to gather the quantitative data were validated wellbeing questionnaires: Quality of Life Specific Scale (QOL), Visual Quality of Life (VQOL) and Symptom Check list (SCL-90). The main finding from this study indicated that the experimental group showed significant improvements when compared to the control group for psychological wellbeing measures, including somatization anxiety, and depression.

The other two experimental studies,[2,72] in this review used qualitative methods such as, observation, note taking and video recordings. Robb[2] conducted a pilot study to compare attentive and participatory behaviours during music and non-music play-based group instructional sessions in preschoolers with visual impairments. The main finding was that attentive behaviour was significantly higher during music therapy sessions in comparison to non-music, play-based ones. The sessions were videotaped to collect behavioral data that was interpreted in a quantifiable way. The mean scores from the study indicated that attentive behaviours were higher in the music condition, but these differences were not statistically significant.[2] A single-subject case study for attentive behaviour in the classroom using music as a reinforcer in a young blind woman with "profound mental retardation" found higher rates of in-seat behavior during the music phase, with a reversal of effects without a music reinforcement.[72] However, this study did not conduct any statistical analysis (See *Table 6*).

| Table 6. Therapeutic outcomes acro | oss the review studies (experimental) |
|------------------------------------|---------------------------------------|
|------------------------------------|---------------------------------------|

| Author                  | Therapeutic | Therapeutic | Therapeutic     | Frequency of when the outcome measures were           |
|-------------------------|-------------|-------------|-----------------|---|
| (year,                  | Domain of   | Outcomes    | Outcome         | observed/ Follow up periods                           |
| country)                | Interest †  |             | Measures        |   |
| Hill, J. <i>et al</i> . | Social      | Improve     | Note taking,    | Data was collected from the 28 video recordings taken |
| ( 1989,                 |             | compliant   | videotaping and | during the intervention period                        |

| USA)               |                 | behaviour ±     | observation      |   |
|--------------------|-----------------|-----------------|------------------|---|
| Robb S             | Social          |                 | Note taking      | Data was gathered from 4 sessions that were videotaged    |
| (2003              | Social          | behaviour       | observations     | to facilitate the collection of behavioral data (a time   |
| (2000,<br>LISA)    |                 | and             | and completing   | sampling data collection method, with 10-second           |
| 004)               |                 | narticipation   | non validated    | observe/5-second record intervals) Observations forms     |
|                    |                 | skills          |                  | were used to evaluate data from the videotanes            |
|                    |                 | SKIIIS          | formo            | were used to evaluate data nom the videotapes.            |
| Zhao Lot           | Mantal          | Improvo         | Validated        | Date was collected before the intervention and offer the  |
| Zhao, L. <i>el</i> | weritai         | mprove          | validated        | Data was collected before the intervention and alter the  |
| <i>al.</i> (2005,  |                 | psychological   | questionnaires   | Intervention period of 26 days.                           |
| China)             | quality of life | wellbeing and   | (Quality of Life |   |
|                    |                 | quality of life |                  |   |
|                    |                 |                 | (DQOL), Visual   |   |
|                    |                 |                 | Quality of Life  |   |
|                    |                 |                 | (VQOL) and       |   |
|                    |                 | O.              | Symptom          |   |
|                    |                 |                 | Check list       |   |
|                    |                 |                 | (SCL-90)         |   |
| Bertelmann,        | Mental          | Reduce          | Profile of mood  | Data was collected daily before the 30-minute             |
| T. <i>et al.</i>   | health,         | psychological   | states (POMS)    | intervention for all 10 days during the core study phase. |
| (2015,             | physiological   | stress and      | questionnaire    | The physiological parameters: adrenalin concentration     |
| Germany)           | parameters      | improve         | and              | (pg/mL), cortisol concentration (µg/dL) and endothelin    |
|                    |                 | overall         | Kurzfragebogen   | concentration (pg/mL) were measured at 4 time points.     |
|                    |                 | mental well-    | zur aktuellen    |   |
|                    |                 | being           | Beanspruchung    |   |
|                    |                 |                 | (KAB) and        |   |
|                    |                 |                 | physiological    |   |
|                    |                 |                 | parameters       |   |
|                    |                 |                 | (intraocular     |   |
|                    |                 |                 | pressure, visual |   |
|                    |                 |                 | acuity, visual   | 9   |
|                    |                 |                 | field, adrenalin |   |
|                    |                 |                 | concentration    |   |
|                    |                 |                 | (pg/mL),         |   |
|                    |                 |                 | cortisol         |   |
|                    |                 |                 | concentration    |   |
|                    |                 |                 | (µg/dL) and      |   |
|                    |                 |                 | endothelin       |   |
|                    |                 |                 | concentration    |   |
|                    |                 |                 | (pa/mL)          |   |
|                    |                 | 1               | (1-3,)           |   |

† Social- includes social engagement, bonding, and interaction, change in behaviour and social skills (e.g. communication), mental health- includes well-being, anxiety, depression, psychological stress, physiological/health related outcomes- includes blood pressure/ heart rate, Quality of life- includes any health-related quality of life measures
‡ Behaviour was defined as sitting when instructed to do so by the teacher.

Music reporting checklist

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Further data were extracted in accordance with the Checklist for Reporting Music-based Interventions[56], including adherence and fidelity (Refer to *Table 7*) to inform on the transparency and specificity of the included music-based interventions in this review.

## Non-experimental studies

Non-experimental studies reported 100% on items B1- Intervention Content, B3- Music Delivery Method (Live or Recorded), B4- Intervention Materials, B-5- Intervention Strategies, C- Intervention Delivery Schedule, G- Unit of Delivery and reported 50% or less on A -Rationale for Music Selection/Intervention Theory, B2- Music selection, E- Treatment Fidelity.

## Experimental studies

Experimental studies reported 100% on items, B1- Intervention Content, B2- Music selection, B3- Music Delivery Method (Live or Recorded), B4- Intervention Materials, B-5- Intervention Strategies, C- Intervention Delivery Schedule and G- Unit of Delivery. They reported less than 100% on items D- Interventionist and E- Treatment Fidelity. Hence, the experimental studies were more rigorously reported compared to the non-experimental studies (See *Table 7*).

| · · · · · · · · · · · · · · · · · · · |                                     |                                      |
|---------------------------------------|-------------------------------------|--------------------------------------|
|                                       | Yes                                 | No                                   |
|                                       | Total                               | Total                                |
|                                       |                                     |                                      |
|                                       | non-experimental designs n = 9 (%)  | non-experimental designs n = 9 (%)   |
|                                       | experimental designs n = 4 ( %)     | experimental designs n = 4( %)       |
| A Rationale for Music                 | non-experimental designs: 1(10)[66] | non-experimental designs: 8 (90)[61- |
| Selection/Intervention Theory         |                                     | 65,67-69]                            |
| - What was the rationale              | experimental designs: 3 (90)[2,70,  | experimental designs: 1 (10)[70]     |
| for the music used and                | 71]‡                                |                                      |
| intervention?                         |                                     |                                      |
| B1: Intervention Content              | non-experimental designs: 9         | n/a                                  |
|                                       | (100)[61-69]                        |                                      |
| - Was it specified who                |                                     |                                      |
| selected the music (eg:               | experimental designs: 4 (100)[2,70- | n/a                                  |
| pre-selected by                       | 72]                                 |                                      |
| investigator, participant             |                                     |                                      |
| selected)?                            |                                     |                                      |

#### Table 7. Music Reporting Checklist †

| B.2: Music                   | non-experimental designs:           | non-experimental designs: 6 (80)[62,64- |
|------------------------------|-------------------------------------|---|
| - Was this is an original    | 3(20)[61,63,68]                     | 67,69]                                  |
| piece of music or a pre-     | experimental designs: 1(10)[2]      | non-experimental designs: 3 (90)[70-72] |
| existing musical             |                                     |   |
| composition?                 |                                     |   |
| - If a pre-existing musical  |                                     |   |
| composition was used         |                                     |   |
| then was the name of         |                                     |   |
| the composer and title of    |                                     |   |
| the musical composition      |                                     |   |
| stated?                      |                                     |   |
| - Was there a description    |                                     |   |
| of the music's overall       |                                     |   |
|                              |                                     |   |
| olomonte, instrumonte or     |                                     |   |
| other)?                      |                                     |   |
|                              |                                     |   |
| B 3 Music Delivery Method    | non-experimental designs: 9         | n/a                                     |
| (Live or Recorded)           | (100)[61-69]                        | 1// 4                                   |
| If the music was played      | experimental designs: 4 (100)[2 70- | n/a                                     |
| - If the music was played    | 721                                 | 1// 4                                   |
| live was it specified who    |                                     |   |
| delivered the music and      |                                     |   |
| performance?                 |                                     |   |
| - Was the size of the        |                                     |   |
| performance group            |                                     |   |
| specified for the live       | <i>L</i> .                          |   |
| music (eg: interventionist   |                                     |   |
| only, interventionist and    |                                     |   |
| participant)?                |                                     |   |
| - If recorded music was      |                                     |   |
| used, was placement of       |                                     |   |
| playback equipment           |                                     |   |
| and/or the use of            |                                     |   |
| headphones versus            |                                     |   |
| speakers specified?          |                                     |   |
| - If recorded music was      |                                     |   |
| used, was the decibel        |                                     |   |
| level of music delivered     |                                     |   |
| and/or use of volume         |                                     |   |
| controls to limit decibels   |                                     |   |
| specified?                   |                                     |   |
| B.4: Intervention Materials  | non-experimental designs: 9         | n/a                                     |
| - Which musical and other    | (100)[61-69]‡                       |   |
| materials were               | experimental designs: 4 (100)[2,70- | n/a                                     |
| specified?                   | 72]                                 |   |
|                              |                                     |   |
| B.5: Intervention Strategies | non-experimental designs: 9         | n/a                                     |
|                              | (100)[61-69]                        |   |

| - What music-based                | experimental designs: 4 (100)[2 70-  | n/a                              |
|-----------------------------------|--------------------------------------|----------------------------------|
|                                   | 721                                  |                                  |
| were used (og: listoping          | '~j                                  |                                  |
|                                   |                                      |                                  |
| re-creating music by              |                                      |                                  |
| singing/playing an                |                                      |                                  |
| instrument,                       |                                      |                                  |
| instrument/vocal play,            |                                      |                                  |
| improvisation,                    |                                      |                                  |
| movement, song writing            |                                      |                                  |
| or other)?                        |                                      |                                  |
| C: Intervention Delivery Schedule | non-experimental designs:            | n/a                              |
| - What was the duration           | <i>9</i> (100)[61-69] <sup>‡</sup>   |                                  |
| frequency and intensity           |                                      |                                  |
| of the treatment?                 | experimental designs: 3 (100)[2 70-  | n/a                              |
|                                   | 701t                                 | <i>1</i> // <i>a</i>             |
| D: Interventionist                | non experimental designs 0           |                                  |
|                                   |                                      | <i>1</i> // <i>a</i>             |
| - vvere trie qualifications       |                                      |                                  |
| and credentials of                | experimental designs: 3 (90)         | experimental designs: 1 (10)[70] |
| interventionist(s)                | [2,71,72]                            |                                  |
| reported?                         |                                      |                                  |
| - If more than one                |                                      |                                  |
| interventionist, from             | <b>A</b>                             |                                  |
| which discipline/what             |                                      |                                  |
| qualifications and                |                                      |                                  |
| training details were             |                                      |                                  |
| reported?                         |                                      |                                  |
|                                   |                                      |                                  |
|                                   | non-experimental designs 1 (10)[68]  | non-experimental designs:        |
| - Were there any                  |                                      | 9(90)[61,67,69]                  |
| strategies used to                | experimental designs: 3(90)[2,70,62] | experimental designs: 1(10)[71]  |
| ensure that treatment             |                                      |                                  |
| and/or control conditions         |                                      |                                  |
| were delivered as                 |                                      |                                  |
| intended (eg:                     |                                      |                                  |
| interventionist training,         |                                      |                                  |
| manualised protocols,             |                                      |                                  |
| and intervention                  |                                      |                                  |
| monitoring)?                      |                                      |                                  |
| F: Setting                        | non-experimental designs: 9          | n/a                              |
| - Where was the                   | (100)[61-69]‡                        |                                  |
| intervention delivered?           | experimental designs: 4 (100)[2 70-  | n/a                              |
| - What houndaries were            | 721                                  |                                  |
| reported (eq. time and            | ' <b>~</b> ].                        |                                  |
| location)?                        |                                      |                                  |
|                                   |                                      |                                  |
| - vvriat ampient noise            |                                      |                                  |
| ieveis were reported in           |                                      |                                  |
|                                   |                                      |                                  |

| - What boundaries were    |                                     |     |
|---------------------------|-------------------------------------|-----|
| reported (eg, time and    |                                     |     |
| location)?                |                                     |     |
| G: Unit of Delivery       | non-experimental designs: 9         | n/a |
|                           | (100)[61-69]                        |     |
| - Was the intervention    | experimental designs: 4 (100)[2,70- | n/a |
| delivered to individuals  | 72]                                 |     |
| or groups of individuals? |                                     |     |
|                           |                                     |     |

† Music-based Intervention Reporting Checklist was reproduced with permission. Robb, S. L., Carpenter, J. S., Burns, D. S. (2011). Reporting guidelines for music-based interventions. Journal of Health Psychology, DOI:

10.1177/1359105310374781.

‡ Information was not fully described

#### Discussion

This scoping review reported on the available evidence related to the effectiveness of musicbased interventions to promote wellbeing in people living with a VI. These are summarised below.

Only two of the 13 studies recruited adult participants.[70,71] There were no significant differences reported in studies aimed at adults and children, other than the latter were facilitated by teachers, with caregivers' consent. Therapeutic interventions can have different approaches dependent on the participants' age group. There is evidence that the effects of music on aspects of wellbeing may differ dependent on age.[73] Further research is required to understand how to optimise outcomes across age groups.

The ocular pathologies reported in this review were predominately congenital VI (11 out of 13 studies).[2,61-69,72] None of the included studies gave a classification on how they defined VI. The psychological and psychosocial impacts associated with having a VI can vary depending on whether onset is early, sudden, or progressive.[74-76] For example, early onset may have a profound effect on a child's development, with adverse consequences for mental health in childhood and adult life. In contrast, the sudden loss of a sight, due to illness or accident, can devastate a person's life, if appropriate support is not given. A mild but progressive loss may have a serious growing effect on a person's self-esteem and independence.[75,76] In order to understand the rationale for study design and intervention type, future studies should specify details of the VI, as its impact can differ

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significantly depending on the manifestation, type of ocular pathology and time of onset.[74-76]

In terms of geographical locations, seven out the 13 studies were conducted in America,[2,61,64-67,70] two in Europe,[68,72] one in China,[71] Canada,[62] Australia[63] and Brazil,[69] respectively. Music-based interventions which reflect the cultural identity and preferences of participants may be more effective at creating meaning, compliance and promoting enjoyment through preferred music listening.[77,78]

Although five studies in this review refer to accessibility and adaptations made (refer to table 3), they lack specific detail on how barriers were addressed, and support provided. Researchers should provide transparent reporting on what accessibility and adaptations are made. This is particularly important as often people with VI are unable to access face-to-face interventions because of constraints related to the location, intervention setting[47] and/or

participants navigating unfamiliar settings.[48]

Twelve out of the thirteen interventions were conducted in a clinical or school setting.[61-70,72] It can be argued that research under such conditions may be convenient and allow researchers to obtain comparative results, which may not be possible to replicate in the participant's home as each home environment presents different variables.[79] However, one study found that participants reported being in a better emotional state and less stressed when doing a music listening intervention from home, in comparison to a clinical setting.[80]

In addition, five studies were facilitated by a music therapist. [2,62,63,65,68], State registered music therapists are highly trained allied health professionals, who have specialist skills in the use of music therapy strategies for assessment and treatment. [28-31] Music-based interventions include: improvisation, guided imagery, song writing, voice work, music listening and functional exercises. It is recommended that wherever music improvisation is used and a therapeutic relationship is central, a music therapist would be optimal. It was not possible to draw conclusions on the benefits of music listening, as only three out the 13 included studies, reported on this. [66,70,71]

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Evidence for psychological benefits is lacking, since only two of the 13 studies reported on this. Music listening research with other populations has shown improved psychological wellbeing, for example older adult populations with insomnia,[81] post-stroke rehabilitation,[82] poor mental health[83,84] and patients with long-term chronic conditions that require intensive care, such as cancer.[85] Older adults with VI can experience similar psychological and psychosocial symptoms to stroke surviors[82] and cancer patients in recovery.[85] These symptoms include stress, social anxiety, insomnia, depression, and poor quality of life.[86-93] developed countries, acquired VI, such as age-related macular degeneration, is highly correlated with poor psychosocial wellbeing.[86-93] Based on the included literature it is not possible to recommend music-based interventions for long-term psychological wellbeing in adults with VI.

Two studies used validated outcome measures for wellbeing (psychological questionnaires)[70,71], the rest were all single-subject case studies that utilised qualitative methods such as observation or informal interviews.[2,61-69,72] Such studies can provide rich data (depending on the method of analysis of observational data) and inform on more bespoke intervention protocols. This is particularly the case where heterogenous symptoms are common within a patient population, such as stroke. Whether single case or randomised controlled trial, the use of validated outcome measures and/or standardised patient reported outcome instruments, validated for the population of interest, will contribute more meaningfully to the internal validity and effectiveness of observational interventions.[94]

#### Music Reporting Checklist

As part of this scoping review, we utilised the music reporting checklist to ensure consistency and structure when reviewing and reporting the interventions. The checklist highlighted inadequate reporting across both non-experimental and experimental studies in areas such as music protocol, cultural influences for music choice, dosage, and frequency. It is also not clear what specialist training requirements are needed for music listening protocol delivery in any setting, including the home environment. An indication of areas that should be reported but were missing from the studies included: fidelity of interventions and guidelines for delivery.

## Limitations

The limitations of this study need to be considered during the interpretation of the findings. One limitation was that Patient and Public Involvement (PPI) was not undertaken to advise on identifying objectives, research questions and types of wellbeing domains. It may also be the case that interventions of interest are used in clinical practice, documented in book chapters, but not in research that were within the scope of this review. We did not report on the rigor of the included studies or whether they were appraised. We did not conduct any patient and public involvement to inform on search terms, inclusion and exclusion criteria and data synthesis. This may have led to identification of a different focus in terms of objectives, research questions and wellbeing domains. It may also be the case that interventions of interest are used in clinical practice, documented in book chapters, but not in research that were within the scope of this review. We did not report on the rigor of the included studies or whether they were appraised.

Overall, this review highlighted that there has been little research on music-based interventions for improving wellbeing for people with VI, particularly adults, indicating the need for a randomised controlled trial. Future studies may also consider the development of interventions which can be adapted to ensure that participants' preferences are included. Researchers should seek to garner opinions of the participants and 'audition' music with them, in order to fully establish the most personally meaningful music, rather than relying too heavily on checklist or questionnaire data.

#### Conclusion

Based on the data reported in the included articles, it appears that the effects of music interventions on wellbeing in VI have not been widely explored, particularly with adults. There is a lack of detail in the included studies regarding music and music therapy protocols. Further, robust research is required in order to understand treatment related effects, dosage, training requirements and treatment fidelity.

Author contributions: NS: conceptualisation-lead, methodology-lead, literature search, literature screening, data extraction, data curation, formal analysis-lead, writing–original draft, writing-review and editing. RL: literature screening, writing-review and editing. PMA, EB and AS: conceptualisation-support, methodology-support, supervision, writing-review and editing. LS: writing-review and editing-support.

> Funding: The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

## Patient and public involvement:

There was no patient and public involvement.

## Data availability statement:

Data are available on request.

## **Ethics statements:**

ation w. Patient consent for publication was not applicable.

**Ethics approval:** 

Not applicable.

## **Competing interests:**

None declared.

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93 van Munster EP, van der Aa H, Verstraten P, et al. Barriers and facilitators to recognize and discuss depression and anxiety experienced by adults with vision impairment or blindness: a qualitative study. *BMC Health Serv Res* 2021;**21**:1-10. doi.org/10.1186/s12913-021-06682-z

94. Velentgas P, Dreyer NA, Nourjah P, *et al.* editors. *Developing a protocol for observational comparative effectiveness research: A user's guide*. Rockville (MD): Agency for Healthcare Research and Quality (US) 2013. Available from: https://www.ncbi.nlm.nih.gov/books/NBK126190/



**BMJ** Open

Records after duplicates removed (n = 5,082)

## Medline (Ovid) [searched on 14/12/21 AND 11/04/22\*]

| #  | Search   | Result          |
|----|--|-----------------|
| 1  | exp Vision Disorders/                            | 73199           |
|    |  | 254778*         |
| 2  | exp Glaucoma, Angle-Closure/ or                  | 53879           |
|    | exp Glaucoma/ or exp Glaucoma,                   |                 |
|    | Open-Angle/                                      | 89698*          |
|    |  |                 |
| 3  | exp Conjunctivitis/                              | 19313           |
|    |  | 41202*          |
| 1  |  | 41202*<br>31408 |
| +  | exp Uveitis/                                     | 51400           |
|    |  | 58961*          |
| 5  | exp Macular Edema/ or exp                        | 25216           |
|    | Macular Degeneration/ or exp Wet                 | 12022*          |
|    | Macular Degeneration/ or exp<br>Macular Pigment/ | 42082*          |
|    | Wacular I Ignient                                | 2               |
| 6  | exp Edema/ or exp Diabetic                       | 68748           |
|    | Retinopathy/                                     | 250000          |
|    |  | 358896*         |
| 7  | exp Strabismus/                                  | 16097           |
|    |  | 25243*          |
|    |  | 23243           |
|    |  |                 |
| 8  | exp Astigmatism/                                 | 7215            |
|    |  | 14022*          |
|    |  | 14923*          |
| 9  | exp Myopia/                                      | 18402           |
|    |  |                 |
|    |  | 26669*          |
| 10 | exp Hyperopia/                                   | 3235            |
|    |  |                 |

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|    |   | 6925*    |
|----|---|----------|
| 11 | exp Trachoma/   | 3976     |
|    |   | 3562*    |
| 12 | exp Cataract/   | 29440    |
|    |   | 62187*   |
| 13 | exp Vision, Low/  | 3483     |
|    |   | 3739*    |
| 14 | (glaucoma or conjuncti* or uveitis<br>or macula* or oedema or edema or                                | 585375   |
|    | strabismus or squint or astigmati*<br>or myopi* or hypermetropia or<br>trachoma or cataract or visual | 940226*  |
|    | diabetic retinopath*)   |          |
| 15 |   | 17468    |
|    | exp Music Therapy/ or exp Music/  | 26125*   |
| 16 |   | 961      |
| 10 | Singing/  |          |
|    |   | 3802*    |
| 17 | (Music or song or singing or Piano  | 48357    |
|    | or guitar or saxophone or ukulele or violin or cello or trumpet or                                    | 61236*   |
|    | accordion or clarinet or flute or   | 01230    |
|    | xylophone or mandolin or  |          |
|    | harmonica or drum or harp or oboe   | U.       |
|    | or trombone or bassoon or viola or  |          |
|    | French horn or tuba or theremin or  |          |
|    | banjo or bass or bagpipes or  |          |
|    | tambourine or lyre or lute or   |          |
|    | didgeridoo or sitar or oud or   |          |
|    | marimba or melodica)  |          |
| 18 | exp Blindness/  | 45773*   |
| 19 | exp Visually Impaired Persons/  | 9088*    |
| 20 | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or<br>9 or 10 or 11 or 12 or 13 or 14 or                         | 654042   |
|    | 10 10   | 11011514 |

| 21 | 15 or 16 or 17 | 48357  |
|----|----------------|--------|
|    |                | 61500* |
| 22 | 20 and 21      | 618    |
|    |                |        |

## EMBASE

| [searched on | 14/12/21 | AND 1 | 1/04/22*] |
|--------------|----------|-------|-----------|
|--------------|----------|-------|-----------|

| #  | Search                        | Result  |
|----|-------------------------------|---------|
| 1  | exp visual impairment/        | 101268  |
|    |                               | 105086* |
| 2  | exp glaucoma/                 | 86447   |
|    | 0                             | 89698*  |
| 3  | exp conjunctivitis/           | 39710   |
|    |                               | 41202*  |
| 4  | exp uveitis/                  | 56876   |
|    |                               | 58961*  |
| 5  | exp age related macular       | 24596   |
|    | degeneration/ or exp diabetic | 27037*  |
| 6  | exp strabismus/               | 24407   |
|    |                               | 25243*  |
| 7  | exp astigmatism/              | 14343   |
|    |                               | 14923*  |
| 8  | exp myopia/                   | 25485   |
|    |                               | 26669*  |
| 9  | exp hypermetropia/            | 6683    |
|    |                               | 6925*   |
| 10 | exp trachoma/                 | 3505    |
|    |   | 3562*             |
|----|---|-------------------|
| 11 | exp cataract/   | 60312             |
|    |   | 62187*            |
| 12 | exp visual disorder/ or exp low vision/   | 244916            |
|    |   | 254778*           |
| 13 | (glaucoma or conjuncti* or uveitis<br>or macula* or oedema or edema or  | 905903            |
|    | strabismus or squint or astigmati*<br>or myopi* or hypermetropia or<br>trachoma or cataract or visual<br>impairment or low vision or<br>diabetic retinopath*) | 940226*           |
| 14 | 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or<br>9 or 10 or 11 or 12 or 13  | 1040312           |
| 15 | ave music thereasy are music/   | 10/8989*<br>25060 |
| 15 | exp music therapy/ or exp music/  | 25069             |
|    |   | 26125*            |
| 16 | exp singing/  | 3680              |
|    | O,  | 3802*             |
| 17 | Music or song or singing or Piano   | 58099             |
|    | or guitar or saxophone or ukulele or  |                   |
|    | violin or cello or trumpet or   | 61236*            |
|    | accordion or clarinet or flute or   | 7                 |
|    | harmonica or drum or harp or oboe   |                   |
|    | or trombone or bassoon or viola or  | 0                 |
|    | French horn or tuba or theremin or  |                   |
|    | banjo or bass or bagpipes or  |                   |
|    | tambourine or lyre or lute or   |                   |
|    | ocarina or harpsichord or cajon or  |                   |
|    | didgeridoo or sitar or oud or   |                   |
| 18 | 15 or 16 or 17  | 58345             |
| 10 |   |                   |
|    |   | 61500*            |
| 19 | 14 and 18   | 1196              |
|    |   |                   |
|    |   |                   |

## CHNL PLUS (EBSCO) [searched on 14/12/21 AND 11/04/22\*]

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|    | impairment or low vision or          |          |
|----|--------------------------------------|----------|
|    | diabetic retinopath*                 |          |
|    | _                                    |          |
| 13 | S1 OR S2 OR S3 OR S4 OR S5           | 158,338  |
|    | OR S6 OR S7 OR S8 OR S9 OR           |          |
|    | S10 OR S11 OR S12 OR S13             | 167,220* |
| 15 | MM "Music Therapy (Iowa NIC)")       | 8,371    |
|    | OR (MM "Music") OR (MM               |          |
|    | "Singing"                            | 8,707*   |
|    |                                      |          |
| 15 | Music or song or singing or Piano    | 54,415   |
|    | or guitar or saxophone or ukulele or |          |
|    | violin or cello or trumpet or        | 59,780*  |
|    | accordion or clarinet or flute or    |          |
|    | xylophone or mandolin or             |          |
|    | harmonica or drum or harp or oboe    |          |
|    | or trombone or bassoon or viola or   |          |
|    | French horn or tuba or theremin or   |          |
|    | banjo or bass or bagpipes or         |          |
|    | tambourine or lyre or lute or        |          |
|    | ocarina or harpsichord or cajon or   |          |
|    | didgeridoo or sitar or oud or        |          |
|    | marimba or melodica                  |          |
|    |                                      |          |
| 16 | S14 OR S15                           | 54,415   |
|    |                                      |          |
|    |                                      | 59,780*  |
|    |                                      | 0        |
|    |                                      |          |
| 17 | S14 AND S17                          | 1,072    |
|    |                                      |          |
|    |                                      |          |
|    |                                      |          |

### PSYCHINFO (EBSCO) [searched on 14/12/21 AND 11/04/22\*]

| # | Search                         | Result  |
|---|--------------------------------|---------|
| 1 | DE "Vision Disorders" OR DE    | 18,073  |
|   | "Balint's Syndrome" OR DE      |         |
|   | "Blind" OR DE "Blindsight" OR  | 18,580* |
|   | DE "Eye Disorders" OR DE       |         |
|   | "Hemianopia" OR DE "Partially  |         |
|   | Sighted" OR DE "Eye Disorders" |         |
|   | OR DE "Amblyopia" OR DE        |         |
|   | "Cataracts" OR DE "Color       |         |
|   | Blindness" OR DE "Glaucoma" OR |         |
|   | DE "Nystagmus" OR DE           |         |
|   | "Refraction Errors" OR DE      |         |

|   | "Strabismus" OR DE "Tunnel<br>Vision"   |                          |
|---|---|--------------------------|
| 2 | MM "Glaucoma"   | 422<br>440*              |
| 3 | MM "Myopia" OR DE "Refraction<br>Errors" OR DE "Myopia"   | 707                      |
| 4 | MM "Cataracts"  | 251                      |
|   |   | 263*                     |
| 5 | (glaucoma or conjuncti* or uveitis<br>or macula* or oedema or edema or  | 42,061                   |
|   | strabismus or squint or astigmati*<br>or myopi* or hypermetropia or<br>trachoma or cataract or visual<br>impairment or low vision or<br>diabetic retinopath*)   | 43,235*                  |
| 6 | DE "Music" OR DE "Musical<br>Instruments" OR DE "Rock Music"<br>OR MM "Rock Music" OR MM<br>"Music Therapy" OR MM "Music<br>Perception" OR MM "Musical<br>Pitch" OR MM "Music Education"<br>OR DE "Musical Pitch" OR DE<br>"Pitch Perception" OR MM<br>"Musical Instruments" OR MM<br>"Musical Ability"   | 29,499<br><b>30,494*</b> |
| 7 | Music or song or singing or Piano<br>or guitar or saxophone or ukulele or<br>violin or cello or trumpet or<br>accordion or clarinet or flute or<br>xylophone or mandolin or<br>harmonica or drum or harp or oboe<br>or trombone or bassoon or viola or<br>French horn or tuba or theremin or<br>banjo or bass or bagpipes or<br>tambourine or lyre or lute or<br>ocarina or harpsichord or cajon or<br>didgeridoo or sitar or oud or<br>marimba or melodica | 67,007<br>69,751*        |

| 8  | S1 OR S2 OR S3 OR S4 OR S5 | 50,315  |
|----|----------------------------|---------|
|    |                            | 51,708* |
| 9  | S6 OR S7                   | 69,057  |
|    |                            | 71,835* |
| 10 | (S6 OR S7) AND (S8 AND S9) | 674     |

#### WoS

### 14/12/21 AND 11/04/22\*

| # | Search                               | Results                                 |
|---|--------------------------------------|---|
| 1 | glaucoma or<br>conjuncti* or uveitis | 663,084                                 |
|   | or macula* or                        | 699.965*                                |
|   | oedema or edema or                   | 0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
|   | strabismus or squint                 |   |
|   | or astigmati* or                     |   |
|   | myopi* or                            | •                                       |
|   | hypermetropia or                     | 6                                       |
|   | trachoma or cataract                 |   |
|   | or visual impairment                 |   |
|   | or low vision or                     |   |
|   | diabetic retinopath*                 |   |
|   |                                      |   |
| 2 | Music or song or                     | 309,383                                 |
|   | singing or Piano or                  |   |
|   | guitar or saxophone                  |   |
|   | or ukulele or violin or              | 323,449*                                |
|   | cello or trumpet or                  |   |
|   | accordion or clarinet                |   |
|   | or flute or xylophone                |   |
|   | or mandolin or                       |   |
|   | harmonica or drum or                 |   |
|   | harp or oboe or                      |   |
|   | trombone or bassoon                  |   |
|   | or viola or French                   |   |
|   | horn or tuba or                      |   |
|   | theremin or banjo or                 |   |
|   | bass or bagpipes or                  |   |
|   | tambourine or lyre or                |   |
|   | lute or ocarina or                   |   |
|   | harpsichord or cajon                 |   |
|   | or didgeridoo or sitar               |   |
|   | or oud or marimba or                 |   |
|   | melodica                             |   |

| 3 | 1 AND 2 | 1,717 |
|---|---------|-------|
|   |         |       |

### Google scholar [searched on 14/12/21 AND 11/04/22\*]

("music"|"music therapy"|"singing"|"musical") + (blindness|"low vision"|"reduced vision"|"subnormal vision"|"diminished vision"|"visual impaired"|"vision disorder"|"visual disorder"|"visual disabled"|"vision loss"|"loss of vision"|retina|retinal|cornea|corneal|vision|visual|visually|glaucoma|cataract)

or oper terier only

Relevant google scholar searches found = 245

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION   | ECTION ITEM PRISMA-ScR CHECKLIST ITEM |   | REPORTED<br>ON PAGE #         |
|---|---------------------------------------|---|-------------------------------|
| TITLE   |                                       |   |                               |
| Title   | 1                                     | Identify the report as a scoping review.  | 1                             |
| ABSTRACT  |                                       |   |                               |
| Structured summary  | 2                                     | Provide a structured summary that includes (as<br>applicable): background, objectives, eligibility criteria,<br>sources of evidence, charting methods, results, and<br>conclusions that relate to the review questions and<br>objectives.   | 2                             |
| INTRODUCTION  |                                       |   | 1                             |
| Rationale   | 3                                     | Describe the rationale for the review in the context of<br>what is already known. Explain why the review<br>questions/objectives lend themselves to a scoping<br>review approach.   | 4                             |
| Objectives  | 4                                     | Provide an explicit statement of the questions and<br>objectives being addressed with reference to their key<br>elements (e.g., population or participants, concepts,<br>and context) or other relevant key elements used to<br>conceptualize the review questions and/or objectives.                                     | 4 to 5                        |
| METHODS   |                                       |   |                               |
| Protocol and registration                                   | 5                                     | Indicate whether a review protocol exists; state if and<br>where it can be accessed (e.g., a Web address); and if<br>available, provide registration information, including<br>the registration number.   | 5                             |
| Eligibility criteria  | 6                                     | Specify characteristics of the sources of evidence<br>used as eligibility criteria (e.g., years considered,<br>language, and publication status), and provide a<br>rationale.   | 5                             |
| Information sources*  | 7                                     | Describe all information sources in the search (e.g.,<br>databases with dates of coverage and contact with<br>authors to identify additional sources), as well as the<br>date the most recent search was executed.  | 6                             |
| Search  | 8                                     | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.   | (see<br>supplement<br>data 1) |
| Selection of<br>sources of<br>evidence†                     | 9                                     | State the process for selecting sources of evidence<br>(i.e., screening and eligibility) included in the scoping<br>review.   | 7                             |
| Data charting process‡                                      | 10                                    | Describe the methods of charting data from the<br>included sources of evidence (e.g., calibrated forms or<br>forms that have been tested by the team before their<br>use, and whether data charting was done<br>independently or in duplicate) and any processes for<br>obtaining and confirming data from investigators. | 7                             |
| Data items  | 11                                    | List and define all variables for which data were sought and any assumptions and simplifications made.  | 7                             |
| Critical appraisal of<br>individual sources<br>of evidence§ | 12                                    | If done, provide a rationale for conducting a critical<br>appraisal of included sources of evidence; describe<br>the methods used and how this information was used<br>in any data synthesis (if appropriate).  | 8                             |



# St. Michael's

| SECTION   | ITEM |   | REPORTED              |
|---|------|---|-----------------------|
| Synthesis of<br>results                         | 13   | Describe the methods of handling and summarizing the data that were charted.  | 9                     |
| RESULTS   |      |   |                       |
| Selection of sources of evidence                | 14   | Give numbers of sources of evidence screened,<br>assessed for eligibility, and included in the review, with<br>reasons for exclusions at each stage, ideally using a<br>flow diagram.           | 9 (Figure 1)          |
| Characteristics of<br>sources of<br>evidence    | 15   | For each source of evidence, present characteristics for which data were charted and provide the citations.   | 10                    |
| Critical appraisal within sources of evidence   | 16   | If done, present data on critical appraisal of included sources of evidence (see item 12).  | n/a                   |
| Results of<br>individual sources<br>of evidence | 17   | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.   | 10 (Tables 1<br>to 3) |
| Synthesis of<br>results                         | 18   | Summarize and/or present the charting results as they relate to the review questions and objectives.  | 11                    |
| DISCUSSION                                      |      |   |                       |
| Summary of evidence                             | 19   | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 17                    |
| Limitations                                     | 20   | Discuss the limitations of the scoping review process.  | 19                    |
| Conclusions                                     | 21   | Provide a general interpretation of the results with<br>respect to the review questions and objectives, as well<br>as potential implications and/or next steps.                                 | 19                    |
| FUNDING   |      |   |                       |
| Funding   | 22   | Describe sources of funding for the included sources<br>of evidence, as well as sources of funding for the<br>scoping review. Describe the role of the funders of the<br>scoping review.        | 20                    |

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where sources of evidence (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with information sources (see first footnote).

t The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467-473. doi: 10.7326/M18-0850.

