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The effect of regular listening to preferred music on pain, depression and anxiety in older care home residents

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Abstract
This research assesses the effect of listening to preferred music on pain, depression and anxiety in older care home residents. One hundred and thirteen participants were randomly allocated to either an experimental or a control group. The former, in addition to their usual routine, listened to a daily 30-minute programme of preferred music over a three-week period. Weekly assessments, using validated measures with some adaptations, evaluated levels of pain, depression and anxiety, each a common disorder in this population. The two groups then crossed over, thus enabling all participants to receive the potential benefits of the music intervention. Results showed statistically significant decreases for each dependent variable with the size of the effect being greater for depression and anxiety than for pain. There were no significant improvements for those in the control group. Additional analysis identified variables that either facilitated or limited the benefits of the music. Those with severe pain were unable to benefit, but those who regarded music as important, listened frequently and whose preferences were accommodated benefited to a greater degree than others. It was concluded that listening to preferred music may benefit many members of the care home population although not all will benefit to the same degree.

Keywords
anxiety, care homes, depression, older adults, pain, preferred music

The use of music to alleviate the effect of a range of physiological and psychological disorders is of increasing interest to academics and health professionals. However, few studies have explored its effectiveness amongst older care home residents. Care needs in this population are

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rising (Ross, 2010) due to a faster increase in total life expectancy than in disability-free life expectancy (George & Martin, 2014); approximately two-thirds of residents require assistance with mobility and four-fifths have dementia; the median number of prescribed medications is nine per resident (The King's Fund, 2015). Resident numbers are projected to increase; in England, for example, from 296,299 in 2014 to 485,441 in 2030 (POPPI, 2014).

The wellbeing of residents is often compromised by an increase in comorbidity (Berg, Hoffman, Hassing, McClearn, & Johansson, 2009; Mroczek & Spiro, 2005), pain (Ferrell, Ferrell, & Osterweil, 1990) and symptoms of anxiety and depression (Jongenelis et al., 2004; McDougall, Matthews, Kvaal, Dewey, & Brayne, 2007; Mukai & Tampi, 2009; Small, 1996). Given that risk factors for anxiety and depression include lack of social support, traumatic events, fear of worsening pain, disability and opioid dependence (Karp & Reynolds, 2009), the increase in these disorders is to be expected. Their symptoms can precipitate further cognitive and functional decline (Lenze et al., 2001).

Up to 80% of the care home population experience pain (Ferrell, 1995; Helme & Gibson, 2001; Herr & Garand, 2001). Effects include decreased mobility, weakened immune systems, insomnia, poor appetite (Devor, n.d.) and reduced energy to fight symptoms or adhere to treatment (Mitchell & MacDonald, 2009). Depression is two to three times more likely to occur in care home residents than amongst those living independently, affecting up to 40% of the population (Godfrey & Denby, 2004). Between 6% and 30% are estimated to suffer from anxiety (National Institute for Health and Care Excellence, 2013).

A strong association exists between pain, anxiety and depression; each is a risk factor for the onset of another (Gagliese & Melzack, 1997; Herr & Garand, 2001; Karp & Reynolds, 2009). Furthermore, side effects and delayed responses to medication due to slower metabolisms may compromise treatment (Baldwin & Wild, 2004; Geerlings, Twisk, Beekman, Deeg, & van Tilburg, 2002). Drugs are not always enough (Voss et al., 2004); supplementary treatments are needed. Melzack (2012, p. ix) advises that, "every possible therapy is needed to battle the pain". It is therefore important to identify interventions that could give relief and improve quality of life.

Music as a therapeutic intervention

Due to physiological or psychological frailty or both, not all therapeutic interventions are appropriate for the care home population. Listening to music, however, is neither physically nor cognitively demanding (Laukka, 2007) and may therefore be suitable.

The use of music to initiate changes in pain and mood is supported by two theories: the Gate Control Theory of Pain (Melzack & Wall, 1965) and the Broaden-and-Build theory (Fredrickson, 2004). The former suggests that a spinal gating mechanism within the dorsal horn, activated by cognitive and emotional processes, can modulate pain perception. A distraction, if sufficiently strong, can limit the cognitive resources available for pain perception. The latter theory suggests that positive emotions, as well as being a sign of optimal function, can also produce optimal function over the long term. This notion suggests that positive emotions can "undo" the after-effects of negative emotions (such as anxiety and sadness) and can lead to "improved psychological and physical wellbeing over time" (Fredrickson, 2004, p. 1367).

Both theories recognise the role that emotions play in the relief of pain, depression and anxiety. The former recommends distraction as a means of relieving pain, with an emotional component to the distraction producing a greater effect; the latter recommends the cultivation of positive emotions for improved psychological and physiological health. Music is recognised as one of "the most powerful triggers of emotions" (Rickard, 2004, p. 371). The growing number of research studies in this area confirm its effectiveness for the relief of pain, depression and anxiety.

The findings of previous research studies have been broadly positive. However, the heterogeneity of methodologies employed has made it impossible to carry out a rigorous comparison of results. Two Cochrane reviews illustrate this. Cepeda, Carr, and Lan (2006) concluded that, despite the evidence for some pain relief from listening to music, the effects were small and insufficient to be considered clinically important. Similarly, Maratos, Gold, Wang, and Crawford (2008) concluded that, despite some benefits to levels of depression, the small number and low methodological quality of the studies made confidence in music's effectiveness impossible. Both reviews recommend greater methodological rigour, particularly regarding randomisation and sample size, if further evidence of music's efficacy is to be provided.

Although several studies have investigated the use of music for various conditions and situations amongst older people, only one randomised controlled study (Guétin et al., 2009) has explored music's effect on anxiety and depression amongst older care home residents. Listening to music once a week for 16 weeks resulted in significant improvements in both disorders. However, the small sample size ($N = 30$) and the reliance on a music therapist for the delivery of the programme, limited the validity of the findings.

Chan, Chan, Mok, Tse, and Yuk (2009) investigated the use of music to relieve depression amongst older people living in the community. Four weeks of daily music listening resulted in significant decreases in depressive symptoms as well as in blood pressure, heart and respiratory rates. However, the researchers recognised that the sample size was small ($N = 47$) and that it was impossible to be confident of participants' adherence to the intervention.

To achieve an effective therapeutic outcome, consideration must be given to the selection of appropriate music (MacDonald et al., 2003). As Elliott, Polman, and McGregor (2011) observe, failure to do so may be a cause of contradictory findings. The two main types of approaches are for researchers either to select the music themselves or to seek out participants' preferences. If researcher-selected, the music may, for example, be chosen for its relaxing properties. However, there is no guarantee that it will be enjoyed; if disliked, a negative response may be evoked. "The 'wrong' music can be boring or irritating" (Burack, Jefferson, & Libow, 2003, p. 73) and may intensify depressive syndromes, aggressiveness and anxiety (Trappe, 2012).

Using participant-selected music has strong support from several studies (Clair, 1996; Kreutz, Ott, Teichmann, Osawa, & Vaitl, 2008) but this is not always clearly defined. For example, the extent of autonomy given to participants in the selection of music may vary. Some studies have allowed participants a choice of musical genre, which may then be described as "preferred" music. Guétin et al. (2009), for example, provided participants with a choice of genre and a selection of five different musical instruments. Although this permitted some participant preference, it could not ensure that the music was universally appreciated; the selection may have been unknown or even disliked. This is not the same as music chosen freely by participants for the degree of preference felt, for its familiarity and associated memories. It is suggested that these are the necessary criteria for achieving a beneficial effect (Janelli, Kanski, & Wu, 2004/2005), giving rise to more intense emotions (Liljeström, Juslin, & Västfjäll, 2013; Salimpoor, Benovov, Longo, Cooperstock, & Zatorre, 2009) and facilitating the desired psychological and physiological changes (Sequeira, Hot, Silvert, & Delplanque, 2009).

The same conclusion was reached in a study that compared participant-selected and researcher-selected music for the relief of pain (Mitchell & MacDonald, 2006): the former was more effective. Further benefits can include a greater sense of autonomy due to personal involvement (Roy, Peretz, & Rainville, 2008) and greater motivation to participate in research (Craig, 2004).

"Doses" of music have varied in number, frequency and duration. The total number of sessions has ranged from one to 48; the frequency of weekly sessions has ranged from one to six and the duration has ranged from 20 to 90 minutes. However, a Cochrane review concludes that a three-week period is sufficient for significant differences to be observed (Maratos et al., 2008) and Nilsson (2008) recommends a minimum of 30 minutes for each session.

The principal aim of this study was to evaluate the effectiveness of listening to preferred music on pain, depression and anxiety in older care home residents. It was hypothesised that levels of each disorder would decrease and that, due to the correlation between them, the extent of the effect would be similar for each variable. As Voss et al. (2004) suggest, decreases in anxiety and distress levels can lead to a reduction in pain. A secondary aim was to determine whether there were particular factors that facilitated or limited the effectiveness of the music intervention. It was hypothesised that those for whom music was important would show a greater response.

Method

The design of this study was influenced by two principal factors, namely, the need to address the methodological limitations of previous studies, particularly those of randomisation and sample size, and to understand the "significant and unprecedented methodological problems" of care home research (Suzman, Manton, & Willis, 1995, p. 4). For example, assessment measures need to accommodate the participants' frailty. They should be relevant, cognitively undemanding and not overly burdensome.

Design

A randomised control trial with a crossover design was used. The independent variable was an individual 30-minute daily listening programme of preferred music over a three-week period. The three dependent variables were pain, depression and anxiety. These were assessed using validated assessment measures with some adaptation, via once-weekly semi-structured interviews. Care staff assessed participants' physiological and psychological health by means of a simple questionnaire.

Participants

An a priori power analysis, using the Gpower computer programme (Buchner, Faul, & Erdfelder, 1998) showed that in order to obtain statistical power at the recommended .80 level (Cohen, 1988) a sample size of 102 would be needed. Since withdrawal rates were likely to be high within this population, a slightly larger number of 117 participants were recruited from nine different care homes, all but one situated in Greater London. Sufficient cognitive and hearing acuity was required in order to provide informed consent, participate in interviews and adhere to the requirements of the music intervention. Information was given regarding anonymity, confidentiality and the right to withdraw; each participant signed a consent form.

The variables of age and gender were representative of other UK care home populations (Lievesley, Crosby, & Bowman, 2011): a majority were female (72.6%); the mean age was 87 years (SD = 7.1) and 69% were widows. The ethnic profile was 77.9% white British, 15% other white, 4% Asian British, 2% Caribbean and 1% Middle Eastern. The sample was divided evenly between those who left school at 16, at 18 and those who went on to higher education.

Participants were randomly assigned to either Group 1 or Group 2. Prior to the start of the intervention, four participants withdrew. Three experienced sudden declines in health and one died. This reduced the sample size to 113. There were a further 26 withdrawals during the study.

Materials

1. Demographic information and music preference questionnaire. The Assessment of Personal Music Preference (Gerdner, 2000) was expanded to include information regarding past music experiences, music's importance, current listening habits, music associated with participants' pasts, preferred and non-preferred genres, composers, instruments and performers.
2. Assessment of pain, depression and anxiety. Measures were selected for their capacity to measure change and for their suitability for the care home population. Pain was assessed using the Iowa Pain Thermometer, a commonly used visual analogue scale (IPT), and a Verbal Descriptor Scale (VDS). The IPT has been judged to be the best measure of present pain intensity for use with older cohorts (Herr, Spratt, Garand, & Li, 2007). The VDS is taken from the McGill Pain Questionnaire (Melzack, 1987) and consists of words such as "distressing" or "mild" to describe pain intensity. Anxiety was assessed using the state items (to determine current levels) from a short form of the STAI-Y anxiety measure (Spielberger, 1983). Widely used both in research and clinical settings, its focus includes worry, tension, apprehension and nervousness. It has a good level of internal consistency as determined by a Cronbach's alpha of .794. Depression was assessed using the PHQ-9 (Kroenke & Spitzer, 2002). It is validated for use with older adults and is recommended for routine application (Espinoza & Kaufmann, 2014). It has an acceptable level of internal consistency as determined by a Cronbach's alpha of .693. Items from the STAI-Y and PHQ-9 (18 in total) were responded to with a four-point Likert scale using the responses *not at all, a little, quite a lot* and *a lot*. To accommodate participants' frailty, Peat, Mellis, Williams, and Xuan (2002) recommend that unnecessary, ambiguous or unsuitable items should be identified, and either discarded or re-worded. Some adaptations were made. For example, "Thoughts that you would be better off dead or of hurting yourself in some way", might be considered as intrusive, and could lead to a reluctance to participate further in the study, while the item, "How difficult have these problems made it for you to do your work and take care of things at home?" is irrelevant.
3. Care staff questionnaire. Care staff assessed the participants' physical health and levels of pain, anxiety and depression. Responses were via a four-point Likert scale. This enabled a comparison with participants' own assessments.

Music delivery

Despite varying degrees of memory loss, each participant provided sufficient information for the compilation of music programmes tailored to their preferences. Programmes were approximately 90 minutes long, thus providing some variety to the daily intervention. Music was downloaded from iTunes, either on to USB memory sticks or CDs. Those without music-players (n = 98) were provided with a simple USB memory stick music-player produced by the Royal National Institute of Blind People (RNIB). The remainder (n = 19) had access to CD players. Music-players were placed within easy reach of participants and clear instructions provided.

Table 1. Demographic data of Groups 1 and 2.

Variable	Group 1	Group 2
	n = 55	*n* = 58
Median age	88 (*SD* = 7.16)	87 (*SD* = 6.95)
Male	17	14
Female	38	44
Widowed	35	43
Single	11	14
Married	4	0
Divorced	2	4
White British	42	46
Other ethnic background	13	12
Left school at 16	14	24
Left school at 18	21	17
Higher education	19	17
Baseline pain measure	3.76 (*SD* = 2.37)	3.07 (*SD* = 2.18)
Baseline anxiety measure	21.35 (*SD* = 6.14)	21.29 (*SD* = 5.18)
Baseline depression measure	21.76 (*SD* = 6.21)	22.14 (*SD* = 5.29)

The volume was determined by the participants. Headphones were not used as those with hearing aids found them uncomfortable. Participants listened to the music in their own rooms at a time of their choosing. When necessary, care staff provided assistance.

Process

The identical process was carried out in each care home. Interviews were carried out in the privacy of participants' own rooms. Using the measures described, baseline assessments were made of pain, depression and anxiety. Potential pain scores ranged from 1 (no pain) to 10 (excruciating pain). Scores for the anxiety measure ranged from a potential 11 to 44; 37 was the highest recorded, 12 the lowest. A cut-off point of 22 was the marker of clinically significant problems; 45% of the sample were in this category. Scores for the depression measure ranged from a potential eight to 32; 25 was the highest recorded, eight the lowest. Twenty-three per cent of the sample experienced moderate to severe symptoms, according to the scoring bands provided by the scale's authors.

There were no statistically significant differences in demographic variables such as age and gender between the two groups; nor were there any between the nine care homes. This was also the case for levels of pain, depression and anxiety. A comparison of Groups 1 and 2 showing demographic variables and baseline levels of the three dependent variables is set out in Table 1.

Following the baseline assessments, Group 1 (music) listened to their music programmes for a minimum of 30 minutes each day. To avoid any increased anxiety, no further instructions, such as a prescribed time of day for listening, were given. Group 2 (no music) maintained their usual routine. At the end of each week's music listening, all participants were assessed in the same way. After three weeks, the two groups crossed over: Group 1 became the "no music group" and Group 2 became the "music group". This allowed all participants to receive the potential benefits of the music programme. It also showed any residual effects following the first three-week period, referred to as Phase 1; the second three-week period is referred to as Phase 2. A flow chart of the process is shown in Figure 1. Care staff were asked to complete their questionnaires before the start of the intervention.

Data analysis

The selection of tests used for the analysis of Likert scores is a matter of some controversy. Our analysis of the anxiety and depression scores follows Carifio and Perla's (2008) argument that although the intervals between response categories cannot be presumed equal such that the data from individual items should be treated as ordinal, total scores can nevertheless be treated as interval data. A two-way mixed ANOVA was therefore performed with time (weekly assessments) as the within-subjects factor and group (Group 1 versus Group 2) as the between-subjects factor. However, pain scores were analysed using non-parametric Wilcoxon tests as recommended by Keela Herr (personal communication, May 2016).[1]

Withdrawals were not due to any negative effects of the intervention and the numbers in both groups remained comparable. Data were analysed on an endpoint basis, i.e., by only including participants for whom a final data point measurement was obtained.

Results

Pain

Phase 1. The analysis of pre- and post-test scores for both measures (VDS and IPT) for Group 1 (music group) showed a statistically significant *decrease* in pain with effect sizes of $d = 0.33$ and $d = 0.31$ respectively. Group 2 (no music) showed no change in VDS scores and a very small non-significant *decrease* in IPT scores.

Phase 2. The same analysis for Group 2 showed non-significant decreases for both measures (VDS and IPT). Group 1 showed a very small non-significant decrease (VDS), and a small non-significant *increase* (IPT). The results are shown in Table 2.

Figures 2 and 3 show the weekly scores of both groups during Phases 1 and 2.

Group 1 (Phase 1) shows a week-on-week decrease in pain. However, in Group 2 (Phase 2), the expected decrease was stalled by a small increase between weeks five and six. As the data were collected from the various care homes at different time periods, there was no identifiable event or situation to account for this. To determine whether the effectiveness of the intervention depended on the level of pain experienced, scores were re-coded into four categories: no pain, just noticeable to weak, mild to strong, severe to excruciating. A pre- and post-test analysis showed that statistically significant decreases were found only for the "mild to strong" category: Phase 1 ($Z = 2.74$, N–Ties = 9, $p = .006$), and Phase 2 ($Z = 2.24$, N–Ties = 4, $p = .025$).

Depression

Phase 1. A Greenhouse Geisser ANOVA was conducted to assess the outcome measures. There was a statistically significant interaction between the intervention and time,

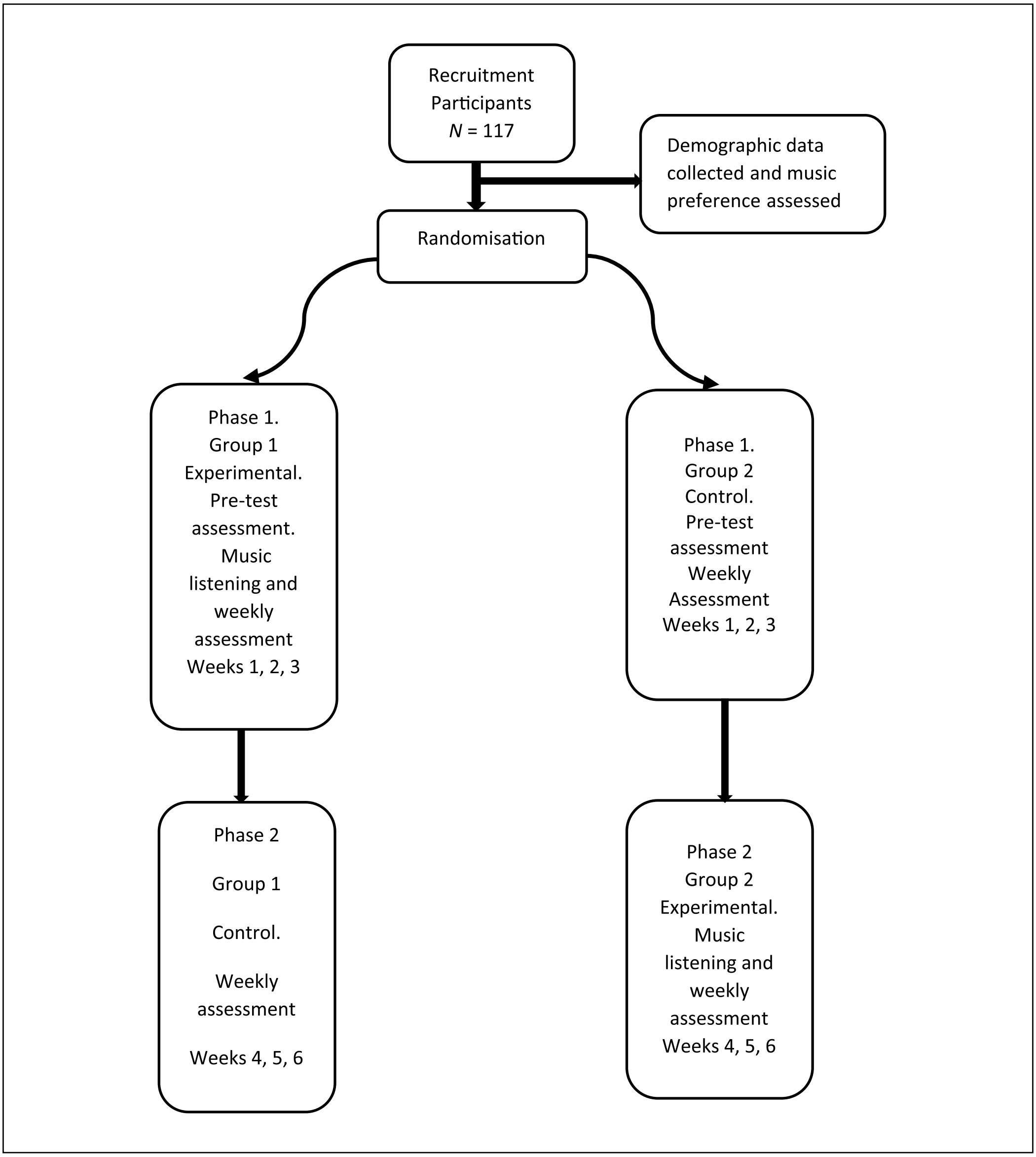

Figure 1. Flowchart of the process.

$F(2.616, 156.947) = 3.939$, $p = .013$, partial $\eta^2 = .062$, and a statistically significant effect of time for the music group, $F(2.551, 81.644) = 9.917$, $p = .0005$, partial $\eta^2 = .237$. Differences between groups were statistically significant at week two, $F(1, 90) = 8.845$, $p = .004$, partial $\eta^2 = .089$, and week three, $F(1, 87) = 8.335$, $p = .005$, partial $\eta^2 = .087$. Figure 4 shows the means, standard deviations and statistically significant time points of Phase 1.

Table 2. Results for pain as assessed by IPT and VDS measures.

	IPT score	VDS score
Phase 1 Group 1	(Z = 2.43, *N*–Ties = 29, *p* = .015)	(Z = 2.95, *N*–Ties = 29, *p* = .003)
Phase 1 Group 2	(Z = 0.22, *N*–Ties = 29, *p* = .828)	(Z = 0.19, *N*–Ties = 7, *p* = .848)
Phase 2 Group 1	(Z = .36, *N*–Ties = 17, *p* = .721)	(Z = .84, *N*–Ties = 17, *p* = .403)
Phase 2 Group 2	(Z = .80, *N*–Ties = 15, *p* = .422)	(Z = 1.50, *N*–Ties = 12, *p* = .133)

IPT = Iowa Pain Thermometer; VDS = Verbal Descriptor Scale.

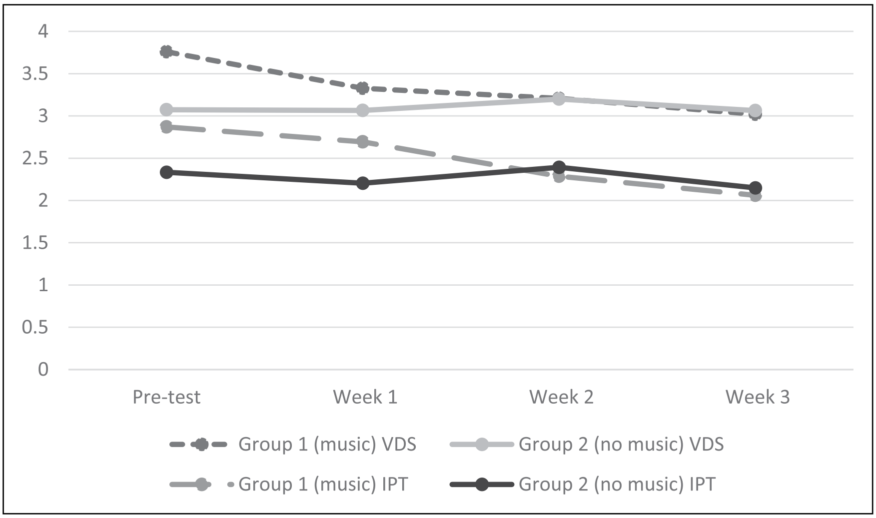

Figure 2. Total pain scores, Phase 1.

Bonferroni pairwise comparisons for Group 1 (music) confirmed the findings. Statistically significant decreases were found between baseline and week three (M = 4.00, SE = .94, p = .001), and between baseline and week two (M = 2.61, SE = .85, p = .027), thus indicating that a two-week intervention was sufficient for a statistically significant decrease in depression scores. There were no findings of significance in Group 2 (no music).

Phase 2. A sphericity-assumed ($\chi^2(5) = 10.133$, $p = .72$) two-way mixed ANOVA was conducted to assess the outcome measures. Results showed a statistically significant interaction between the intervention and time, $F(3, 180) = 3.939$, $p = .009$, partial $\eta^2 = .062$, and a statistically significant effect of time for the music group, $F(3, 87) = 6.630$, $p = .0005$, partial $\eta^2 = .186$, and the no music group, $F(3, 378) = 4.447$, $p = .006$, partial $\eta^2 = .146$. Differences between groups were significant at week three (following Phase 1) at week five, $F(1, 74) = 6.995$, $p = .010$, partial $\eta^2 = .086$, but not at week six, $F(1, 75) = 1.587$, $p = .212$, partial $\eta^2 = .021$. Figure 5 gives the means, standard deviations and statistically significant time points of Phase 2.

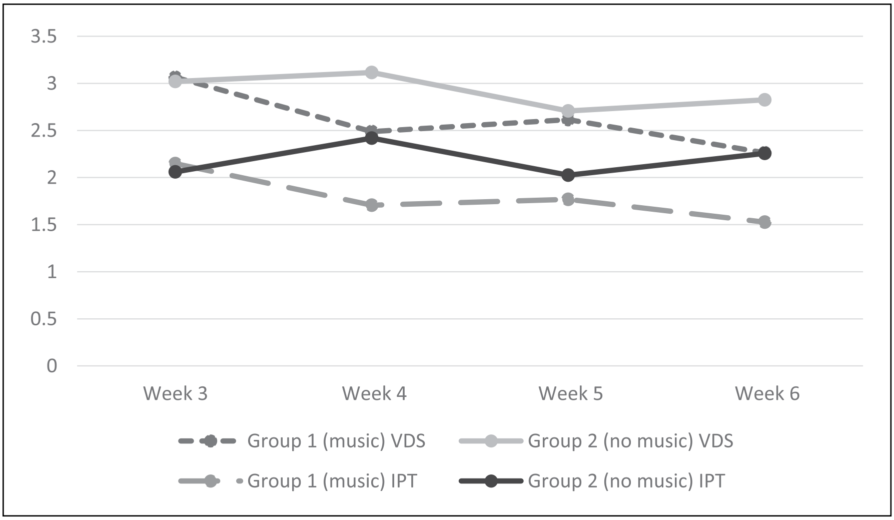

Figure 3. Total pain scores, Phase 2.

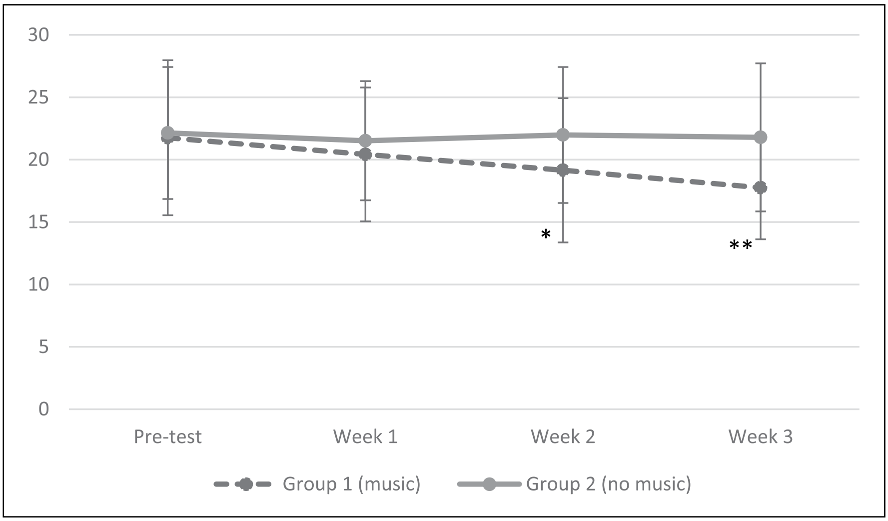

Figure 4. Total depression scores, Phase 1.
* p = .027; ** p = .001.

Bonferroni pairwise comparisons confirmed the findings. Group 1 (no music) showed statistically significant *increases* between weeks three and five (M = 2.630, SE = .841, p = .026) and between weeks three and six (M = 1.519, SE = .496, p = .03), indicating that the intervention's benefits were short-lived. Group 2 (music) showed statistically significant *decreases* between the same time points, i.e., between weeks three and five (M = 3.567, SE = .864, p = .002) and between weeks three and six (M = 2.667, SE = .692, p = .004). This again suggests that two weeks was sufficient for a significant decrease in depression scores.

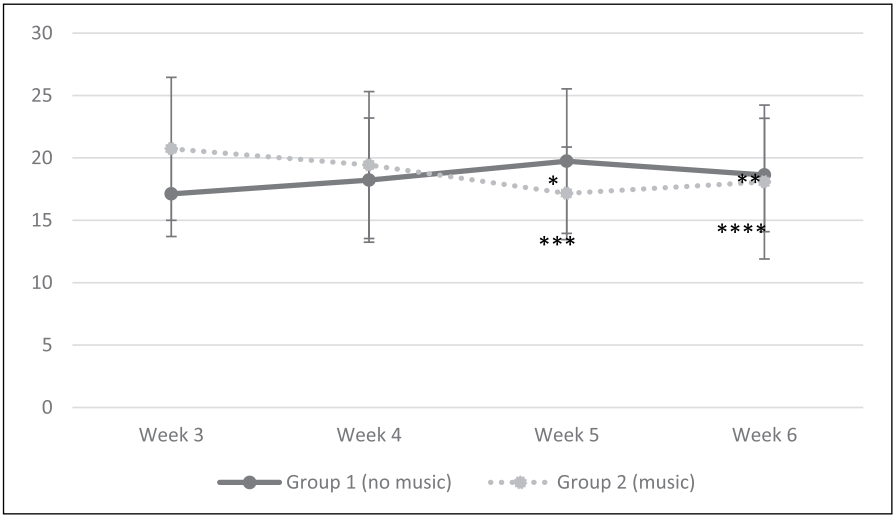

Figure 5. Total depression scores, Phase 2.
* p = .026; ** p = .03; *** p = .002; **** p = .004.

Anxiety

Phase 1. A sphericity-assumed ($\chi^2(5) = 3.39$, $p = .64$) two-way mixed ANOVA was conducted to assess the outcome measures. Results showed a statistically significant interaction between the intervention and time, $F(3, 198) = 5.354$, $p = .001$, partial $\eta^2 = .075$, and a statistically significant effect of time for the music group, $F(3, 111) = 10.935$, $p = .0005$, partial $\eta^2 = .228$. Differences between groups were statistically significant at week two, $F(1, 90) = 6.949$, $p = .010$, partial $\eta^2 = .072$, and week three, $F(1, 89) = 8.202$, $p = .005$, partial $\eta^2 = .084$. Figure 6 shows the means, standard deviations and statistically significant time points of Phase 1.

Bonferroni pairwise comparisons confirmed these findings. Statistically significant decreases were found between baseline and week three ($M = 3.69$, $SE = 0.76$, $p = .0005$), indicating that the intervention was effective in reducing anxiety. In addition, statistically significantly decreases were found between baseline and week two ($M = 2.29$, $SE = 0.62$, $p = .004$), and between weeks one and three ($M = 3.24$, $SE = 0.79$, $p = .001$). There were no findings of significance in Group 2.

Phase 2. A sphericity-assumed ($\chi^2(5) = 5.32$, $p = .38$) two-way mixed ANOVA was conducted. Results showed a statistically significant interaction between the intervention and time, $F(3, 183) = 12.472$, $p = .005$, partial $\eta^2 = .170$, and a statistically significant effect of time for the music group, $F(3, 90) = 8.365$, $p = .0005$, partial $\eta^2 = .218$, and the no-music group, $F(3, 93) = 4.755$, $p = .004$, partial $\eta^2 = .133$. Differences between groups were statistically significant at week three (following Phase 1), week five, $F(1, 62) = 8.191$, $p = .006$, partial $\eta^2 = .117$, and week six, $F(1, 64) = 9.014$, $p = .004$, partial $\eta^2 = .123$. Figure 7 gives the means, standard deviations and statistically significant time points of Phase Two.

Bonferroni pairwise comparisons confirmed these findings. Group 1 (no music) showed statistically significant *increases* between weeks three and five ($M = 2.53$, $SE = 0.898$, $p = .05$) and between weeks three and six ($M = 1.519$, $SE = 0.496$, $p = .03$), indicating that the intervention's benefits were not maintained after Phase 1. Group 2 (music) showed statistically

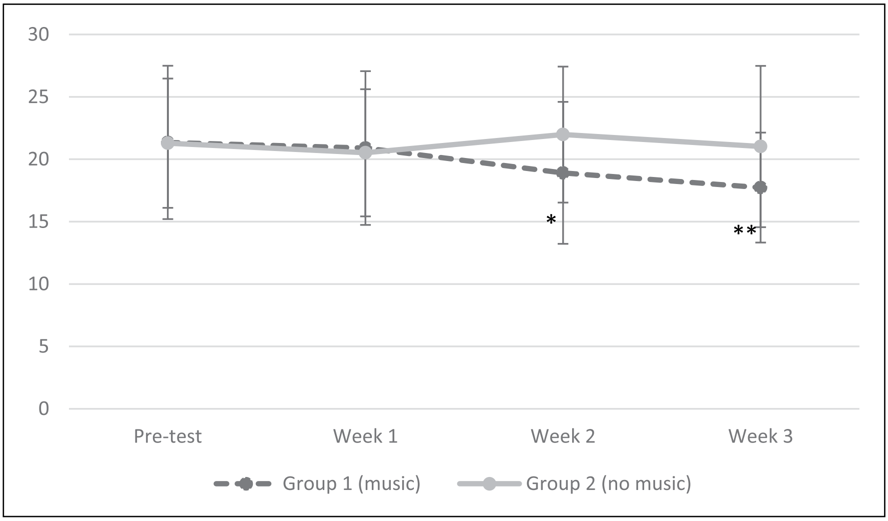

Figure 6. Total anxiety scores, Phase 1.
* p = .004; ** p = .001.

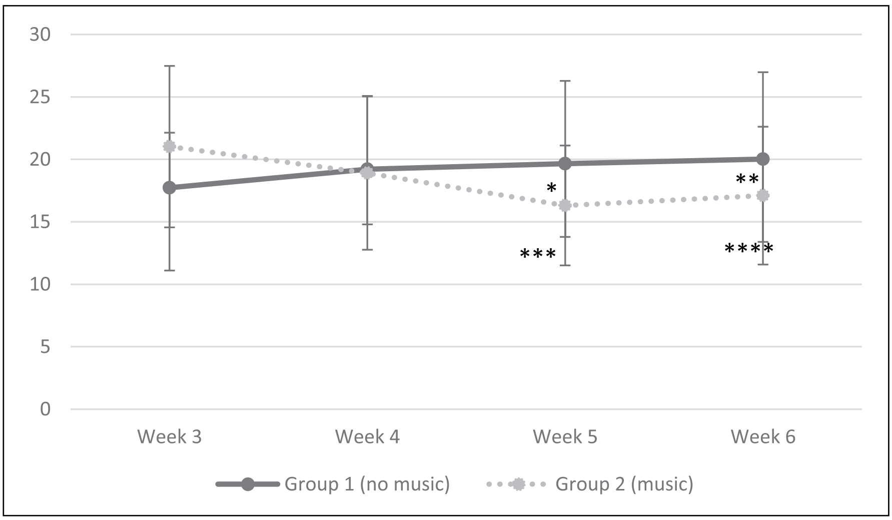

Figure 7. Total anxiety scores, Phase 2.
* p =0 .05; ** p = .021; *** p = .0005; **** p = .003.

significant *decreases* between the same time points, i.e., between weeks three and five (M = 4.23, SE = 0.825, p = .0005) and between weeks three and six (M = 3.13, SE = 0.81, p = .003). This again suggests that two weeks was sufficient for a significant decrease in anxiety scores.

Care home questionnaire

Fifty-seven per cent of questionnaires were returned. Staff assessments of the three disorders were compared with those of the participants. Differences were slight: care staff assessments of

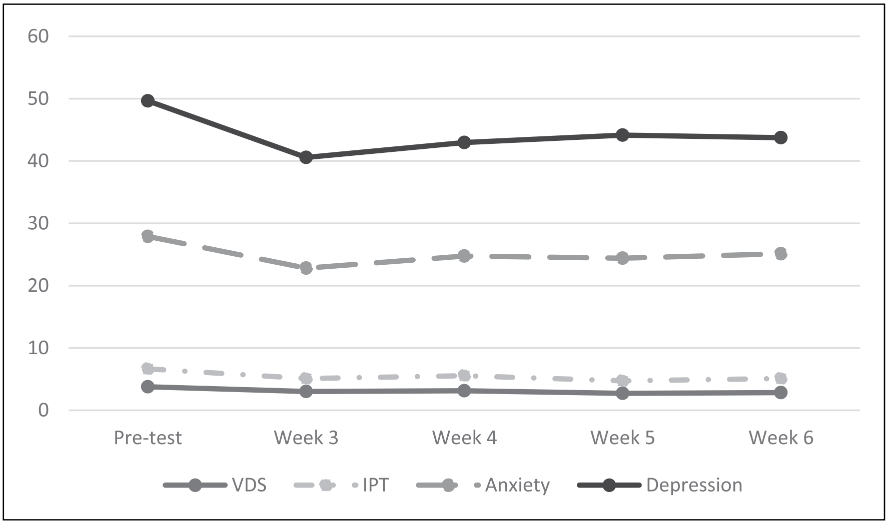

Figure 8. Mean scores of Group 1 at baseline and during Phase 2.

pain and anxiety were marginally lower; those of depression were very slightly higher. No statistically significant differences were found, thus suggesting that the participants' self-report scores were valid.

Additional findings

The crossing over of the two groups enabled an assessment of any residual effects following Phase 1. Subsequent weekly depression and anxiety scores gradually increased, although not to baseline levels. These increases were statistically significant in anxiety (M = 1.519, SE = .496, p = .03) and depression (M = 2.667, SE = .692, p = .004). Changes in pain were insignificant: a slight decrease (VDS) (Z = .84, N–Ties = 17, p = .403) and a slight increase (IPT) (Z = .36, N–Ties = 17, p = .721). These results are shown in Figure 8.

As the Bonferroni-corrected pairwise comparisons showed, a two-week period was sufficient to show a significant decrease in anxiety and depression scores. This was not the case for pain. Although there was a decrease between baseline assessment and week two, statistical significance was not achieved – IPT: Z = 1.098, N–Ties = 29, p = .272; VDS: Z = .965, N–Ties = 26, p = .07.

Further findings related to participants' selection of music, their attitude towards music, and the benefits received. Despite a presumption that those of a higher educational status would have a greater preference for classical music (Baldwin & Wild, 2004), this was not reflected in the sample. Educational status was equally divided between those who left school at 16, at 18 and those who went on to higher education. However, choice of musical genre was divided as follows: 81% classical, 2% jazz, 3% Big Band, 4% pop, 6% country and western and 4% folk.

The music preference questionnaire included a rating of music's importance. Answers were coded on a four-point Likert scale (*very important, important, quite important, not important*). Statistically significant decreases for each disorder were more frequent in those who responded *very important* than for those in the other categories. There were no significant improvements for those with the response *unimportant*. However, the number in this category was very small (n = 9).

Participants rated the frequency of their music listening: *occasionally, most days* and *every day*. Statistically significant decreases were found for all dependent variables in everyday listeners. There were some positive outcomes for less frequent listeners but none were found for improvements in pain.

Any differences in the results due to participants' ability to communicate their music preferences were evaluated by dividing them into two categories: specific (n = 38) and less specific (n = 75). The allocation was determined by the questionnaire responses and was inevitably somewhat arbitrary. Differences were only found in the results for pain; there was a statistically significant decrease for those in the specific category, but not for those who were less specific.

Discussion

These results offer evidence to support the use of a music listening programme for the relief of pain, depression and anxiety in older people. However, the hypothesis that there would be equal benefits for each variable was not supported. Benefits to anxiety and depression were similar, with comparable levels of statistical significance and effect size in both groups. Although pain decreased significantly during Phase 1, the effect size was small and the decrease during Phase 2 was not significant. Given Melzack and Wall's (1996) suggestion that changes in pain intensity may directly change depression scores and vice versa, these results were unexpected. As the assessments for each disorder were made concurrently, they cannot be attributed to any procedural differences. Two explanations are suggested.

Firstly, further analysis showed that the effect of the intervention on participants with "mild to strong" pain was statistically significant. However, those in the "just noticeable", "weak", "severe" or "excruciating" categories received no measurable benefit. It has been suggested that for those with "just noticeable" or "weak" pain, any improvement may have been too small to determine any measurable effect. For those with severe pain, the music may have been inadequate as a distraction as compared with pain signals. This corroborates the findings of MacDonald et al. (2003), who investigated the effect of music on post-operative pain; one study following minor foot surgery, the other following hysterectomy. Results were insignificant. The authors concluded that in the first, pain perception was very low and probably beyond the discrimination of the assessment measure; in the second, the pain was too severe.

Secondly, participants were selected according to their need for assistance as provided by a care home, rather than their experience of pain. Pain was not universally experienced. However, all participants reported some symptoms of depression and anxiety, thereby ensuring a greater number of participants in whom there might be a discernible effect. This is not the first study to have found a greater effect on psychological markers. MacDonald et al. (2003), as discussed above, and Cadigan et al. (2001) both found positive results for the relief of anxiety, but not of pain.

The crossover design allowed for an examination of any residual effectiveness of the intervention following Phase 1. The significant decreases in scores of each disorder during Phase 1 were followed by increases during Phase 2; these increases were significant for depression and anxiety. However, none returned to baseline levels but showed a small residual effect. These findings indicate that for benefits to continue or to increase, a regular music-listening programme should be maintained. This replicates the findings of two previous studies: Finlay (2014) reported that music's effect on pain perception was short term with no ongoing benefits; Suzuki, Kanamori, Nagasawa, Tokiko, & Takayuki (2007) reported that benefits to anxiety were temporary.

The use of preferred music contributed in large measure to the effectiveness of the intervention. Significant decreases in depression and anxiety were achieved using music tailored to participants' preferences. Although the level of detail provided by participants varied, results were not affected. However, significant decreases in pain were only achieved amongst those who provided more detailed information. It is suggested that this resulted in closer attention, commitment and enjoyment, thereby causing greater emotional arousal, essential for pain relief. Similarly, those who rated music as important experienced greater benefits, perhaps for the same reasons. Thus, the hypothesis that those who rated music as important would show a greater response was supported by the findings.

The week-on-week decreases (found for each disorder during Phase 1, and for depression during both phases), suggest that there may have been a cumulative effect. This supports Fredrickson's (2004) theory that the effect of positive emotions is accumulative, leading to a decline in negative emotions. It suggests that if continued over a longer period, further benefits might accrue.

Limitations

Bias is impossible to avoid completely (Maratos et al., 2008), and is particularly challenging in research with this population. Selection and performance bias were avoided by randomisation and by applying the same treatment protocol to all participants. However, detection bias was hard to avoid. Cochrane reviewers, Cepeda et al. (2006), recognise that blinding participants to group allocations is rarely possible in music interventions. For a sole researcher, it was impossible. Several strategies were implemented to reduce unintended influence. Each interview was conducted in the same way, using pre-coded assessments and consistent language; leading questions and expressions of surprise or disapproval were avoided; every effort was made to be accurate in the reporting of scores.

The two strongest predictors of attrition are living in an institution and cognitive impairment (Beekman et al., 2002), both characteristics of this population. There were 26 withdrawals (23%): nine from Group 1; 17 from Group 2. At the end of the study, Group 1 had 46 participants, Group 2 had 41. Reasons for withdrawal were wide ranging: illness, hospital admittance, relocation, insufficient hearing or cognition, complaints from neighbours, fear of music-players or inability to use them, and an unwillingness to answer questions. However, other studies have reported attrition rates of up to 45% (Bowsher et al., 1993). This suggests that the attrition levels reflected the reality of research amongst this cohort. "Fear" of the music-players resulted in five withdrawals; difficulties with their operation resulted in four. The notion that the music-player could be an object of fear and anxiety was unexpected.

Further research

Three issues arise that suggest areas for future research. First, the recruitment of a sample of older people, all experiencing some pain, would increase the probability of significant findings and would enable a better comparison of the relative benefits of music to pain and mood. Second, the incremental effect shown in the results requires further investigation. A longer intervention period would provide an opportunity to assess whether the improvements continued. Third, the development of a simple-to-operate, low-cost music-player would reduce attrition rates and enhance the experience for all participants.

Conclusion

These findings provide further evidence of the effectiveness of listening to preferred music. Although not everyone will benefit to the same degree, extreme old age is no barrier to receiving some alleviation from pain, depression and anxiety. It is hoped that if music were listened to regularly over a longer time span, the benefits would continue, leading to greater wellbeing in this frail and vulnerable population.

Ethical approval

The research for this project was submitted for ethics consideration and approved under the reference EDU 12/030 and approved under the procedures of the University of Roehampton's Ethics Committee on 28.05.2012.

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1. Keela Herr is Professor and Associate Dean at the University of Iowa.

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