Elsevier Editorial System(tm) for The Lancet
Manuscript Draft

Manuscript Number: THELANCET-D-14-04601R3

Title: Music as an aid for postoperative recovery in adults: a systematic review

Article Type: Article

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Abstract: Background Music is a relatively non-invasive, safe and inexpensive intervention that can be delivered easily and successfully. This systematic review evaluated music to improve postoperative recovery after surgical procedures.MethodsRandomised controlled trials (RCTs) in any language of adult patients undergoing surgical procedures excluding central nervous system or head and neck were included. Any form of music initiated before, during or after surgery was compared to standard care or other non-drug interventions. Medline, Embase, CINAHL, and Cochrane Central were searched to October 2013: Inclusions, data extraction and quality assessment were in duplicate. Meta-analysis with RevMan (5.2), with standardised mean differences (SMD) and random effects models were used. (Prospero-CRD42013005220).ResultsSearches found 4261 titles and abstracts, 73 RCTs were included, with size varying between 20 - 458 participants. Choice of music, timing and duration varied. Comparators included routine care, headphones with no music, white noise and undisturbed bed rest. Postoperatively music reduced pain (SMD -0.77 (95% confidence intervals (95%CI) - 0.99 to -0.56), anxiety SMD -0.68 (95%CI -0.95 to -0.41), and analgesia use SMD -0.37 (95%CI -0.54 to -0.20) and increased patient satisfaction SMD 1.09 (95%CI 0.51 to 1.68) but there was no difference in length of stay (MD -0.11 (95%CI -0.35 to +0.12)). Subgroup analyses on choice and timing made little difference. Music was effective even when patients were under general anaesthetic. ConclusionsThere is now evidence to demonstrate that music should be available to all undergoing operative procedures. Patients should choose the type of music. Timing and delivery may be adapted to individual clinical settings and medical teams.

# Music as an aid for postoperative recovery in adults: a systematic review

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## Abstract

### Background

Music is a relatively non-invasive, safe and inexpensive intervention that can be delivered easily and successfully. This systematic review evaluated music to improve postoperative recovery after surgical procedures.

### Methods

Randomised controlled trials (RCTs) in any language of adult patients undergoing surgical procedures excluding central nervous system or head and neck were included. Any form of music initiated before, during or after surgery was compared to standard care or other non-drug interventions. Medline (1946-Oct 2013), Embase (1947-Oct 2013), CINAHL (1960-Oct 2013), and Cochrane Central (1898-Oct 2013) were searched, using MESH and keyword search terms: music, music therapy, surg*, operat*, recovery, recuperation, rehabilitation, convalescence, post-op*. Inclusions, data extraction and quality assessment were in duplicate. Meta-analysis with RevMan (5.2), with standardised mean differences (SMD) and random effects models, and STATA for meta-regression were used. (Prospero-CRD42013005220).

### Results

Searches found 4261 titles and abstracts, 73 RCTs were included, with size varying between 20 – 458 participants. Choice of music, timing and duration varied. Comparators included routine care, headphones with no music, white noise and undisturbed bed rest. Postoperatively music reduced pain (SMD -0.77 (95% confidence intervals (95%CI) --0.99 to -0.56), anxiety SMD -0.68 (95%CI -0.95 to -0.41), and analgesia use SMD -0.37 (95%CI -0.54 to -0.20) and increased patient satisfaction SMD 1.09 (95%CI 0.51 to 1.68) but there was no difference in length of stay (MD -0.11 (95%CI -0.35 to +0.12)). Subgroup analyses on choice and timing made little difference. Meta-regression found no causes of heterogeneity in the eight variables evaluated. Music was effective even when patients were under general anaesthetic.

### Conclusions

There is now evidence to demonstrate that music should be available to all undergoing operative procedures. Patients should choose the type of music.

Timing and delivery may be adapted to individual clinical settings and medical teams.

## Introduction

Most people undergo a surgical procedure at some point in their lives, over 51 million operative procedures are performed annually in the United States of America (USA)[1] and 4.6 million hospital admissions lead to surgical care in England.[2] There is an emerging trend towards the conduct of surgical procedures without general anaesthesia, for example hysteroscopy and Caesarean section. Whether anaesthesia is used or not, the postoperative period is a difficult time for patients. The term 'postoperative recovery' has not been precisely defined. It is clinically based and includes the restoration of the patient's cerebral and motor function. Current surgical recovery strategies, such as Enhanced Recovery[3-5] recommend numerous successful perioperative interventions within this package.[6] Some preoperative strategies, such as patient education and nutritional additives, have been seen to reduce postoperative pain requirements and improve satisfaction levels[7-9] but not all potentially useful interventions have yet been evaluated or incorporated.

The use of music to improve patients' hospital experience has a long foundation in medical care, including by Florence Nightingale.[10] Music was first described being used to help patients during operations by Kane in 1914.[11] There is abundant research investigating music's impact on the emotions and neurophysiology.[12-14] Pre-recorded music, used through headphones, musical pillows or background sound systems can be a non-invasive, safe and inexpensive intervention, compared to pharmaceuticals, that can be delivered easily and successfully in a medical setting.[15] Music has frequently been investigated in the context of recovery from operative procedures and numerous RCTs have demonstrated positive effects on patients' postoperative recovery.[16,17] This use of music is different from music therapy, which is a cognitive rehabilitation method.[18]

Previous systematic reviews have investigated music and its role in specific surgical procedures such as colonoscopy[19,20] or only one aspect of patient experience in isolation, such as preoperative anxiety[21], or postoperative pain.,[22,23]. Cepeda (2010) investigated music for pain relief in both surgical and non-surgical settings.[24] Nilsson (2008) comprehensively reviewed 60 articles on music in the perioperative period but did not perform a meta-analysis.[25]. None have provided a comprehensive overview with meta-analyses and meta-regression.

Music is not currently being used routinely during episodes of surgery. General issues around lack of uptake include ignorance and scepticism of professionals as to clinical usefulness of music, and lack of: budget, research dissemination and integration of the intervention in daily practice.[26]

Despite the wealth of relevant studies the implementation of music as a therapeutic tool in everyday surgical practice is lacking because the information demonstrating effectiveness has not been synthesised and universally disseminated. This systematic review evaluates the effectiveness of music to improve postoperative recovery incorporating all available RCTs, reviewing the impact of music on common outcome measures for postoperative care: pain, analgesia requirements, anxiety and length of stay and exploring a number of relevant subgroups – patient choice of music, timing of the intervention and whether general anaesthesia was used.

## Methods

We developed and registered a protocol for this systematic review (Prospero registration number CRD42013005220). The pre-defined inclusion criteria were RCTs in any language with adult patients undergoing any form of surgical procedure (with or without sedation or anaesthesia) to any part of the body excluding the central nervous system or head and neck (because of potential hearing impairment). Any form of music initiated before, during or after surgery was compared to standard care or any other non-drug

interventions such as massage, undisturbed rest or relaxation. Outcomes of interest were: postoperative pain, analgesia requirement, anxiety, infection rates, wound healing, costs, length of stay, and satisfaction with care. Analgesia use included any opioids or non-steroidal anti-inflammatory drugs (NSAIDs). If both were reported, opioid use was used in the meta-analyses. The outcomes were measured up to six weeks postoperatively. We investigated subgroups of pain before and after four hours postoperatively, timing of the intervention pre, intra and postoperatively, general anaesthetic versus none and patient choice of music. We recorded if music given intraoperatively was started after induction of anaesthesia.

The following databases were searched: Medline (1946-Oct 2013), Embase (1947-Oct 2013), Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1960-Oct 2013), and Cochrane Central (1898-Oct 2013). The following search terms were used; music, music therapy, surg*, operat*, recovery, recuperation, rehabilitation, convalescence, post-op*. Both MESH terms and keywords were used. Reference lists of relevant reviews were checked for additional studies. All relevant titles and abstracts were transferred to Endnote Web for assessment.

Two reviewers (JH and MH) checked study eligibility. Both independently extracted data from studies using a standardised, pre-designed extraction form in Microsoft Excel 2007. Disagreements were resolved through discussion or referral to a senior reviewer (CM). Quality of included studies was assessed using criteria set by The York Centre for Reviews and Dissemination[27]; focussing on randomisation, allocation concealment, presence of blinding, explanation of withdrawals and presence or absence of intention-to-treat analysis.
We tabulated the characteristics and results of all the included studies; analysis was quantitative. Where standard errors or ranges were provided, standard deviations were calculated using standard formulae. Review Manager (version 5.2, The Cochrane Library) was used for meta-analyses. We used random effects models because of heterogeneity of participants and interventions. All outcomes were continuous measures and we used

standardised mean differences (SMD) where the outcomes had differing measurement scales. Risk of publication bias was assessed using funnel plots. In addition to presenting SMD, which can be difficult to interpret clinically, we conducted back transformations of two outcomes used in the included RCTs. These were calculated using Excel and were performed on the pain outcome, using a mean of control group standard deviations from the RCTs measuring pain using a VAS, and for the anxiety outcome, using a mean of control group standard deviations from RCTs measuring anxiety with STAI. To further investigate heterogeneity, meta-regressions were conducted using STATA version 12.

**Role of the funding source**

There was no funding source for this study. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## Results

Searches found 4261 titles and abstracts. After removing duplicates 3876 remained for screening, of which 3616 were irrelevant. Full papers for 260 articles were assessed for inclusion (238 from database searches and 22 from reference lists) (see figure 1). There were 73 RCTs included in the qualitative synthesis and 72 RCTs in quantitative syntheses, including a Japanese study that was translated. It is unlikely that there will be much effect from publication bias (see figure 2).

Characteristics of included studies are in table 1. The size of the studies varied between 20 – 458 participants, and they underwent a variety of different surgical procedures ranging from minor endoscopic interventions to transplant surgery. Most studies only included elective procedures. Choice of music could be by patient or researcher. Patients chose a wide variety of styles. Researchers determined single types of music such as Chinese classical music, or gave patients' choice from a list of six or more styles. Most were of a soothing quality. Delivery could be by headphones or music pillows for patients only to hear, or loudspeakers which could also be heard by the medical team. When music was delivered by headphones, it was often at a

sufficiently low level that patients could still communicate easily. Timing could be pre, intra or postoperative, or a combination. The music could be played when patients were awake or anesthetised. Duration of music varied between a few minutes to repeated episodes over several days. Comparator descriptions varied, and included routine care, headphones with no music, white noise, and undisturbed bed rest. Duration and timing was normally similar to the interventions. Outcomes included postoperative pain, analgesia requirement, anxiety, length of stay, and satisfaction with care. None of the RCTs measured infection rates, wound healing or costs. Some outcomes were measured during or just after the procedure, others were measured at multiple times during the hospital stay.

A variety of outcomes were measured (see Table 2). Pain was usually measured with visual analogue scales (VAS) or numerical rating scales (NRS). An indirect measure of pain was the consumption of analgesia, which varied considerably between the studies including opioid-based drugs such as pethidine, fentanyl, and morphine, and non-steroidal anti-inflammatories such as diclofenac, ibuprofen, and paracetamol.

Quality of included studies varied (see table 3) but a number of the studies gave insufficient details to assess all aspects of quality. An intervention such as this cannot be blinded to the patient unless they are under general anaesthesia, but blinding of investigators and outcome assessment would be possible but was not stated in many of the studies. Where music was delivered when the patient was under anaesthesia it was unclear whether the patient knew beforehand to which group they were allocated.

The results showed that postoperatively music reduced pain (45 RCTS, SMD -0·77 (95%CI-0·99 to -0·56)), anxiety (43 RCTS, SMD -0·68 (95%CI -0·95 to -0·41)), and analgesia use (34 RCTS, SMD -0·37 (95%CI-0·54 to -0·20)) and increased patient satisfaction (16 RCTS, SMD 1·09 (95%CI 0·51 to 1·68)) but there was no difference in length of stay (7 RCTs, SMD -0·11 (95%CI-0·35 to +0·12)) (see figure 3). Pain and anxiety SMD outcomes were back-calculated into specific measurements most used in the RCTs. Pain results (using the

10cm VAS) suggested that music reduced pain scores by 2.3cm on average, compared to placebo. Anxiety results (measured by STAI) were reduced by 6.4 units on average, compared to placebo.

Heterogeneity was high for pain, anxiety and analgesia use, with $I^2$ varying between 75-92%, for length of stay it was 0%. No RCTs reported wound healing rates, costs, wound infections or serious adverse events. A subgroup analysis by type of control (routine care vs control with attention) made little difference to the effectiveness of music. Univariate m~~M~~eta-regression analysis to explain heterogeneity did not show a significant impact of any of the eight variables on the main result (variables investigated were patient choice, timing of music, general anaesthetic, use of VAS to measure pain v other pain measures, routine care v other comparisons, endoscopy type procedures v surgery, allocation concealment, and blinding of outcome assessment). Because there were no significant outcomes found on univariate meta-regression, multivariate meta-regression was not conducted.

Postoperative pain was pragmatically categorised as being measured between zero and four hours and more than four hours. There was no difference between pain measured at the early versus later time categories (-0·79 (95%CI-1·06 to -0·52) and -0·76 (95%CI-1·19 to -0·33) respectively). For individual subgroup meta-analyses – see Web Appendix figures W2 – W12.

When patients were allowed to choose the music (from personal choice or from a playlist) there was a slightly greater but non-significant reduction in pain compared to when there was no choice (SMD -0·86 (95%CI-1·14 to -0·57) vs -0·70 (95%CI-1·01 to -0·39). Similarly, there was a slightly greater but non-significant reduction in analgesia use with patient choice (SMD -0·53 (95%CI-0·84 to -0·23) vs -0·15 (95%CI-0·29 to -0·02) but a slight but non-significant worsening in anxiety SMD -0·54 (95%CI-0·82 to -0·27) vs -0·89 (95%CI-1·42 to -0·36).

There was a trend for pain to be less if music was played preoperatively compared to postoperatively (preoperatively SMD -1·28 (95%CI-2·03 to -

0·54), intraoperatively SMD -0·89 (95%CI-1·20 to -0·57) postoperatively SMD -0·71 (95%CI-1·03 to -0·39). A similar pattern was seen with analgesia use and anxiety. Results for analgesia use were preoperatively SMD -0·43 (95%CI-0·67 to -0·20), intra-operatively SMD -0·41 (95%CI-0·70 to -0·12), post-operatively SMD -0·27 (95%CI-0·45 to -0·09) and for anxiety were pre-operatively SMD -1·12 (95%CI-2·05 to -0·19), intra-operatively SMD -0·83 (95%CI-1·19 to -0·47) and postoperatively (SMD -0·50 (95%CI-0·96 to -0·04).

Even under general anaesthetic music still reduced pain, but a larger effect on pain was found intra-operatively where patients were conscious compared to where patients heard the music whilst under general anaesthetic (SMD -1·05 (95%CI-1·45 to -0·64) vs SMD -0·49 (95%CI-0·74 to -0·25). A similar effect was found with analgesia use (SMD -0·58 (95%CI -1·05 to -0·11) vs -0·26 (95%CI-0·44 to -0·07) and anxiety (SMD -0·91 (95%CI-1·33 to -0·48) vs -0·48 (95%CI-0·91 to -0·05).

None of the included studies reported side effects. However, some reported that they ensured that the low volume delivered permitted communication with medical teams.

## Discussion

### Statement of principal findings

The results of this systematic review suggest that playing music in the perioperative setting can reduce postoperative pain, anxiety and analgesia requirements, and improve patient satisfaction. Fewer studies measured length of stay and no difference was found. None of the studies investigated the effects of music on infections, wound healing rates, or costs.

### Strengths and weaknesses

We used wide inclusion criteria in order to make the results more generalisable to clinical practice. It could be argued that we should not have combined very heterogeneous studies because of the clinical differences. For example, is it useful to meta-analyse studies reporting different analgesics used? Stronger pain tends to be alleviated with stronger analgesia whereas

milder pain responds to weaker analgesia. Therefore the relative reduction in pain would be of interest. We took the pragmatic decision that combining all studies reporting analgesia use would be more useful clinically than grouping specific types of analgesics. This was also extended to other aspects of clinical heterogeneity such as age groups, types of interventions and also whether the intervention was conducted awake or under general anaesthesia. The measures of heterogeneity within the meta-analyses indicated that there was a large amount of statistical heterogeneity in the main analyses for pain, analgesia use and anxiety. To mitigate this we used random effects meta-analyses. It is acknowledged that this only partially removes the impact of heterogeneity[28] Nevertheless we considered that combining data would provide a more clinically useful result than including a narrower range of homogenous studies. The implication of combining clinically heterogeneous studies is that we cannot be sure whether music applies equally to all clinical scenarios. However, we investigated a number of clinically relevant subgroup analyses such as general anaesthesia vs. none, and timing and choice of music and also conducted meta-regression. The heterogeneity remains unexplained so to fully investigate this an IPD meta-analysis would be the next step.

It is surprising that the largest RCT recruited only 458 participants and one could argue that it would be interesting to discover whether a very large RCT would generate similar results to this systematic review. However, there were so many small trials showing positive effects of music in helping patients with surgical procedures, that a large trial may not now be needed. These small RCTs were hard to find in lesser-known journals, which illustrates the benefits of systemic reviews and meta-analysis. One aspect that a large RCT would additionally address would be the issues around heterogeneity.

Prediction intervals could have been calculated as this would have given a more comprehensive picture of the potential effect of music in individual settings. However, prediction intervals tend to be wider than 95% confidence intervals and, because of clinical heterogeneity, it is unclear as to how the calculation of prediction intervals would help to guide individual clinicians on

the implementation of music.

**Strengths and weaknesses in relation to other systematic reviews including any differences in results**

One strength of this systematic review is the large number of included studies compared to previous systematic reviews. The most comprehensive previous systematic review used a vote-counting approach to summarise results only.[25] Some of the previous systematic reviews only investigated one outcome, such as anxiety or pain, whereas we report all relevant clinical outcomes. We believe this is the most comprehensive systematic review to date on the use of music in the perioperative setting, including 6902 patients. Our results are similar to Cepeda (2010) in magnitude of effect size.[24]. We found no side effects reported, as did a recent Cochrane review.[29]

**Meaning of the study: possible mechanisms and implications for policymakers**

The general findings on the beneficial effects of music on the wellbeing of patients are consistent with expectations and the public's perception of music. There are a number of potential mechanisms that could help to explain the effects of music, from the patient's and the medical team's perspective. Modern theories of pain suggest that pain experience is affected by physical and psychological factors. Cognitive activities such as listening to music can influence perceived intensity and unpleasantness of pain, allowing for a reduced pain sensation by the patient.[30] Another potential mechanism could be a reduction in autonomic nervous system activity such as reduced pulse and respiration rate and lower blood pressure.[31] For those undergoing general anaesthesia there is some RCT evidence that parts of the brain involved in hearing may sometimes remain perceptive during general anaesthetic.[32] For approximately one in a thousand people undergoing general anaesthesia, unwanted intraoperative awareness during the anaesthetic is a risk factor for post-traumatic stress[33]. It is unclear at the moment whether intraoperative music might have prevented this by reducing anxiety levels.

Other primary studies and systematic reviews have found that, for medical

teams, carers may be more relaxed and attentive[34] where there is music playing that they enjoy, but its use may be inappropriate in certain settings. The medical team may be distracted if music is audible from the patient's headphones. Music may impede communication with patients, particularly during an awake procedure. If patients need to be able to communicate with healthcare workers bilateral headphone use may be an obstacle. Music and noise have the potential to obstruct other interventions through negatively affecting the surgeon's performance. Because of this, music should not be imposed on the medical team, particularly during the procedure. If medical teams intend to introduce music into the perioperative setting care needs to be taken that music does not interfere with the communication between the medical team.[35,36]

**Unanswered questions and future research**

Music is a non-invasive, safe and inexpensive intervention that can be delivered easily and successfully in a hospital setting. We consider that there now appears sufficient research to demonstrate that music should be available to all undergoing operative procedures. Patients should be able to choose the type of music they would like to hear, but it is unclear currently whether this should be of their own choice or from a playlist. However, some might prefer for religious reasons to listen to recitations or natural sounds. The timing of music does not make much difference to outcomes so may be adapted to the individual clinical setting and medical team. For example some may want to implement intraoperative music whereas other may prefer the patient to listen to their own electronic musical device, such as an MP3 player, before the procedure or as soon as they arrive back onto the ward. The appropriate volume to be used in different settings is also currently unclear. Whether other distracting stimuli might have a similar effect, such as watching videos or listening to talking books, is also unclear. There is some experimental evidence that distraction using video gaming can reduce experimentally-induced pain in adults[37] but no evidence examining the effectiveness of talking radio or talking books during surgery in the adult population.

One type of research needed now would be around barriers to implementation

in the clinical setting, such as copyright and intellectual property issues. On a local scale encouraging patients to listen to music could be introduced into patient information leaflets and hospital guidelines and its use then audited. This audit would need to be published to inform wider circles of decision-makers.

**Declaration of interest**

None of the authors had any financial or personal relationships with other people or organisations that could bias the present paper.

**Acknowledgements**

We would like to acknowledge the help of Ewelina Rogozinska with conducting the meta-regression.

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Senior reviewer peer review comments response - 5th Jan 2015

| Peer comment | Our comments | Our final response (referring to document with tracked changes) |
|---|---|---|
| Music as an aid for postoperative recovery in adults: a systematic review<br>This is an interesting and well done review of a simple "treatment", but with 2 main limitations:<br>1. The high heterogeneity<br>2. The clinical interpretation and application of the results<br>I suspect these are both "fixable" but would take more work by the authors, or at least a good editorial commentary. However, unless these issues were fixed, I suspect there would be little uptake. | We thank the peer reviewer for their comments. We agree that there is high heterogeneity and it is puzzling. We have investigated a number of potential factors through subgroup analyses and have found not causes to explain it so far. We have also run some meta-regressions. Univariate analyses showed no impact from any of the eight factors we investigated including allocation concealment, blinding of outcome measures and type of procedure. We discuss these below.<br>Of note, a recent HTA report on maternal obesity also showed high and unexplained heterogeneity, which is why they subsequently started an IPD meta-analysis.<br>Ref: S Thangaratinam, E Rogozińska, K Jolly, S Glinkowski, T Roseboom, J W Tomlinson, R Kunz,<br>B W Mol, A Coomarasamy, K S Khan. Effects of interventions in pregnancy on maternal weight and obstetric outcomes: meta-analysis of randomised evidence. BMJ 2012;344:e2088 doi: 10.1136/bmj.e2088 (Published 17 May 2012) | None required |

| Peer comment | Our comments | Our final response (referring to document with tracked changes) |
|---|---|---|
| In more detail, my comments are:<br>A. Is the topic important?<br>Probably yes, for the many patients undergoing surgery it reduces the transient discomforts of operation, and it is simple and cheap.<br>A drug that had similar effects might generate some excitement.<br>B. Is the review well done?<br>Mostly yes, but with some weaknesses in the analysis.<br>The search is good, but did not appear to check trials registries; they appraised and selected only better studies; and did an appropriate pooling of results. | We thank the peer reviewer for their comments. We did not check trial registries because we were looking for fully published RCTs, rather than also looking for on-going RCTs. | None required |
| The main weakness, as Reviewer 2 points out, is the Heterogeneity of included studies, which is not well explained.<br>The authors recognize:<br>"Heterogeneity was high for pain, anxiety and analgesia use, with I2 varying between 75%-92%"<br>Those are VERY high I2 and require either explanation or caution or preferably both.<br>To address this the authors did some subgroup analyses, but did not do meta-regression. | We agree that the heterogeneity is a weakness hence the subgroup analyses. We have since run some meta-regressions on the pain outcome in STATA on patient choice, timing of music, general anaesthetic, use of VAS to measure pain v other measures, routine care v other comparisons, endoscopy type procedures v surgery, allocation concealment and blinding of outcome assessment. In univariate analyses none were statistically significant and only type of procedure was approaching significance (p=0.055). so no-multivariate analysis was appropriate. | Sentence added to methods section about methods of meta-regression on lines 157-8<br><br>Sentence added to results on lines 225-30 |

| Peer comment | Our comments | Our final response (referring to document with tracked changes) |
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| C. What do the results mean?<br>There now appears sufficient research to demonstrate that music should be available to all undergoing operative procedures.<br>But the size of the effects are hard to clinically interpret results, particularly as they are only given as Standardized Mean Differences (SMD) which most readers will find hard to interpret clinically.<br>Some options to improve this might be to back-transform to other scales (such as VAS and/or a % change) and/or compare to pre-medication. | We have back-calculated using the control group SDs for the VAS for pain and STAI for anxiety. We did not do analgesia use because of the variety of drugs used. | Addition to methods lines 151-7 and results lines 215-9 |
| D. What would you use in practice?<br>The authors suggest patients should be able to choose the type of music they would like to hear, and that the timing of music does not make much difference to outcomes so may be adapted to the individual clinical setting and medical team.<br>But I still find those suggestions hard to interpret.<br>Does "choose the type of music" mean they bring their own or choose from a set of genres? Which genres, and what playlists might be used?<br>Is there a default? What volume of music? | In spite of the large number of RCTs we found, there was still insufficient information to determine whether personal choice of music or choice from a playlist would be the better options, nor the volume to be used. These could be evaluated in a more focused pragmatic RCT evaluating how best to implement music in the NHS. We also note an ethical consideration as some Muslims are not allowed to listen to music, but would be able to listen to religious recitations or natural sounds) | Sentences added to results section lines 238-9<br><br>Choice of music issues - added sentence to Unanswered questions and future research section in lines 367-9 and 374-80. |
| If the authors cannot be more specific about this, perhaps you could get an editorial/comment from a surgical team that routinely does this? | We would be very happy for the Lancet to run this type of editorial/comment from a suitable surgical team. For example, there was a very recent BMJ editorial (December 2014) on music in the operating theatre, authors David C Bosanquet, James Glasbey and Raphael Chavez. | None required |

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| Previously mentioned by Naomi – I would also like to ask you to consider commenting in your discussion on whether another engaging/distracting stimuli might have a similar effect to music - specifically for example television, talk radio etc. | There is evidence that streamed video clips and cartoons reduce anxiety in children during inhaled induction of anesthesia or operative procedures (but we excluded children from our review).<br>There is experimental evidence on distraction from pain with video gaming.<br>Another search showed no publications examining the intervention of talk radio or talking books. | Additional sentence added in Unanswered questions and future research section – lines 374-80 plus added reference 37. |

***Manuscript with revisions highlighted**