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Evaluating the therapeutic use of music to address anxiety for women undergoing gynaecological and fertility treatments



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Abstract

Background Music has been effectively used to address anxiety associated with medical treatments across broad applications. However, scant evidence exists about using music to reduce the significant anxiety experienced by women undergoing gynaecological procedures and fertility treatments. Such anxiety relates to the nature of procedures/examinations, invasiveness of the procedures, uncertainty around expectations, and intimate body part exposure, potentially affecting outcomes in triggering sympathetic nervous system responses. Music potentially contributes to anxiety management via known physiological and emotional effects. This funded collaborative project investigates therapeutic uses of music to address anxiety before and during gynaecology and fertility procedures, in order to assist participants with reducing their anxiety.

Methods Participants attending office, day surgery and other hospital procedures (N=41) completed validated self-report surveys before and after procedures, listening to specific music via a purpose-designed Music Star. Additional contextual and qualitative data was sought to understand the nature of the experience for the women.

Results Results of this study indicated that the music intervention appeared to have a significant effect of reducing anxiety for women awaiting gynaecological and fertility procedures (p < .001, r = .82).

Conclusions The use of music forms an acceptable intervention to decrease anxiety in this context and can enhance the experience of women during treatment. Such an increased use of music can provide anxiety management benefits to women undergoing gynaecological and fertility treatments, with these experiences suggesting potential educational benefits to support women through this extremely stressful and complex stage of their life.

Keywords Anxiety, Music, Fertility treatment, Gynaecological treatment, Music therapy, Anxiety management

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Introduction

Anxiety is an undesirable emotional state which can be caused by a wide range of situations and circumstances. In Australia, a higher proportion of women experience anxiety disorders compared to men (women = 21%; men = 12%; [1]), and anxiety is also commonly associated with invasive medical procedures, impacting in turn patient satisfaction, well-being, and outcomes [2, 3]. In the medical context, patients typically may have concerns around anaesthesia, intrinsic intrusiveness and risks associated with invasive procedures, and uncertainty about outcomes [2-5]. In addition, unavoidable waiting times can exacerbate patient anxiety in anticipation of an invasive medical procedure [5-8]. In such circumstances, the experience of anxiety is known to increase as the scheduled time for the procedure approaches [9], which may in turn lead to negative implications for procedural outcomes and reduced patient satisfaction caused by anxiety [3, 8]. Both pre-procedural treatment adherence and clinical effectiveness can be impacted by negative patient experiences and their own perceptions of health and well-being [10]. In contrast, patient satisfaction is enhanced by a recognition of the humanity in patients and integration of physical, emotional, social, and spiritual needs during medical care [11].

Anxiety and fertility treatment

One focus of medical care is fertility treatment, which incorporates a range of gynaecological procedures related to reproductive health in order to work towards potential pregnancy. Women¹ undergoing gynaecological and fertility treatments such as in vitro fertilisation (IVF) and intrauterine insemination (IUI) procedures may experience additional anxiety due to sensitive and emotive factors [6, 12]. Gynaecological procedures such as IUD insertion and removal, hysteroscopy, pap smear, and polypectomy, are necessary for diagnosing, treating, and maintaining reproductive health. Assisted reproductive techniques (ART) involve procedures such as IUI, egg retrieval and embryo transfer to assist individuals with conception. Gynaecological and fertility treatments are often invasive and can impact patients physically and psychologically. It is well-established that patients undergoing gynaecological procedures have personal concerns of exposing intimate parts of the body [13, 14], self-consciousness of odour [15], pain and discomfort [16], and cleanliness [15]. Additionally, patients experience psychological concerns of diagnosis [17], loss of control [3, 15], and uncertainty around outcomes [16].

Not only this, but fertility treatments have repercussions on social and psychological well-being where the effect of treatments may create or contribute to a sense of isolation, dissonance in partner relationships, and negative self-perception and emotions [12, 18–20]. Experiencing infertility and associated treatments and societal pressures tends to predominantly affect women, even though men may also contribute to infertility [21]. Women undergoing IVF treatments typically report experiencing grief, anxiety, stress, and depression, especially if they have undergone multiple cycles of IVF treatment without success [18–22].

Resilience is needed in the face of these challenges, where resilience is considered the ability to dynamically adapt and recover positively from difficulties and adversity [23–25]. Lower levels of resilience and higher levels of distress are common with women undergoing fertility treatment, and do not appear to link to higher incidences of pre-existing or novel psychopathology [12, 18]. Although high anxiety could be correlated with unsuccessful IVF cycles, mixed data and results leave this unsubstantiated [26–28]. In view of existing research to date, fertility treatments clearly have a multi-dimensional impact on the psychological well-being of patients, as well as general concerns and anxiety around invasive procedures [12].

Using music to address anxiety

Music is a non-pharmacological and cost-effective intervention that can effectively diminish anxiety prior to medical procedures and promote self-efficacy, even in settings where time constraints inhibit most relaxation methods such as day surgeries [5, 29-33]. In addition, music has been shown to reduce anxiety and stress and enhance the stability of circulation prior to elective caesarean birth [34]. However, education and training about the use of integrative health approaches such as music is often lacking [35] within a context of supporting self-help strategies by women during the perinatal period [36]. Music is seen as meeting the psychological and spiritual needs of patients awaiting medical procedures [4] by distracting patients from their worries and concerns [32], activating neural mechanisms that promote a sense of well-being [30, 33], and blocking out hospital sounds in the unfriendly clinical environment [31, 37, 38]. Specific music therapy techniques have been used to assist with resolving trauma after ectopic pregnancy and in the transition to motherhood [39]; and additional applications relate to postnatal depression [40]. What constitutes 'relaxing' music has been defined by musical parameters [7, 32, 41]. Relaxing music typically has a slow tempo at 60-80 beats per minute, uncomplicated and repetitive rhythms, a consistent dynamic range that is moderate in volume, no more than five instruments in ensemble works, and is instrumental rather than songs with lyrics. The mechanism of these parameters has the capacity to

¹ For the purpose of our study, the term "women" refers to a person with a womb who is seeking to carry a child to term.

decrease sympathetic arousal and induce relaxation [30]. In addition, preferred music that is also familiar to a person is most effective for relaxation [41]. This can be seen as an association between internal locus of control and positive outcomes for recovery, health, and well-being [30], as related to the current medical context.

Using music with gynaecology and fertility procedures

Scant evidence exists about the use of music to address anxiety for patients undergoing gynaecological and fertility treatments; likewise, evidence about music and pre-procedural anxiety is limited. Only two studies were found to specifically examine the efficacy of music listening on anxiety before gynaecological procedures [7, 9] and none were found for fertility treatments. Both studies demonstrated a significant reduction in anxiety scores after 20 min of music listening before gynaecological surgery in hospital settings. Other studies have included an examination of the effects of music listening on anxiety prior to gynaecological procedures [31, 42] and embryo transfers in the context of IVF treatments [26], but despite clear clinical advantages these studies did not find significant research results. Further, findings on the efficacy of music in seeking to reduce intra-procedural anxiety present conflicting results, since the studies demonstrated that music listening reduced anxiety [16, 29] or had no significant effect [13, 14, 43, 44]. Despite debate existing around the efficacy of music listening on reducing anxiety before and during gynaecological and fertility procedures, music listening is seen as improving patient satisfaction [3, 27, 43].

Substantial variations occur around the type of music used in this context. Although most existing studies have used predetermined music which was selected according to musical parameters suggested for music to be 'relaxing, literature suggests that self-selected music involving choice by the person concerned is the most effective for addressing anxiety [5, 30, 42, 43]. Some studies have incorporated personal choice into their methodologies [37, 45]. However, in comparing self-selected preferred music with predetermined music compilations (MUSIC CARE), Reynaud and colleagues [7] found no significance difference in effectiveness. MUSIC CARE is an application consisting of music created from collaboration between musicians, scientists, and music therapists that are compiled into playlists lasting 20-minutes and according to principles of hypnotherapy [46]. In their intervention group, self-selected preferred musical playlists were created by participants prior to hospitalization. However, this was surprisingly no more effective than the predetermined playlists, a result which can be explained by the lack of education given to participants about selecting music with known musical elements conducive to relaxation, where the "favourites" chosen were not necessarily of a relaxing music character.

Non-pharmacological methods to assist with reducing anxiety related to gynaecological and fertility procedures have been of increasing interest in order to support positive outcomes and patient satisfaction with this cohort. Benefits of non-pharmacological approaches to management of anxiety include the ease of use [5, 47] absence of side effects [7, 30], and cost-effectiveness [48]. Since patients are known to typically have varying profiles of anxiety [6] and unique emotional and spiritual needs [11], music is also seen as a highly adaptable intervention which can accommodate varying profiles of anxiety [6] and the unique emotional and spiritual needs [11] of patients to obtain maximum satisfaction and clinical effectiveness. Taken together, our extensive literature review combines clinical research and theoretical evidence to suggest that music is an effective intervention for addressing pre-procedural anxiety related to gynaecological and fertility procedures. Our current study is the first to examine the efficacy of music to reduce preprocedural anxiety in gynaecological and fertility treatment settings in Australia, hypothesizing that listening to music will reduce pre-procedural anxiety for these women.

Method

Our mixed methods study with a primary outcome of validated anxiety measures was implemented with patients attending a scheduled appointment with a one gynaecologist/ fertility specialist in Sydney, Australia. This occurred in the treatment setting in an office appointment or day surgery where participants were provided with music before their procedure, and all recruits completed questionnaires to measure anxiety before and after the music intervention. Additionally, all participants completed project-specific questionnaires before and after their procedure. Ethics approval for this study was obtained through Western Sydney University and Genea Australia (Clinical Trial Number: H13273), and informed written consent was obtained from all participants prior to their procedure.

Participants

Inclusion criteria were all patients of the medical specialist attending a scheduled appointment who were over the age of 18 and had a good command of English. Patients were excluded if they had: (a) severe hearing loss or speech impairment, (b) severe cognitive impairment, (c) severe mental health diagnosis, (d) pregnancy, and (e) poor command of written and spoken English. Patients were recruited through the medical specialist during a consultation prior to their scheduled gynaecology or fertility procedure, as an arms-length recruitment process.

Materials

Questionnaires

The primary outcome measure of this study was the State Trait Anxiety Inventory Short Form (STAI-6) to measure state anxiety. The STAI is a standardised tool for measuring anxiety in research and the short form has been validated for use where with a reliability coefficient of (Cronbach's alpha) a = 0.82 [49] The total score acquired from the STAI-6 typically ranges between 20 and 80, where a higher score corresponds with higher anxiety. The STAI-6 was chosen to accommodate time constraints in day surgery and fertility clinic settings. Participants completed the STAI validated assessment tool both before and after the music intervention.

All participants completed project-specific pre-procedural and post-procedural questionnaires encompassing both qualitative and quantitative data which could be analysed within this mixed method study. The pre-procedural questionnaire collected information about age and medication through short-answer response. Participants indicated the type of procedure they were attending and what aspects of the procedure worried them by selecting from options provided or providing a short-answer response. A 10-point and 5-point Likert scale was used in the questionnaire to assess anticipated pain and level of worry about the procedure, respectively. A 5-point Likert scale was additionally used to collect information on frequency of everyday music listening and personal use of music to address feelings, anxiety, and relaxation. Participants selected preferred genres of music for everyday listening and for relaxation by selecting from options provided, with opportunity to list their three favourite pieces of music using short-answer response. The postprocedural follow-up questionnaire reflected on participant experiences of how painful the procedure was and of experiences of the music intervention in terms of assisting with relaxation and reducing anxieties about the procedure, using a 10-point and 5-point Likert scale, respectively Participants were additionally asked whether they would recommend music listening before a procedure to a friend by selecting true or false, and were asked to provide a long-answer explanation for their choice. Finally, participants were asked to describe the music they selected for their procedure, including the genres, artists and names of songs, and share further comments about the use of music before their procedure through long-answer response.

Music and music equipment

For the intervention in this study, a digital application called 'Music Star' available on iPad was selected [46]. The 'Music Star' is designed by professional music therapists in Denmark and enables participants to self-select music from 14 genre options within a colour-coded process on a specialised iPad application (see Fig. 1). This application was developed to promote use of music as "a 'friend' accompanying [patients] through the hospital stay" (46 p.58), assisting with coping and maintaining

The Music Star (Lund et al., 2016).

). Labelled Music Star guide, from current study







emotional well-being. The Music Star has been previously used in mental health research with patients in the psychiatric ward of Aalborg University Hospital, Denmark, and also to reduce the negative symptoms of schizophrenia [50] and to improve sleep quality related to depression [51, 52]. The 'Music Star' orders playlists according to musical complexity via a colour-coded "Star" graphic; playlists consist of instrumental music, Jack Johnson, electronic music, and nature sounds. Playlists were created according to theoretical and empirical research in music medicine and music therapy by music therapists [46, 53]. In the current study, participants were provided with the Music Star iPad, headphones, and a printed diagram of the Star with simple text labels to suggest the type of music within each element of the star graphic.

Procedure

Patients were screened for study eligibility and recruited during attendance for treatment with the medical specialist, where they were provided with flyers and additional information. Eligible participants then gave informed consent and completed the project-specific questionnaires. The STAI-6 was administered by a research assistant before and after the music intervention at the day surgery and by the medical specialist in the office and fertility clinic settings. Questions in the project-specific post-procedural questionnaire were answered by participants during a standard follow-up phone call.

Data analysis

Quantitative data were analysed in the Statistical Package for Social Science (SPSS) version 28 [54]. Any incomplete surveys were excluded due to missing data. Dependent t-tests were used to assess any differences in pre and post surveys and Spearman's correlations were used to assess any associations or relationships between variables. Qualitative data were coded, categorised and grouped, in line with standard thematic analysis processes [55].

Results

A total of 91 patients of the medical specialist were invited to participate in this study. While 44 participants engaged in research activity, only 41 sets of data were complete with three participants being excluded due to missing data. Some initially interested patients dropped out of the study when they opted for the public health system instead of their procedure being performed by

Table 1 STAI scores

	Pre-intervention	Post-intervention	Difference
Median	45.45	33.25	12.20
SD	10.56	8.80	1.76
Range	20.00-63.33	20.00-50.00	0-13.33

a the medical specialist involved in this project. Of the 44 participants, 23 were day surgery patients, 3 were office procedure patients, and 15 were fertility treatment patients. Study participants ranged between the age of 18-72 and the mean age was 35.61 years (SD = 9.50).

Pre-procedural information

Participants reported attending a scheduled appointment for intrauterine device (IUD) insertion (26%), hysteroscopy (22%), egg retrieval (15%), embryo transfer (11%), pap smear (9%), intrauterine insemination (IUI) (7%), polypectomy (7%), and IUD removal (4%). Of the 41 participants, five (12%) attended a scheduled appointment for more than one procedure and five had taken pre-procedural pharmacological anxiolytics. Prior to their procedure, the majority of participants (83%) reported being worried, with more than half being slightly worried (56%) and almost a quarter being worried (22%), and a small amount reporting being very worried (5%). Less than one-fifth were not worried at all (17%). Factors reported as causing concern for participants were pain/discomfort (35%), uncertainty (25%), invasion of body (15%), loss of control (10%), past experiences (6%), after-care (5%), and undressing (2%).

Effect on music on anxiety

Immediately prior to the music intervention, baseline STAI scores ranged from 20 to 63.33 with a mean score of 45.45 (SD = 10.56), signifying high anxiety². In contrast, post-intervention STAI scores ranged from 20 to 50 with a mean score of 33.25 (SD = 8.80), signifying low anxiety, as noted in Table 1. From this, it is clear that there was a higher level of anxiety in the pre-music intervention in comparison to the post-music intervention (t (41) = 9.1, p < .001. On average, participants appeared to have experienced significantly greater anxiety before music intervention (M = 44.96, SE = 1.6), than to post scores after music intervention (M = 33.25, SE = 1.33, (t (41) = 9.1, p < .001, r = .82). This is a highly significant finding p < .001 and the effect size is large (r = .82) and so represents a substantive finding. Therefore, our primary outcome measure of the STAI strongly suggests a significant relationship between and reducing anxiety for women awaiting gynaecological and fertility procedures.

Music intervention

In the post-intervention questionnaire, participants were asked to report on the effect that music had on relaxing before the procedure, and on forgetting about their worries. Of the 41 participants, 37 agreed or strongly agreed that the music helped them relax before the procedure,

² Within the STAI Scale: "no or low anxiety" (20–37), "moderate anxiety" (38–44), and "high anxiety" (45–80).



Fig. 2 General preferred music compared to preferred music for relaxation

Table 2	Spearman's	correlations	hetween	music and	relaxation
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Spearman's Rho	Daily life listen to music	When anxious listen to music	Listening to music helps me to relax		
Daily life listen to music	1.000	0.817*	0.504*		
When anxious listen to music	0.817*	1.000	0.741*		
Listening to music helps me to relax	0.504*	0.741*	1.000		

*All values p < .01, 2-tailed

whilst four were neutral. The majority of the participants (75%) agreed or strongly agreed that the music helped them forget about their worries; however, just over a quarter were neutral and two participants strongly disagreed. All participants (100%) reported that they would recommend listening to music before a procedure to a friend.

Music for relaxation

The personal context of music typically used by each of the women was explored in both pre-intervention and post-intervention questionnaires. The majority of our respondents indicated that they deliberately listened to music when they felt anxious: sometimes, most of the time or all of the time (88%). Conversely, only five participants reported that they would rarely use music for this purpose. The majority of participants also reported that music helped them relax: sometimes, most of the time or all of the time (95%), with only two participants reporting that this was rarely the case for them.

Preprocedural information gained prior to the music intervention indicated that women had a general preference of pop music (19%), followed by hip hop/ rhythm&blues (14%), classical (11%) and rock (10%). However, when choosing music for relaxation in our study, women reported a preference for classical music³ (23%), followed by other (14%) followed by pop (12%). 'Other' was identified by participants as "meditation" and "spa music" as well as other types of music described as 'chill out session' and 'old time'. These results suggested changes in preference related to understanding of the role of the music; these differences are depicted in Fig. 2.

Participant uses of music

To explore associations or relationships between music and relaxation, Spearman's correlation coefficients were calculated (n = 41). All correlations were viewed and those associations with the highest correlations, that is, those with an rho value of more than 0.40, and those that were statistically significant (p < .01, two-tailed) were deemed as the most important for women experiencing relaxation with music. We were interested in associations between listening to music in everyday life, listening to music when anxious, and perceptions of music helping with relaxation. Table 2 demonstrates these associations.

We found that listening to music when anxious was positively associated with listening to music in daily life (r=.817, p<.01, 95%CI – 0.675-0.901). Not only this, but listening to music helping participants to relax was

³ For clarification, the term 'classical' (small-c) music refers to Western art music and is distinct from music specifically from the 18th century known as 'Classical music' (big-C) [56].

Table 3 Spearman's correlations between music and forgetting worries prior to surgery

Spearman's Rho	Music helped me relax pre procedure	Music helped me forget my worries
Music helped me relax pre procedure	1.000	0.539
Music helped me forget my worries	0.539	1.000
xall 1 01.0 11.1		

*All values *p* < .01, 2-tailed

positively associated with listening to music in daily life (r = .504, p < .01, 95%CI – 0.223-0.707). If the person was anxious and listened to music, this was positively associated with relaxation when listening to music (r = .741, p < .01, 95%CI – 0.555-0.856).

Spearman's correlation coefficients were also calculated for 41 women to allow certain associations or relationships between music and helping women to forget their anxieties as well as prior to surgery, as demonstrated in Table 3. Music helping them to relax pre procedure was positively associated with listening to music helping to forget their worries (r=.539, p<.01, 95%CI - 0.268-0.730).

Understanding the role of music with pre-procedural anxiety

Thematic analysis of the qualitative data suggested a role for music as both distraction and focus, assisting with calming and relaxation, and should be used as much or as long as possible before procedures. Participants expressed a mostly positive emotional view of the use of music, with examples responses as follows:

- "It was distracting, calming and pleasant." (day surgery).
- "Music is an important distraction and it takes you places." (day surgery).
- "It helps slow the brain and stop over-thinking." (fertility clinic).
- "Soundscapes are particularly good as they can transport you to another place and help slow breathing." (fertility clinic).

Additionally, the effects of music with nature sounds involving water led to reports of further distress with a woman having a full bladder (needed for ultrasound diagnostics) and was reported to increase anxiety for this woman. Therefore, the medical specialist noted that music containing sounds suggesting water must be used with caution in circumstances were patients have a full bladder.

Discussion

This study aimed to investigate the capacity of music to reduce pre-procedural anxiety for patients undergoing gynaecological and fertility treatments in Australia. In particular, the study examined the prevalence of anxiety, contributing factors, and the effectiveness of music on addressing anxiety as indicated by self-report and validated evaluation measures. Our findings showed significantly lower pre-procedural anxiety following music intervention, suggesting a relationship between anxiety and music listening in this clinical setting. This was demonstrated by a reduction in anxiety levels from 'high' to 'no/low' anxiety based on mean STAI scores after the music intervention. Not only this, but study participants saw music as an acceptable intervention, as indicated by 100% of participants who would recommend listening to music to a friend in order to address pre-procedural anxiety. The distracting and focusing nature of music which can take a person's attention out of the current environment and at the same time influence the calming of physiological measures such as breathing were well noted by qualitative data responses.

Both the quantitative and qualitative findings demonstrate the benefits of using music therapeutically to reduce anxiety in daily life and prior to experiencing fertility and gynaecological procedures. In particular, women's anxiety levels were significantly reduced post procedure following the intervention of music therapy in comparison to their anxiety levels pre procedure. We suggest that the therapeutic use of music is a safe nonpharmacological technique that can promote relaxation for women in both in their daily lives and when experiencing medical procedures such as those relating to gynaecology and fertility treatment. Many of the women reported already spontaneously using music for relaxation and reduction of their anxieties during fertility-related procedures, and more could be done with education about the breadth of techniques they could use, to help themselves using music.

Clearly, more research is needed in this area. Only two other studies in recent years have examined the positive effect of music in reduction of anxiety levels prior to gynaecological procedures [7, 9], both from the USA. Our study adds to this small body of work with our study taking place in Australia to further justify the importance of incorporating music both into everyday life and surrounding the experience of medical procedures. Our study also found that when women are anxious, this is negatively associated with listening to music, which resonates with women finding solace in listening to music and forgetting their anxieties. This aligns with the findings of other studies, showing that the simple act of listening to music decreases anxiety [57, 58]. One study found that women experienced higher levels of anxiety than men, which further supports the importance of music for women undergoing medical procedures, but they also found no differences in levels of anxiety when listening to music, which contrasts with the significant results of our current study [59]. An interesting finding of our study is that although pre-procedural anxiety in gynaecological and fertility settings is well-documented, researchers in this study were still surprised at the very high levels of anxiety in patients prior to procedures, as determined by baseline STAI scores. Our study strengthens and extends existing knowledge about factors that induce pre-procedural anxiety for women, including perceptions of invasion of body and loss of control.

The element of choice is essential for both patient satisfaction and for the use of music for relaxation. Using selfselected music via a music therapist developed digital application (the Music Star) is unique. No other studies that examined the use of music in gynaecological and fertility settings engaged with music therapists; in contrast 'music experts' [9] and a 'musicologist' [26] select music for studies, with other studies providing no information about how they selected the music used. One study also used MUSIC CARE [7].

We note the inherent challenges with naming musical genres, for example the colloquial term "classical" to refer to Western art music – bearing in mind that there are classical musical traditions within many cultures and societies such as those stemming from India and China. Likewise, the definition of "ambient" music can be interpreted as referring to gentle and slow electronic music with no distinct beat or sounds from nature such as whale sounds. As noted earlier, any music and nature sounds that involve water must be used with caution in circumstances were patients have full bladders, such as before procedures requiring ultrasound scanning.

Innovations, strengths and limitations

Our study is the first published evidence to examine the relationship of music listening as an intervention to reduce anxiety before gynaecological and fertility procedures. By focusing on broad-based gynaecological and fertility procedures, we have found that using music showed a strong relationship to reducing anxiety independent of the specific procedure undergone by the women.

Although our sample size was considerable (N=41), it was not large, and each person served as their own control rather than a formal control group. Additionally, the amount of time that participants listened to the music varied between participants, due to systems and processes in relation to the nature of waiting in day surgery. The effects of each woman potentially having multiple procedures across a considerable period of time (weeks/ months/years) is not accounted for in our study and may have influenced the reported experiences of women. Also, the participants of this study underwent procedures of varying grades of complications creating heterogeneity of treatment effects that were not evaluated within the scope of this study. Thus, future studies will benefit from additional statistical analysis to identify which clinical cases would most benefit from music intervention within this context [60]. The type and style of music used via the Music Star was ostensibly "Western" in nature which may have been a factor for participants from culturally and linguistically diverse communities. However, we note that Reynaud and colleagues [7] did not find significant differences between participants who had culturally appropriate songs on their playlists versus those who did not. Future studies may also choose to include biomarkers of stress/anxiety, patient satisfaction questionnaires, and noise-cancelling headphones. Variations existed about how long before and after the pre and post questionnaires were administered, and the participants' feelings may have changed during antecedent and subsequent time periods for a range of factors, including influences of memory and prior experiences.

Unlike many studies, we sought to understand the role of music in the life of each woman, and to factor in personal choice and preferences, the latter of which are known to influence the relaxation response. The relationships found within the statistical analyses provide interesting detail about associations between music choices and the purpose of music in reducing anxiety and supporting relaxation, suggesting that supporting women with reflecting on their music choices for anxiety management via relevant experiences and educational initiatives may be a fertile area for future development.

Final thoughts

This project forms stage one of a three-phase approach to meeting the needs of women undergoing gynaecological and fertility treatments, by using music to address anxiety and promote relaxation. This study has identified and explored the nature of experiences of the women and their existing use of music, noting that experiences and education may even further enhance self-empowerment strategies by women in order to reduce anxiety using music as planned for the next phase of this overarching study aimed at women during this complex treatment phase of their life.

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Author contributions

AS, NA & GC contributed to the conception, design, and data acquisition of this study. AS, NA, GC and VS contributed to analysis, interpretation, drafting and revisions of the work. All authors approved the submitted version and agreed to be accountable for ensuring the integrity and accuracy of the work.

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Data availability

All data generated or analysed during this study are included in this published article.

Declarations

Ethics approval and consent to participate

Together with my colleagues Dr Natasha Andreadis, Ms Geena Cheung, and Associate Professor Virginia Stulz, we confirm that Ethical Approval was granted for the Study as a scientific research study. This Ethical Approval was granted by the Human Research Ethics Committee of Western Sydney University, with the approval number of H13273 on 6 June, 2019.

Consent for publication

Consent for publication was given as per the Human Research Ethics approval and consent process.

Competing interests

The authors declare no competing interests.

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