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Fancourt D & Perkins R (in press), Does attending community music interventions lead to changes in wider musical behaviours? The effect of mother-infant singing classes on musical behaviours amongst mothers with symptoms of postnatal depression, *Psychology of Music*.

Abstract

There is a growing body of research exploring how music interventions impact on wider behaviours in people's lives, such as anti-social behaviours, classroom behaviours and consumer behaviours. However, an understudied area is whether engagement in structured music programmes leads to wider changes in musical behaviours amongst participants. This study explored this question in relation to women with symptoms of postnatal depression (PND). Ninety-three women up to 40 weeks post-birth with symptoms of PND were randomised to 10 weeks of group singing classes or usual care. Women who attended the singing workshops had a significantly greater increase than those in the control group in the frequency of their singing, their confidence in singing and the repertoire they knew. There were also indications that the partners of women in the singing group also increased their frequency of singing, suggesting effects can extend to the wider family unit. However, there was no impact on wider musical behaviours such as listening to music. This is the first demonstration that weekly singing programmes can alter musical behaviours in new mothers. Analyses explore the optimum number of singing classes required to trigger a wider behaviour change and health psychology theories around behaviour change that could account for these results are discussed.

Keywords

behaviour change, health psychology, mental health, mother–infant, postnatal depression, singing

Over the last two decades, there has been a growing body of literature showing how engagement in music interventions can lead to changes in wider behaviours in people's lives. For example, activities such as learning an instrument, listening to background music and attending festivals have been associated with changes in antisocial behaviours amongst young offenders (Daykin, de Viggiani, Pilkington, & Moriarty, 2013), agitated behaviours amongst dementia patients (Lou, 2001; Sung & Chang, 2005), consumer behaviours (North & Hargreaves, 2011), drug-taking behaviours (Hesse, Tutenges, & Schlieve, 2010), exercise and physical activity behaviours (Clark, Baker, & Taylor, 2016), gambling behaviours (Dixon, Trigg, & Griffiths, 2007; Spenny, Barrett, & Griffiths, 2010) and classroom behaviours (Hallam & Price, 1998). However, a question that remains under-explored is whether engagement in music interventions leads to wider changes in other *musical* behaviours. In other words, if people take part in a specific music intervention, such as community music workshops, does this lead to increased musical engagement outside of the workshop sessions? This is an important question given that much funding for community music interventions is fixed-term and for a relatively small period of time, such as 1 hour per week. Therefore it is relevant to ascertain whether a short intervention can essentially act as a catalyst for other musical engagement, and so have a wider effect on people's lives.

Although research into the impact of community music interventions on musical behaviours is thin, there is research looking at predictors of musical engagement. For example, it has been identified that a predictor of musical sophistication (referring to musical skills, expertise, achievements and also behaviours) is both previous musical training and current active engagement in music (Müllensiefen, Gingras, Musil, & Stewart, 2014). It has also been shown that musical training for caregivers can lead to increased musical engagement between them and the person they care for, as well as leading to greater non-musical engagement, suggesting a wider effect on behaviours (Clair, 2002). However, other studies have shown less of an indication that musical behaviours can be changed. For example, Clair, Mathews, and Kosloski (2005) showed that patients with dementia did not change their levels of musical engagement over an 8-week intervention. Consequently, although there is some promising initial evidence that engaging in music interventions could lead to wider changes in musical behaviours, this remains to be explored further.

In order to provide some more empirical data, this article focuses on a specific population: mothers with young infants. Previous research has provided insight into the musical activities that mothers engage with; for example, a recent study showed that 59% of mothers in the first 9 months post-birth sing to their babies on a daily basis, and 71% listen to music on a daily basis, but only 22% of

mothers attend regular music classes with their babies (Fancourt & Perkins, 2017a). This research has also suggested specific *musical* predictors of musical behaviours in mothers. For example, women with past musical experience were more likely to listen to music daily and sing to their babies on a daily basis. Particularly interestingly, mothers who were attending baby music classes were 65% more likely to sing to their babies on a daily basis. This suggests that community baby music workshops might lead to changes in musical behaviours outside of the sessions. However, these results are correlational and the hypothesis that community music workshops could lead to changes in wider musical behaviours remains untested in an experimental setting.

There are a number of reasons why increasing musical behaviours in mothers of young infants could be a valuable pursuit. There is a wide body of literature showing the benefits of musical engagement, including attending concerts, making music and listening to music, on a range of outcomes in different populations, including stress and anxiety, mental health and even mortality (Bygren, Konlaan, & Johansson, 1996; Coulton, Clift, Skingley, & Rodriguez, 2015; Fancourt, Perkins, Ascenso, Atkins, et al., 2016; Fancourt, Perkins, Ascenso, Carvalho, et al., 2016; Koelsch et al., 2011). There is also more specific research focused on mothers and music. First, in relation to singing specifically, theories suggest that singing to babies could support mother–infant bonding. Evolutionary theories suggest that singing may have evolved from “motherese” (Falk, 2004; Malloch & Trevarthen, 2010) (a type of speech directed by mothers to their infants; Dissanayake, 2004) as a way of supporting mother–infant interactions (Bouissac, 2004). In support of this, infants of varying ages and at different stages of development have been shown to focus attention for longer when listening to motherese than standard talking (Fernald, 1985; Kitamura, Guellai, & Kim, 2014; Pegg, Werker, & McLeod, 1992; Santarcangelo & Dyer, 1988). Second, it could be beneficial to increase musical behaviours in mothers as singing has been shown to support language development in new babies. For example, maternal vocalisations have been found to encourage early infant vocalisations (Pelaez, Virués-Ortega, & Gewirtz, 2011). Third, new research has suggested that singing to babies is associated with lower symptoms of postnatal depression (PND) in mothers; a condition affecting around 13% of mothers (Fancourt & Perkins, 2017b). This builds on previous research showing how women with PND demonstrate less spontaneous and more restrained mother–infant interaction behaviours (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986), flatter, duller and slower prosody, and less modification of motherese in response to infant behaviour (Bettes, 1988). It is also important given that PND is not only a debilitating condition for mothers (Morrell et al., 2009), but is also associated with poorer psychological and behavioural development in their infants (Cooper & Murray, 1998; Harris,

Huckle, Thomas, Johns, & Fung, 1989). Thus, increasing musical behaviours in mothers could have benefits both for them and for their infants.

Consequently, this study had three main aims: (a) to investigate whether community singing workshops for mothers with young infants could lead to changes in singing behaviours outside of the workshops; (b) to test whether community singing workshops could also lead to changes in other musical behaviours besides singing; (c) to ascertain the “dose” of singing workshops required for behavioural change to occur, or in other words, how many singing workshops women need to attend before there is a significant change, if any, in their musical behaviours. Given the particular importance of singing for women experiencing symptoms of PND, as high-lighted above, we drew specifically on this population of mothers.

Methods

Design and participants

Participants were part of a larger study exploring the impact of creative interventions (including group singing and group play compared with a non-intervention group) on mental health in mothers of young infants (Fancourt & Perkins, in press a). However, this study formed a distinct research question focusing specifically on musical behaviours rather than mental health outcomes. Consequently, we focused on a subset of women from the larger study: those who were randomised into receiving either 10 weeks of weekly singing workshops or 10 weeks of usual care (control; no active intervention) ($n = 93$). Randomisation was carried out using a 1:1 allocation using random block sizes of 6, stratified by age of infant and severity of PND symptoms as measured on the Edinburgh Postnatal Depression Scale (EPDS). To meet eligibility criteria, women had to be no more than 40 weeks post-birth and had to display symptoms of PND, indicated by a score of 10 or higher on EPDS when screened at baseline for eligibility. Women were excluded if a healthcare professional advised that the intervention was not suitable for them, if they did not or could not provide informed consent or if they lived outside the Greater London area so were unable to attend the workshops. Women were recruited through midwives, doctors, perinatal psychiatrists, health visitors and GPs in the Greater London area, as well as through social media, leaflets and by a research assistant in children’s centres and in the local community. All participants were provided with participant information sheets and provided informed consent. The study received ethical approval from the NHS Research Ethics Committee.

Participants were 93 women experiencing symptoms of PND. Overall, women were aged 22 to 46 with an average age of 34.8 years ($SD = 4.0$) and were majority white and married. For 89% of participants, this was their first child. Groups were well matched on all demographic variables (see Table 1).

Table 1: Participant characteristics

	Singing n=49	Control n=44	Test statistic
Age of mother (years), $\mu \pm SD$	35.0 \pm 4.4	34.6 \pm 3.4	$F_{1,91}=0.21, p=.65$
Age of infant (weeks), $\mu \pm SD$	19.8 \pm 9.0	18.4 \pm 9.1	$F_{1,91}=0.51, p=.48$
Marital status, % married	67.3%	77.3%	$X^2(1)=1.13, p=.29$
Previous children, % yes	10.6%	11.4%	$X^2(1)=.012, p=.91$
Educational attainment, %			$Z=-.09, p=.93$
School	12.2%	4.5%	
Undergraduate degree	34.7%	45.5%	
Postgraduate degree	53.1%	50.0%	
Household income, %			$Z=-.66, p=.51$
<£30,000	10.9%	11.6%	
£31,000-£60,000	23.9%	16.3%	
£61,000-£90,000	28.3%	30.2%	
£91,000-£120,000	21.7%	20.9%	
>£120,000	15.2%	20.9%	
Ethnicity, %			$X^2(3)=3.95, p=.27$
White	72.9%	88.9%	
Asian/Asian British	10.4%	2.8%	
Black/African/Caribbean/Black British	2.1%	2.8%	
Other	14.6%	5.6%	
PND at baseline (EPDS score), $\mu \pm SD$	14.2 \pm 4.0	13.1 \pm 2.9	$F_{1,91}=2.41, p=.12$

Intervention

Participants randomised to the singing workshops received free 60-minute workshops for them and their infant once a week on a weekday afternoon for 10 weeks. Classes involved 8–12 mothers together, so the 10-week block was offered multiple times over a 6-month period to recruit the total number of women. Two professional music workshop leaders with experience leading community singing workshops for mothers and infants were recruited and the 10-week blocks of classes were split between them so that mothers consistently had the same music leader across their 10 sessions. Sessions involved learning songs ranging from short vocal exercises that used motherese style noises, to simple lullabies that could be sung in simple harmonies or rounds, to longer or more complex songs. Simple songs were learnt quickly and often repeated in subsequent weeks whereas more complex songs were learnt gradually over the weeks. Songs were deliberately sourced from a range of languages and cultural backgrounds. Songs were a mix of relaxing in style, with mothers encouraged to hug or stroke their babies as they sang, to energetic, with mothers standing and moving with their babies. Some songs were accompanied by hand chimes, shakers, drums and other simple instruments that the mothers and babies could play together and also a combination of guitar and ukulele was used for a small number of songs. Mothers also worked to write some of their own songs over the weeks, developing lyrics together on the subject of their babies and creating simple melodies. However, no previous musical experience was necessary for

participation. Recordings of the group singing the songs together were made and uploaded to private online platforms for the mothers to listen to at home. Participants randomised into the usual care group did not receive any active music workshops for the 10 weeks, but following the end of their research involvement they were offered a 10-week singing programme (a wait-list control).

Measures

We analysed data from anonymous questionnaires completed online in participants' own homes at baseline and week 10, focusing on two specific topics: singing habits and other musical behaviours. Regarding singing habits, we had 4 specific measures: how often women sang to their babies (daily vs. less frequently), their confidence in singing (rated on a Likert-type scale from 1 = *not at all* to 5 = *very*); whether the music was sung more for them or more for their infant (3-point scale: *more for them*, *50:50*, *more for their infant*) and if they felt they knew enough suitable songs to sing to their infant (4-point scale: *hardly any*, *yes a few*, *quite a lot*, *plenty*). Regarding other musical behaviours, we had 3 specific measures: how often women listened to music (rarely, a couple of times a week, daily <1hr, daily 1–2hrs, daily 3–5hrs, daily 5+hrs), whether they had attended a concert in the past month, and how much their partner (if applicable) sang to the infant (4-point scale: *not at all*, *a bit*, *quite a lot*, *very much*). These measures on wider musical behaviours were based on the questions asked as part of the previous study on musical engagement in mothers with young infants involving a separate sample of women (Fancourt & Perkins, 2017a). However, we chose to omit questions on how often mothers made music (such as playing an instrument) due to the very low levels of such engagement reported in the previous study. Further, we added in an additional question on partners' singing as this was hypothesised to be associated with maternal singing. Further demographic questions assessed age of mother and infant, marital status, educational attainment, ethnicity, household income and whether the mother had any previous children.

Analysis

Data were analysed using IBM SPSS version 23.0 (SPSS, Chicago IL). To ascertain whether there were baseline differences between the two groups, between-group comparisons were made using one-way analyses of variance (ANOVAs) for linear data, Mann-Whitney U Test for ordinal data and chi-squared test for categorical data. To explore whether behaviours changed over the 10 weeks, change scores were calculated (the difference between the response at week 10 compared to baseline) and the same statistical tests were conducted as for baseline comparisons.

Naturally, some women attended more sessions out of the 10-week programme than others. In order to compare how the number of workshops attended by mothers in the singing group over the course of the 10-week intervention affected responses, three levels of sensitivity were applied during analyses: Level 1 = any number of classes from 1–10 ($n = 49$ in the singing group); Level 2 = 5 or more classes attended ($n = 42$ in the singing group); Level 3 = 8 or more classes attended ($n = 32$ in the singing group). These sensitivity analyses were designed to ascertain whether any engagement with music classes would lead to changes in musical behaviours, or whether a certain number of classes had to be attended before there would be significant changes in musical behaviours outside of the class.

Results

Singing behaviours

Daily singing. We first explored whether women were more likely to sing to their infant on a daily basis following participation in the workshops compared to at the start of the project. At baseline, singing and control groups were not significantly different: 55.1% of the singing group and 61.4% of the control group reporting singing to their babies on a daily basis ($Z = -0.61, p = .54$). When exploring how behaviours changed over the 10 weeks, applying sensitivity level 1 (including all women in the singing group, regardless of how many classes they attended), there was an indication that more women in the singing group were singing on a daily basis after 10 weeks (77.6%) compared to the control group (63.6%). However, this did not reach significance ($Z = -1.77, p = .076$). When applying level 2 (comparing the control group with women who had attended 5 or more singing classes), this result became significant ($Z = -2.20, p = .028$), with 81.0% of women in the singing group singing on a daily basis compared to 63.6% in the control group. Interestingly, when applying level 3 (8 or more classes attended) this result remained significant ($Z = -2.00, p = .045$) but there was no indication that it led to a greater number of women increasing their singing habits, with a similar 81.3% reporting singing on a daily basis.

Singing confidence. Second, we explored whether women were more likely to feel more confident when singing to their babies following participation in the workshops compared to at the start of the project. At baseline, there was a chance difference between singing and control groups ($Z = -2.39, p = .017$). However, this was weighted such that participants in the control group reported feeling more confident than participants in the singing group: 68.3% of the control group vs. 41.3% of the singing group reporting 4/5 or 5/5 confidence (indicating a high level of confidence). However, at week 10 there was no increase in the number of people reporting high levels of confidence in the control group (65.9%), whereas the number of people reporting high levels of

confidence in the singing group significantly increased in comparison, reaching 80.9% at week 10 using sensitivity level 1 ($Z = -3.86, p < .001$), 85% using sensitivity level 2 ($Z = -3.90, p < .001$), and 86.7% using sensitivity level 3 ($Z = -3.63, p < .001$).

Repertoire knowledge. As a third measure of musical behaviours, we asked mothers whether they felt they knew enough songs to sing to their infant. At baseline, there was a chance difference between singing and control groups ($Z = -3.18, p = .001$). However, as with singing confidence, this was weighted such that participants in the control group reported knowing more songs than the participants in the singing group: 27.3% of the control group vs. 16.3% of the singing group reporting that they knew “quite a lot” or “plenty” of songs. By week 10 there was only a small increase in the number of participants in the control group reporting knowing “quite a lot” or “plenty” of songs (47.7%), whereas the number of such people in the singing group significantly increased in comparison, reaching 61.2% using sensitivity level 1 ($Z = -3.69, p < .001$), 66.7% using sensitivity level 2 ($Z = -4.03, p < .001$), and 68.8% using sensitivity level 3 ($Z = -3.80, p < .001$).

Focal point of singing. Finally, we asked mothers whether they sang music that was more for their own benefit, more for their infant’s benefit or a 50:50 split. At baseline, there was no significant difference between groups ($Z = -0.12, p = .90$), with 65.3% of mothers in the singing group and 65.9% of mothers in the control group singing more for their infant, and only 4.1% of the mothers in the singing group and 2.3% of the mothers in the control group singing more for their own benefit. At week 10, these figures stayed very consistent (69.8% reporting singing for their infant in the control group compared to 71.4% of the singing group at level 1, 69% at level 2, and 75% at level 3), with no significant differences between groups at any of the three levels of sensitivity.

Other musical behaviours

Listening to music. Regarding other musical behaviours, we explored how often women listened to music. There were no baseline differences between groups ($Z = -0.88, p = .38$; 6.8% control vs. 8.2% singing = rarely, 31.8% vs. 42.9% = a couple of times per week, 27.3% vs. 18.4% = daily <1hr, 22.7% vs. 20.4% = daily 1–2hrs, 4.5% vs. 6.1% = daily 3–5hrs, 6.8% vs. 4.1% = daily +5hrs). At week 10, these figures remained very consistent, with no significant changes at any of the three levels of sensitivity.

Concert attendance. We also explored whether women had attended a concert or other music performance in the past month. At baseline, there was no significant difference between groups ($Z = -1.27, p = .21$): 44.2% of the control group and 31.3% of the singing group had attended a concert in the past month. At week

10, there was a slight decrease in the number of women attending concerts in the control group (down to 37.2%) and a slight increase amongst women in the singing group (38.3% reporting attending at sensitivity level 1, 35.0% at level 2, and 40.0% at level 3). However, this was not enough of a change as to be significant at any of the three levels of sensitivity.

Partner singing. Finally, we explored whether changes in musical behaviours extended beyond the women who took part in the project to the family unit by focusing on partners. There were no baseline differences between groups ($Z = -0.004$, $p > .99$), with 25.6% of the controls and 23.4% of the singing group reporting that their partners “never” sang to their babies, 37.2% of the controls and 44.7% of the singing group reporting that they sang “a bit”, 25.6% vs. 14.9% reporting that they sang “quite a lot”, and 11.6% vs. 17% reporting that they sang “very often”. At week 10, there was evidence that partners of women in the singing group increased the amount that they sang to their babies, with significant or near-significant statistical comparisons. At sensitivity level 1, 54.1% of the singing group compared to only 34.9% of the control group reported that their partners sang either “quite a lot” or “very often” ($Z = -1.97$, $p = .049$). At sensitivity level 2, this increased to 57.1% of the singing group ($Z = -1.84$, $p = .066$), and at sensitivity level 3 this increased to 62.5% ($Z = -1.59$, $p = .11$). However, the reduced power of the sensitivity analyses may have been a factor in the loss of significance.

Discussion

Overall, the main finding from this study is that 10-week programmes of singing workshops for mothers and their babies appear to lead to changes in singing, but not other musical behaviours. Women who had attended the singing workshops were significantly more likely, at the end of the programme, to sing to their infant on a daily basis, were significantly more confident in singing and had a significant increase in the number of songs they knew to sing to their babies compared to the control group. However, the classes did not alter the fact that most mothers sang specifically to their babies rather than for other reasons and there was no indication that women changed wider musical behaviours, such as how much they listened to music or attended concerts. Interestingly, there was an indication of a change in the amount that they reported their partners singing to their infant, suggesting that singing workshops for mothers could have implications for the musical behaviours of the wider family unit, but this remains a preliminary finding to be explored further.

Naturally, a question to emerge from this is *why* weekly singing workshops led to changes in wider singing behaviours in mothers with young infants. There is a wide body of health psychology literature devoted to how to change health behaviours, with a number of broad theoretical perspectives for how

interventions lead to modulations in behaviour. Three models in particular appear to be pertinent for this study and may offer explanations for why the classes led to changes in singing behaviours. First, learning and cognitive theories suggest that activities such as exposure, modelling of behaviours, reinforcement and associative learning can lead to behaviour change (Gibson, 2008; Pearson, Timperio, Salmon, Crawford, & Biddle, 2009; Rousset, Schlich, Chatonnier, Barthomeuf, & Droit-Volet, 2008; Wardle, Herrera, Cooke, & Gibson, 2003). Certainly, mothers in the singing group were exposed to other people singing to babies, were taught in the classes to copy a leader in singing to their infant, and had their singing praised and positively reinforced. Furthermore, as many mothers reported finding the singing sessions themselves relaxing and uplifting (Fancourt & Perkins, in press b), this may have led to learnt associations between singing and feeling happier that encouraged further singing outside of the classes.

Second, social cognition theory may also have been important in this process (Bandura, 1986). Social cognition theory suggests that expectancies, incentives and representations of one's social world motivate people to change their behaviours. As discussed in the Methods section, this study was a part of a larger project exploring the effects of creative interventions on mental health in mothers of young infants (Fancourt & Perkins, in press a). Mothers taking part in the project were aware that the classes were aimed at supporting their wellbeing. Consequently they may have expected benefits from singing and therefore sung more at home. They may also have received incentives from their infant to keep singing (such as smiling, reduced crying or sleeping). In particular, mothers were made aware that the other mothers in the group and the music leaders approved of singing and were supportive of them doing it, constituting perhaps an additional incentive to sing more regularly away from the classes.

Finally, the singing classes may have changed affect, in particular affective cognitions (leading the mothers to feel more positive towards singing; Lawton, Conner, & McEachan, 2009) and self-affirmation (whereby the mothers wanted to feel adaptively and morally adequate as mothers and saw singing as a way of achieving this; Steele, 1988). However, it is noteworthy that despite the mothers in the control group also being aware that the project was testing the effects of singing on postnatal wellbeing and despite them being interested in singing (evidenced by the fact that the "wait-list control" design employed in this study meant that many of the mothers in the control group went on to take part in taster singing workshops and a 10-week free singing programme delivered by the study team after their research data as controls had been collected), their interest alone was not enough to lead to changes in their singing behaviours. Behaviour change was only found amongst the mothers who attended the classes, suggesting that actually *doing* the singing was required for an increase in singing

outside of the classes to be found. While further work is required to confirm the role of these health psychology theories in the behaviour change noted here, they provide a potential theoretical rationale for the results found in this study.

Another key finding was in relation to the number of workshops that women needed to attend for these changes to occur. Unsurprisingly, results were strongest amongst women who had attended 8 or more classes across all singing and wider musical behaviours. However, attending more sessions only meant the difference between significant and non-significant results for the variable of daily singing, with a significant increase in the number of women who sang on a daily basis evident only when women had attended 5 sessions or more out of the 10-week course. Other changes in singing behaviours were still significant even for women who had attended fewer than half the sessions. This is an intriguing result as it suggests that relatively little exposure to singing classes can modulate singing behaviours. Results from the process evaluation of the wider study, which explores the content and delivery of the intervention in more detail, indicate that lower attendance in the singing group was rarely from women dropping out from choice, but usually because of external factors such as returning to work or moving away from the area. Indeed, only 2% of women involved in the singing groups dropped out after 1 session (Fancourt & Perkins, in press b). Furthermore, the psychological results from the wider study suggest that the main improvement in mental health was seen within the first 6 weeks, with only a marginal additional improvement in the month following this (Fancourt & Perkins, in press a). This suggests that the intention to take part in singing classes along with just a few weeks of exposure could be enough to lead to significant improvements not only in mental health but also in the frequency of singing, singing confidence and singing repertoire amongst mothers.

This study was not without limitations. We only measured effects over the 10 weeks. As such, it remains unknown whether the workshops led to sustained change in singing behaviours after the 10-week period. In addition, we relied on self-report for assessing behaviours. So it is possible that women paid more attention to their behaviours following involvement in the singing workshops, leading to an upward biasing of responses. For assessing changes in singing behaviours amongst the partners, in particular, we relied on the mothers' self-report which may not have been comprehensive.

Nevertheless, the data have important implications for practice. For example, given the evidence that weekly singing programmes can alter musical behaviours in mothers with young infants, it raises the suggestion that potential psychological benefits of community music engagement might not just be due to the sessions themselves but also due to the wider behaviours that these sessions encourage. As such, practitioners running community singing programmes for

mothers are encouraged to consider how to develop resources and activities that mothers can continue to do in their own time outside of the classes. Although the suggestion that there was greater engagement in singing from the mothers' partners too is less conclusive and remains to be explored further, the development of additional resources for the wider family may also have a value. Further research into the reach and sustainability of the behaviour change reported here and potential implications for health and wellbeing remain promising avenues for future studies.

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References

- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory* (Vol. 13). Englewood Cliffs, NJ: Prentice-Hall.
- Bettes, B. A. (1988). Maternal depression and motherese: Temporal and intonational features. *Child Development*, *59*(4), 1089–1096.
doi:10.2307/1130275
- Bouissac, P. (2004). How plausible is the motherese hypothesis? *Behavioral and Brain Sciences*, *27*(4), 506–507. doi:10.1017/S0140525X04250117
- Bygren, L. O., Konlaan, B. B., & Johansson, S. E. (1996). Attendance at cultural events, reading books or periodicals, and making music or singing in a choir as determinants for survival: Swedish interview survey of living conditions. *British Medical Journal*, *313*(7072), 1577–1580.
- Clair, A. A. (2002). The effects of music therapy on engagement in family caregiver and care receiver couples with dementia. *American Journal of Alzheimer's Disease & Other Dementias*, *17*(5), 286–290.
doi:10.1177/153331750201700505
- Clair, A. A., Mathews, R. M., & Kosloski, K. (2005). Assessment of active music participation as an indication of subsequent music making engagement for persons with midstage dementia. *American Journal of Alzheimer's Disease & Other Dementias*, *20*(1), 37–40.
doi:10.1177/153331750502000105
- Clark, I. N., Baker, F. A., & Taylor, N. F. (2016). The modulating effects of music listening on health-related exercise and physical activity in adults: A systematic review and narrative synthesis. *Nordic Journal of Music Therapy*, *25*(1), 76–104. doi:10.1080/08098131.2015.1008558
- Cohn, J. F., Matias, R., Tronick, E. Z., Connell, D., & Lyons-Ruth, K. (1986). Face-to-face interactions of depressed mothers and their infants. *New Directions for Child Development*, (34), 31–45.
- Cooper, P., & Murray, L. (1998). Postnatal depression. *British Medical Journal*, *316*(7148), 1884–1886.
- Coulton, S., Clift, S., Skingley, A., & Rodriguez, J. (2015). Effectiveness and cost-effectiveness of community singing on mental health-related quality of life of older people: Randomised controlled trial. *The British Journal of Psychiatry: The Journal of Mental Science*, *207*(3), 250–255.
- Daykin, N., de Viggiani, N., Pilkington, P., & Moriarty, Y. (2013). Music making for health, well-being and behaviour change in youth justice settings: A systematic review. *Health Promotion International*, *28*(2), 197–210.
doi:10.1093/heapro/das005

- Dissanayake, E. (2004). Motherese is but one part of a ritualized, multimodal, temporally organized, affiliative interaction. *Behavioral and Brain Sciences*, 27(4), 512–513. doi:10.1017/S0140525X0432011X
- Dixon, L., Trigg, R., & Griffiths, M. (2007). An empirical investigation of music and gambling behaviour. *International Gambling Studies*, 7(3), 315–326. doi:10.1080/14459790701601471
- Falk, D. (2004). Prelinguistic evolution in early hominins: Whence motherese? *The Behavioral and Brain Sciences*, 27(4), 491–503.
- Fancourt, D., & Perkins, R. (2017a). Maternal engagement with music up to nine months post-birth: Findings from a cross-sectional study in England. *Psychology of Music*. Advance online publication. doi:10.1177/0305735617705720
- Fancourt, D., & Perkins, R. (2017b). Associations between singing to babies and symptoms of post-natal depression, wellbeing, self-esteem and mother–infant bond. *Public Health*, 145, 149–152. doi:10.1016/j.puhe.2017.01.016
- Fancourt, D., & Perkins, R. (in press a). The effect of singing interventions on symptoms of postnatal depression: A three-arm randomised controlled trial. *British Journal of Psychiatry*.
- Fancourt, D., & Perkins, R. (in press b). Creative interventions for symptoms of postnatal depression: A process evaluation of implementation. *Arts & Health*.
- Fancourt, D., Perkins, R., Ascenso, S., Atkins, L., Kilfeather, S., Carvalho, L. A., ... Williamon, A. (2016). Group drumming modulates cytokine activity in mental health service users: A preliminary study. *Psychotherapy and Psychosomatics*, 85(1), 53–55.
- Fancourt, D., Perkins, R., Ascenso, S., Carvalho, L. A., Steptoe, A., & Williamon, A. (2016). Effects of group drumming interventions on anxiety, depression, social resilience and inflammatory immune response among mental health service users. *PLOS ONE*, 11(3), e0151136. doi:10.1371/journal.pone.0151136
- Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant Behavior and Development*, 8(2), 181–195. doi:10.1016/S0163-6383(85)80005-9
- Gibson, B. (2008). Can evaluative conditioning change attitudes toward mature brands? New Evidence from the Implicit Association Test. *Journal of Consumer Research*, 35(1), 178–188. doi:10.1086/527341
- Hallam, S., & Price, J. (1998). Research Section: Can the use of background music improve the behaviour and academic performance of children with emotional and behavioural difficulties? *British Journal of Special Education*, 25(2), 88–91. doi:10.1111/1467-8527.t01-1-00063

- Harris, B., Huckle, P., Thomas, R., Johns, S., & Fung, H. (1989). The use of rating scales to identify post-natal depression. *The British Journal of Psychiatry*, *154*(6), 813–817. doi:10.1192/bjp.154.6.813
- Hesse, M., Tutenges, S., & Schlieve, S. (2010). The use of tobacco and cannabis at an international music festival. *European Addiction Research*, *16*(4), 208–212. doi:10.1159/000317250
- Kitamura, C., Guellaï, B., & Kim, J. (2014). Motherese by eye and ear: Infants perceive visual prosody in point-line displays of talking heads. *PLOS ONE*, *9*(10), e111467. doi:10.1371/journal.pone.0111467
- Koelsch, S., Fuernetz, J., Sack, U., Bauer, K., Hohenadel, M., Wiegel, M., ... Heinke, W. (2011). Effects of music listening on cortisol levels and propofol consumption during spinal anesthesia. *Frontiers in Psychology*, *2*, 58. doi:10.3389/fpsyg.2011.00058
- Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, *28*(1), 56–65. doi:10.1037/a0013424
- Lou, M.-F. (2001). The use of music to decrease agitated behaviour of the demented elderly: The state of the science. *Scandinavian Journal of Caring Sciences*, *15*(2), 165–173.
- Malloch, S., & Trevarthen, C. (Eds.). (2010). *Communicative musicality: Exploring the basis of human companionship*. Oxford, UK: Oxford University Press.
- Morrell, C., Warner, R., Slade, P., Dixon, S., Walters, S., Paley, G., & Brugha, T. (2009). Psychological interventions for postnatal depression: Cluster randomised trial and economic evaluation. The PoNDER trial. *Health Technology Assessment*, *13*(30). doi:10.3310/hta13300
- Müllensiefen, D., Gingras, B., Musil, J., & Stewart, L. (2014). The musicality of non-musicians: An index for assessing musical sophistication in the general population. *PLOS ONE*, *9*(2), e89642. doi:10.1371/journal.pone.0089642
- North, A. C., & Hargreaves, D. J. (2011). Music and consumer behaviour. In S. Hallam, I. Cross, & M. Thaut (Eds.), *Oxford handbook of music psychology* (pp. 481–490). Oxford, UK: Oxford University Press.
- Pearson, N., Timperio, A., Salmon, J., Crawford, D., & Biddle, S. J. (2009). Family influences on children's physical activity and fruit and vegetable consumption. *International Journal of Behavioral Nutrition and Physical Activity*, *6*, 34. doi:10.1186/1479-5868-6-34
- Pegg, J. E., Werker, J. F., & McLeod, P. J. (1992). Preference for infant-directed over adult-directed speech: Evidence from 7-week-old infants. *Infant*

Behavior and Development, 15(3), 325–345. doi:10.1016/0163-6383(92)80003-D

- Pelaez, M., Virués-Ortega, J., & Gewirtz, J. L. (2011). Contingent and noncontingent reinforcement with maternal vocal imitation and motherese speech: Effects on infant vocalizations. *European Journal of Behavior Analysis*, 12(1), 277–287. doi:10.1080/15021149.2011.11434370
- Rousset, S., Schlich, P., Chatonnier, A., Barthomeuf, L., & Droit-Volet, S. (2008). Is the desire to eat familiar and unfamiliar meat products influenced by the emotions expressed on eaters' faces? *Appetite*, 50(1), 110–119. doi:10.1016/j.appet.2007.06.005
- Santarcangelo, S., & Dyer, K. (1988). Prosodic aspects of motherese: Effects on gaze and responsiveness in developmentally disabled children. *Journal of Experimental Child Psychology*, 46(3), 406–418. doi:10.1016/0022-0965(88)90069-0
- Spennwyn, J., Barrett, D. J. K., & Griffiths, M. D. (2010). The role of light and music in gambling behaviour: An empirical pilot study. *International Journal of Mental Health and Addiction*, 8(1), 107–118. doi:10.1007/s11469-009-9226-0
- Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 21, pp. 261–302). Cambridge, MA: Academic Press. doi:10.1016/S0065-2601(08)60229-4
- Sung, H., & Chang, A. M. (2005). Use of preferred music to decrease agitated behaviours in older people with dementia: A review of the literature. *Journal of Clinical Nursing*, 14(9), 1133–1140. doi:10.1111/j.1365-2702.2005.01218.x
- Wardle, J., Herrera, M.-L., Cooke, L., & Gibson, E. L. (2003). Modifying children's food preferences: The effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition*, 57(2), 341–348.