

Is group singing special? Health, well-being and social bonds in community-based adult  
education classes

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### Abstract

Evidence demonstrates that group singing improves health and well-being, but the precise mechanisms remain unknown. Given that cohesive social networks also positively influence health, we focus on the social aspects of singing, exploring whether improvements in health and well-being are mediated by stronger social bonds, both to the group as a whole (collective-bonding) and to individual classmates (relational-bonding). To do so, seven newly-formed community-based adult education classes (four singing,  $N=84$ , and three comparison classes studying creative writing or crafts,  $N=51$ ) were followed over seven months. Self-report questionnaire data on mental and physical health, well-being, and social bonding were collected at Months 1, 3 and 7. We demonstrate that physical and mental health and satisfaction with life significantly improved over time in both conditions. Path analysis did not show any indirect effects via social bonding of Condition on health and well-being. However, higher collective-bonding at timepoint 3 significantly predicted increased flourishing, reduced anxiety and improved physical health independently of baseline levels. In contrast, relational-bonding showed no such effects, suggesting that it is feeling part of a group that particularly yields health and well-being benefits. Moreover, these results indicate that singing may not improve health and well-being more than other types of activities. Nonetheless, these findings encourage further work to refine our understanding of the social aspects of community-based adult education classes in promoting health, well-being and community cohesion.

Accumulating evidence suggests that group singing can improve mental and physical health and well-being (e.g. Clift, Hancox, Staricoff, & Whitmore, 2008; Grindley, Astbury, Sharples, & Aguirre, 2011; Stewart & Lonsdale, 2016). These benefits have been reported for specific subgroups, such as homeless men (Bailey & Davidson, 2002), female prison inmates (Silber, 2005), disadvantaged adults (Dingle, Brander, Ballantyne, & Baker, 2012) and the elderly (e.g. Bungay, Clift, & Skingley, 2010; Coulton, Clift, Skingley, & Rodriguez, 2015), as well as for particular conditions such as dementia (e.g. Bannan & Montgomery-Smith, 2008; Camic, Williams, & Meeten, 2013), and amongst the general population (Clift & Hancox, 2010; Grindley et al., 2011). Here we seek to establish, firstly, whether community singing has a greater impact on improving health and well-being than other regular group activities that do not involve a shared collaborative goal, such as creative writing and crafts, and secondly, whether any such health and well-being benefits are mediated by the particularly social nature of group singing.

The physical act of singing in creating music with the body is reported to improve physical health. For instance, the breathing control involved in singing seems to yield positive results for individuals with speech difficulties (Tamplin, Baker, Jones, Way, & Lee, 2013; Tamplin, Baker, Grocke, et al., 2013), or with specific breathing problems such as Chronic Obstructive Pulmonary Disease (COPD: Bonilha, Onofre, Vieira, Prado, & Martinez, 2009; Lord et al., 2010, 2012; Skingley et al., 2013). In addition to more clinical applications of group singing, qualitative research indicates that members of community choirs perceive physical health improvements associated with singing in terms of breathing control, posture and stress reduction, along with cognitive stimulation and memory, which may explain the benefits seen in dementia patients (e.g. Bannan & Montgomery-Smith, 2008; Clift & Hancox, 2001, 2010; Hillman, 2002; Joseph & Southcott, 2014).

As well as these physical effects, singing may improve health and well-being psychologically, by encouraging positivity. Quantitative comparison has demonstrated that active group singing yields a greater increase in positive affect and decrease in negative affect compared both to passive listening to music (Kreutz et al., 2003; though see Unwin, Kenny, & Davis, 2002, where although there were no significant differences between singers and listeners, singers did show more robust changes) and discussing positive personal experiences (Kreutz, 2014). The elevated positive affect and hedonic feelings associated with group singing may lead to perception of greater well-being, which may also be tied into better mental health. For instance, a randomised-control study found that after one hour of active choral singing, participants experienced significant decreases in anxiety and negative affect, whereas controls participating in unstructured activity for the same time period showed increases in both (Sanal & Gorsev, 2013). Moreover, older adults randomly-assigned to community singing groups reported significantly higher mental-health-related quality of life after 6 months than a comparison group doing 'usual activities' (Coulton et al., 2015).

As well as these health-promoting individual physical and psychological effects, singing has strong social effects. Indeed, one consistently reported consequence of singing is that choirs and singing groups develop a strong sense of belonging and encourage greater involvement in the community, for example through volunteering (Clift & Hancox, 2001, 2010; Grindley et al., 2011; Hillman, 2002; Joseph & Southcott, 2014). Moreover, recent work suggests that choir members feel that their singing groups are more cohesive than sports players report their teams to be (Stewart & Lonsdale, 2016). These positive social outcomes of singing seem to start early: the national UK 'Sing Up' program with primary-school-aged children has shown a significant positive association between singing ability and a child's sense of being socially included (Welch, Himonides, Saunders, Papageorgi, & Sarazin, 2014). This continues into old age, where individuals involved in music-making have

demonstrated a greater improvement in social affirmation compared to those participating in book clubs, crafts, language classes, and yoga (Creech, Hallam, Varvarigou, McQueen, & Gaunt, 2013).

Any form of music-making in groups involves a number of behaviours that might independently influence the connection felt among group members: sharing motivation and attention to produce a cohesive sound (Reddish, Fischer, & Bulbulia, 2013; Shteynberg, Hirsh, Galinsky, & Knight, 2014), prediction of the behaviour of other members (Sebanz & Knoblich, 2009), coordination itself (e.g. Hove & Risen, 2009) and experience of shared success (e.g. Launay, Dean, & Bailes, 2013). These shared goals, attention foci and successes are all likely to enhance feelings of closeness and affiliation with the group. Furthermore, the synchrony of timing, pitch and breathing is likely to contribute to closer social bonds, since movement synchrony has been associated with increased prosociality (e.g. Hove & Risen, 2009; Launay et al., 2013; Launay, Dean, & Bailes, 2014; Reddish, Bulbulia, & Fischer, 2013; Reddish, Fischer, et al., 2013; Valdesolo, Ouyang, & DeSteno, 2010; Wiltermuth & Heath, 2009). Indeed, both singing synchronously in unison and singing in coordinated turns has been linked to increased feelings of belongingness to a group (Koudenburg, Postmes, Gordijn, & van Mourik Broekman, 2015).

Although the social benefits of singing are often taken for granted, little work has focused specifically on whether improved health and well-being partly develop due to the social bonding effects of group singing. A large body of literature indicates that being part of a supportive social network is itself essential for health and well-being (e.g. Cruwys et al., 2014; Holt-Lunstad, Smith, & Layton, 2010; Iaupuni, Donato, Thompson-Colón, & Stainback, 2005). Consequently, it may be that some of the health benefits attributed to group singing occur due to the social bonding effects of musical engagement in a group. Moreover, the hedonic impact of singing in lifting positive mood, combined with the eudaimonic

outcomes associated with feeling of being part of something bigger than oneself, are together likely to yield an improved sense of well-being and satisfaction with life in regular singers (Hillman, 2002; Ryan & Deci, 2001). In other words, as well as the physical and psychological processes linking singing and improved health and well-being, the social aspects of group singing are also likely to play a key role in health and well-being outcomes.

In this paper we ask whether improvements in health and well-being associated with group singing are mediated via social connections. We propose that singing might create a level of group cohesion beyond that associated with other activities that provide opportunities for regular social engagement, but do not encourage coordination and shared goals. Consequently, we hypothesise that some of the health and well-being benefits previously associated with group singing are driven by heightened social cohesion. We seek firstly, to establish whether group singing has a stronger effect on health and well-being than comparison activities that involve individual creative projects undertaken in a group context, and secondly, to explore whether any health and well-being effects of singing are mediated through social factors.

To this end, we used a quasi-experimental design to compare self-reported mental and physical health and well-being measures for participants attending weekly singing or non-singing (crafts or creative writing) adult education classes over the course of 7 months. These classes were run by a national charity that promotes lifelong learning in the community (the Workers' Educational Association, WEA) and took place in venues utilised by the local community, including a library, community halls and a school. We visited each class to collect data at three timepoints, at the beginning, middle and end of these courses, and test (i) whether reported health and well-being changed over time, and (ii) whether any changes in health and well-being over time differed between the singers and non-singers. In addition we use path models to test whether any changes are mediated by differences in social bonding

between the singing and non-singing conditions. Recent work has highlighted the importance of distinguishing between different types of social relationships in terms of their impact on health and well-being: for instance, engagement with a broader social group has been found to have a stronger effect on cognitive health in the elderly than one-on-one engagement with close friends and family (Haslam, Cruwys, & Haslam, 2014). Here we measure both the extent to which an individual felt included in the group as a whole (collective-bonding) and the degree to which they felt connected to individual group members (relational-bonding). Our hypotheses were: (1) singers show a greater positive change in physical health over time than non-singers, (2) singers show a greater reduction in self-reported mental ill-health over time than non-singers, (3) singers show a greater positive change in well-being over time than non-singers, and (4) improvement in health and well-being is mediated by the degree to which individuals feel more bonded to their classmates over time, with greater social bonding effects in singers compared to non-singers.

## **Materials & methods**

### **Participants**

Adults recruited from the local community attended one of seven weekly classes (4 singing classes, 2 creative crafts classes and 1 creative writing class) set up for the purpose of the research by the West Midlands WEA. The singing groups included 84 participants (Age: range = 18-83 years,  $M = 60$ ,  $SD = 12$ ; 73 female) and the non-singing groups included 51 participants (Age: range = 24-81 years,  $M = 52$ ,  $SD = 15$ ; 45 female). The majority of the sample identified their ethnicity as white (singing: 95%, non-singing: 80%). Participants gave full written informed consent at the start of the study and were debriefed at the end.

### Questionnaire measures

**Anxiety & depression.** Mental ill-health was measured using the 7-item Generalised Anxiety Disorder scale (GAD7) and the 9-item Patient Health Questionnaire (PHQ9) scale, which includes an additional item asking participants to rate the severity of any problems identified in response to the scale (Kroenke, Spitzer, & Williams, 2001; Spitzer, Kroenke, Williams, & Lowe, 2006). These scales rate how much of the time respondents experience symptoms associated with anxiety and depression: the higher the total score for each of these scales, the greater the level of mental ill-health. These scales were used as a general indication of mental health, rather than as a diagnostic tool for clinical categorisation. However, for reference we provide the frequencies of participants showing different severities of depressive and anxiety traits in Table 1. Due to severe positive skew and to deal with total scores of zero, a value of 1 was added to the total scores for each participant and these were then log-transformed (referred to as logGAD7 and logPHQ9 here). The results were the same whether raw or logged values were used, but the residuals were more normally distributed for the logged models so these are reported here.

**Physical health.** Physical health was assessed using modified items from the MOS 36-item short-form (MOS 36-SF) of the RAND Health-related Quality of Life scale (Ware Jr. & Sherbourne, 1992) (see the Extra Supplementary Material). Instead of asking about 'health' in general as in the original scale, participants were asked to separately rate their physical and mental health 'at the moment'. In addition, rather than asking participants to rate their health (mental and physical separately) compared to the year before as in the MOS 36-SF, due to the timescale of our study we shortened this to 'compared to 2 months ago'. Other items from the MOS 36-SF survey were shortened in a similar manner to those used in the 12-item short-form (Ware Jr., Kosinski, & Keller, 1996). Reverse scoring was used where necessary so that higher scores on all items indicated better physical health. Due to

experimenter error the creative writers were not asked to rate their physical health compared to two months ago or their mental health at timepoint 1. Due to these missing questions a mean of the physical health score was calculated for each participant at each timepoint, taking the different number of items into account across participants.

**Well-being.** Participants completed the Flourishing and Satisfaction with life (SWLS) scales (Diener et al., 2010; Diener, Emmons, Larsen, & Griffin, 1985). Higher summed scores indicate higher well-being in both cases.

**Collective-bonding to the group.** Connectedness to the class group as a whole was measured before class using a modified version of the pictorial Inclusion of Other in Self (IOS) scale (Aron, Aron, & Smollan, 1992), as reported in Pearce et al (2015). Participants were instructed to ‘circle the diagram that best describes your current relationship to your WEA class group as a whole’. The 7-point scale (1 to 7) comprises a series of paired circles labelled ‘self’ and ‘group’. The circles ranged from being completely non-overlapping to being almost completely overlapping. These were taken to represent how close or connected a participant felt to their class as a whole group.

**Relational-bonding to individual classmates.** Participants were asked to list all the names of the classmates they could remember and then asked whether or not (dichotomous: yes or no) they felt connected to each of the individuals they had listed (see also Pearce, MacCarron, Launay, & Dunbar, n.d.). Differences in class size (for singers: 23, 28, 16 and 17 individuals; for creative writers: 18 individuals; for crafters: 13 and 20 individuals, although not all members attended each class) were taken into account by calculating the number of classmates named and connected to as a proportion of the total number of individuals in the corresponding class. A relational-bonding index was calculated as the mean of these two variables, which were highly correlated with each other (at timepoint 1:  $r=0.659$ ,  $t_{133}=10.114$ ,

$p < 0.0001$ ; timepoint 2:  $r = 0.760$ ,  $t_{133} = 13.506$ ,  $p < 0.0001$ ; at timepoint 3:  $r = 0.867$ ,  $t_{133} = 20.041$ ,  $p < 0.0001$ ). Histograms of the relational-bonding index at each timepoint demonstrated a disproportionate number of participants scoring zero and these outliers are excluded from analyses using the raw variables (versus change), although the results remain the same either way.

**Qualitative data.** At timepoint 3 participants were asked open questions, including how their relationships with classmates had changed over the course of 7 months: ‘Since the start of the class have your relationships with, or feelings towards, people in your class changed? If so, how?’ (see Pearce, n.d.). Although systematic analysis of the resulting data is beyond the scope of this paper, we use some of the responses to support specific points in our Discussion.

## Procedure

The singing condition comprised four singing classes, who were taught by professional singing tutors using a Natural Voice Network style approach (<http://www.naturalvoice.net/>). The comparison condition comprised non-singing classes: two crafts classes and a creative writing class, who were also led by professional tutors. The tutors had 2-20 years experience teaching their specialty. The tutors were blind to our specific hypotheses and multi-level model analysis was used to take account of any differences between classes associated with their different tutors.

All seven classes were set up specifically for the study: although some participants were known to each other as part of the local community, the class groups were newly formed at the start of the study. The classes ran over 7 months comprising two terms with a two-week break in the middle. Questionnaire data were collected at three timepoints: month 1

(timepoint 1), month 3 (prior to the break; timepoint 2) and month 7 (timepoint 3). Each class was approximately two hours long.

### **Analysis**

**Multi-level modelling.** Since participants were nested in classes and therefore do not represent independent data-points, multi-level linear models (MLM) were conducted using R with ‘Class’ as a superordinate layer. All models controlled for Sex and Age. Model residuals did not exhibit heteroscedasticity and were approximately normally distributed. Initial models to look at the overall effect of time used timepoint coded as an ordered factor. Subsequent models testing for differences between the three timepoints used contrasts between baseline (timepoint1) and the two subsequent timepoints, 2 and 3. These models take account of the missing data associated with drop-out and absences for holidays and illness, so the results presented here combine all participants, regardless of whether they provided data at all three timepoints (27 non-singing participants and 48 singing participants provided complete data). Multi-level models taking the class structure into account found no significant differences between participants who provided data at all three timepoints and those who provided data at only one or two timepoints for any of the measures at baseline (timepoint 1).

**Mediation analysis.** To assess potential causal pathways between Condition (singing versus non-singing) and changes in health and well-being, mediation analyses were conducted with social bonding measures (change in collective-bonding/IOS and the relational-bonding index) as mediators using the PROCESS plug-in for SPSS (Hayes, 2013). Change in the social bonding and health/well-being variables were calculated by subtracting the raw score at timepoint 1 from the raw score at timepoint 3. In all models baseline measures were included to control for individual differences at timepoint 1.

## Results

### Comparisons between conditions at baseline.

There was no significant difference between Conditions at baseline in Physical Health ( $p=0.555$ ), logGAD7 ( $p=0.965$ ), logPHQ9 ( $p=0.633$ ), SWLS ( $p=0.412$ ), Flourishing ( $p=0.442$ ), collective-bonding/IOS ( $p=0.243$ ), or the relational-bonding index ( $p=0.357$ ) scores: Table 2.

### Hypothesis 1: Singers show a greater positive change in self-reported physical health over time than non-singers.

Overall there was a significant positive relationship between time and Physical Health ( $t_{295}=2.273$ ,  $p=0.007$ , Table 2), independently of Condition. When comparing Physical Health between baseline and timepoints 2 and 3, neither Condition ( $p=0.405$ ) nor the interactions (Condition $\times$ Timepoint 2:  $p=0.997$ , Condition $\times$ Timepoint 3:  $p=0.285$ ) had a significant effect on Physical Health. Self-reported Physical Health was significantly higher at Timepoint 3 compared to Timepoint 1 ( $t_{294}=2.523$ ,  $p=0.012$ ), but there was no significant difference between Timepoint 1 and Timepoint 2 ( $p=0.343$ ) independently of Condition or the interactions. Although physical health improved overall, singers did not show a significantly greater increase than non-singers.

### Hypothesis 2: Singers show a greater reduction in self-reported mental ill-health over time than non-singers.

Overall there was a significant negative relationship between time and both logGAD7 ( $t_{295}=-2.115$ ,  $p=0.035$ ) and logPHQ9 ( $t_{293}=-2.031$ ,  $p=0.043$ ) independently of Condition, suggesting a significant reduction in mental ill-health over time (Table 2). Visual inspection of Table 1 corroborates this finding: the percentage of participants in the ‘moderately severe’

and 'severe' categories declines and the percentage in the 'mild' category increases over the three timepoints.

For logPHQ9, Condition ( $p=0.866$ ) and the interactions (Condition $\times$ Timepoint 2:  $p=0.668$ , Condition $\times$ Timepoint 3:  $p=0.522$ ) had no significant effect on the scores, which were significantly lower at Timepoint 3 compared to Timepoint 1 ( $t_{293}=-2.031$ ,  $p=0.043$ ), but did not differ between Timepoint 2 and baseline ( $p=0.187$ ). For logGAD7 scores, none of the terms showed significant effects in the model including interactions, but the additive model excluding interactions indicated that there was no significant main effect of Condition ( $p=0.795$ ) whereas the logGAD7 scores at timepoint 3 were significantly reduced compared to timepoint 1 (main effect:  $t_{295}=-2.115$ ,  $p=0.035$ ). There was no significant difference in logGAD7 between timepoint 2 and baseline ( $p=0.080$ ). Consequently, similarly to physical health, mental health improved overall, but singers did not show a significantly greater increase than non-singers.

**Hypothesis 3: Singers show a greater positive change in self-reported well-being over time than non-singers.**

A significant positive relationship was found between time and SWLS ( $t_{299}=2.048$ ,  $p=0.041$ ) but not between time and Flourishing ( $p=0.188$ ), when controlling for Condition (Table 2). Flourishing scores did not significantly differ between either Timepoint 2 ( $p=0.768$ ) or Timepoint 3 ( $p=0.795$ ) and baseline (timepoint1) independently of Condition ( $p=0.475$ ) or the interactions (Condition $\times$ Timepoint 2:  $p=0.958$ , Condition $\times$ Timepoint 3:  $p=0.493$ ).

In a model including interactions none of the terms showed significant effects on SWLS scores, but the additive model excluding interactions indicated that there was no significant main effect of Condition ( $p=0.827$ ), whereas at timepoint 3 participants reported

significantly higher Satisfaction with Life than at timepoint 1 (main effect:  $t_{299}=2.048$ ,  $p=0.041$ ). There was no significant difference between timepoint 2 and baseline ( $p=0.580$ ) SWLS scores. These analyses suggest that there was a significant increase in life satisfaction over time, but not in flourishing, and that singers did not demonstrate a significantly greater increase than non-singers.

**Hypothesis 4: Improvement in health and well-being is mediated by the degree to which individuals feel more bonded to their classmates over time.**

We conducted mediation analyses to assess whether there were any indirect effects of Condition on total change in the health and well-being measures mediated by changes in social bonding (collective-bonding and the relational-bonding index) over time. There were no significant direct or indirect effects between Condition and total change in either physical or mental ill-health (GAD7 and PHQ9) or well-being (SWLS and Flourishing) via social bonding when controlling for baseline measures. In contrast with the lack of effect of Condition, however, the mediation analyses did suggest some significant relationships between changes in social bonding and change in the health and well-being measures (Figure 1). In order to investigate this further we undertook post-hoc analyses consisting of MLMs predicting health and well-being scores at timepoint 3 from social bonding scores at timepoint 3, as well as the corresponding baseline scores at timepoint 1, and controlling for age and sex (based on the previous results Condition was not included in the models).

Collective-bonding (IOS) scores at timepoint 3 were significantly positively associated with Physical Health at timepoint 3 ( $t_{67}=2.373$ ,  $p=0.020$ ) independently of collective-bonding at timepoint 1 ( $p=0.549$ ) and Physical Health at timepoint 1 ( $t_{68}=8.523$ ,  $p<0.0001$ ). Similarly, collective-bonding scores at timepoint 3 were significantly negatively associated with logGAD7 at timepoint 3 ( $t_{68}=-2.590$ ,  $p=0.012$ ) independently of collective-bonding scores at timepoint 1 ( $t_{68}=-2.367$ ,  $p=0.021$ ) and logGAD7 at timepoint 1 ( $t_{68}=7.800$ ,

$p < 0.0001$ ). Finally, collective-bonding scores at timepoint 3 were significantly positively associated with Flourishing at timepoint 3 ( $t_{64} = 2.317, p = 0.024$ ) independently of collective-bonding scores at timepoint 1 ( $p = 0.194$ ) and Flourishing at timepoint 1 ( $t_{65} = 8.646, p < 0.0001$ ). However, collective-bonding was not significantly related to logPHQ9 ( $p = 0.068$ ) or SWLS ( $p = 0.165$ ) at timepoint 3 independently of baseline measures. Moreover, none of the health and well-being measures at timepoint 3 were significantly predicted by the relational-bonding index at timepoint 3 controlling for baseline levels. Although no indirect effects via social bonding were uncovered by mediation analysis (Figure 2), greater changes in collective-bonding were significantly associated with increased flourishing, improved physical health and reduced anxiety independently of the corresponding baseline levels.

### Discussion

Both mental and physical health improved between timepoints 1 and 3, which indicated that any interventions along the lines of those used in this study need to continue for more than 3 months in order for benefits to be observable statistically. However, singers did not show a greater improvement compared to non-singers, meaning that Hypotheses 1 and 2 were not supported. Well-being only showed a significant improvement over time in relation to life satisfaction, but not flourishing, and this improvement in life satisfaction was demonstrated by singers and non-singers alike, which meant that Hypothesis 3 was not supported by these data either. Together, these findings suggested that singing did not directly result in an improvement in health and well-being over and above that of other regular activities that comprised individual projects conducted in a group context, where there were opportunities for social interaction but no shared collaborative goal. This contrasts with previous findings that singing reduced anxiety and improved mental health compared to not singing (Coulton et al., 2015; Sanal & Gorsev, 2013). However, these other studies compared singing to ‘unstructured’ or ‘usual’ activity, rather than contrasting singing to

another active task, such as creative writing or crafts. The current findings build on previous work to suggest that community adult education classes may improve health and well-being irrespective of the subject studied (Jenkins & Mostafa, 2014).

Although mediation analysis revealed no indirect effects via social bonding between Condition and the health and well-being outcomes, the degree of collective-bonding felt by a participant by timepoint 3 was significantly linked to their Flourishing, logGAD7 and Physical Health scores at the end of the study, independently of their health and well-being scores and how close they felt to their group at the start of their course. These findings indicated that the extent to which individuals felt integrated into their class group was significantly related to the degree to which they felt these health and well-being improvements, regardless of the activity in which they participated. In turn, this implies that some of the health well-being benefits of community adult education classes in general may lie in the opportunities they provide for social engagement with a wider social network.

Whereas the singers perhaps became closer through sharing a common goal of coordinating the production of a piece of music, the creative writers and crafters would have had to cohere through other means. For instance, a number of crafters reported enjoying the sharing of ideas and learning new techniques from each other:

We all seem to talk and help each other with ideas. [Female, 78 years old]

[I] got to know the class better, [and I] like to learn new crafts from the group.

[Female 35 years old]

Future research could productively examine whether different activities lead to the same level of collective-bonding along different trajectories (cf. Pearce et al., 2015). Whatever the mechanisms, previous findings that participation in community-based adult education as a

whole is associated with higher levels of well-being is supported by the current results (Jenkins & Mostafa, 2014).

The fact that Flourishing, logGAD7 and Physical Health scores at timepoint 3 were only related to the extent of collective-bonding (IOS), and not the strength of relational-bonding to individual classmates, suggested that feeling part of a wider social group may be a particularly powerful way of promoting health and well-being, corroborating previous work (Haslam et al., 2014, though note that Haslam et al compared relational bonds with close friends and family to engagement with wider groups, rather than collective and relational-bonding within the context of those wider groups as we did here). Moreover, the recent finding that participating in choirs or team sports is associated with higher levels of psychological well-being than engaging in solo singing further indicates that regular interaction in a group supports good mental health (Stewart & Lonsdale, 2016). However, more work is needed to assess whether collective social bonding is particularly associated with reduced anxiety and improved flourishing (purposefulness and engagement with activities and other people), rather than linked to reduced depression and improved life satisfaction, as suggested by the lack of significant relationships found here between IOS and either the logPHQ9 or SWLS scores.

Although participants were not randomly assigned to the conditions due to the naturalistic nature of the set-up, chosen in order to ensure ecological validity, the baseline measures showed no significant differences between singers and non-singers, arguing against systematic biases. Furthermore, since it is probable that whether or not a particular activity has beneficial outcomes in terms of individual health and well-being is based largely on individual preferences and temperaments, the opportunity to choose what kind of community-based learning activity to take part in is likely to have been integral to the health and well-being benefits observed here. For example, one of the crafters reported:

...I'm not usually over keen on group activities, but the singular (individual) activities worked in a group setting w[ere] good. [Female, 55 years old]

Thus, although the lack of random assignment means we could not infer that these activities would have benefited everyone, our findings indicated that on average individuals who had chosen to take part in singing or creative writing/crafting classes could show improved mental and physical health over a 7-month period.

### **Conclusions**

This paper explored whether weekly, community-based group singing classes could create a greater positive impact on health and well-being than other weekly activities such as creative writing and crafts, and whether any improvements were mediated by singers having stronger social bonds with classmates. Contrary to expectation, the findings indicated that over the course of 7 months the mental and physical health and life satisfaction of participants attending adult education classes significantly improved regardless of whether they were singers or not. Moreover, although no indirect effects mediated by social bonding were found, higher levels of collective-bonding were significantly linked to better physical health, reduced anxiety and higher flourishing for crafters, creative writers and singers alike.

Although further work is required in this area, the current findings suggested that improvements in health and well-being linked to attending adult education classes may be associated, at least partly, with the greater sense of integration into a wider social group that these classes can foster.

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### Tables

Table 1. The frequencies of participants in different categories representing the severity of anxiety (GAD7) and depression (PHQ9) at different timepoints, combined across the conditions.

Time	Clinical Categories	GAD7 (Anxiety)		PHQ9 (Depression)	
		Frequency	Percent	Frequency	Percent
1	Mild (0-5)	74	63.2	56	50.0
	Moderate (6-10)	24	20.5	29	25.9
	Moderately severe (11-15)	11	9.4	15	13.4
	Severe (16+)	8	6.8	12	10.7
	Total (N)	117	100	112	100
2	Mild (0-5)	75	71.4	59	57.8
	Moderate (6-10)	17	16.2	24	23.5
	Moderately severe (11-15)	8	7.6	14	13.7
	Severe (16+)	5	4.8	5	4.9
	Total (N)	105	100	102	100
3	Mild (0-5)	65	71.4	57	62.6
	Moderate (6-10)	17	18.7	19	20.9
	Moderately severe (11-15)	6	6.6	9	9.9
	Severe (16+)	3	3.3	6	6.6
	Total (N)	91	100	91	100

Table 2. Descriptive statistics (Mean, Standard Deviation) for Physical Health, raw GAD7, raw PHQ9, SWLS, Flourishing, IOS and the Relational Index for singers and non-singers at each timepoint.

Condition	Timepoint	Physical Health	Sum GAD7	Sum PHQ9	Sum SWLS	Sum Flourishing	IOS	Relational Index	
Non-singing	1	N	46	46	46	46	46	51	
		M	2.69	5.93	8.41	21.65	43.22	3.15	.17
		SD	.79	5.60	6.69	7.87	8.13	1.83	.15
	2	N	39	39	39	39	39	38	51
		M	2.79	4.97	6.51	21.33	43.72	4.45	.21
		SD	.67	5.04	5.08	7.89	6.70	1.57	.23
	3	N	32	32	32	32	32	32	51
		M	3.02	3.91	5.38	23.06	43.63	5.53	.23
		SD	.60	4.31	4.40	6.83	7.14	1.44	.25
Singing	1	N	73	71	71	71	71	65	84
		M	2.80	5.49	7.76	20.49	42.08	2.51	.11
		SD	.63	4.90	6.59	7.16	7.52	1.35	.10
	2	N	66	66	66	66	66	66	84
		M	2.97	4.21	6.35	21.29	42.20	4.95	.33
		SD	.55	4.97	6.06	6.36	7.00	1.40	.24
	3	N	60	59	59	59	59	58	84
		M	3.03	4.12	5.58	23.00	44.00	5.50	.34
		SD	.58	4.31	5.11	6.62	7.32	1.38	.27

## Figures

Figure 1. Direct and indirect effects between Condition (Singing versus Non-singing adult education classes) and change in (A) Physical Health, (B) Anxiety/GAD7 and (C) Flourishing scores between timepoints 1 and 3, mediated by change in Inclusion of Other in Self (IOS: collective-bonding) score, and controlling for baseline (timepoint 1) measures, giving the relationship coefficients. Direct effects are partial relationships controlling for the other variables. Any significant associations are indicated as \*  $p < 0.05$  (two-tailed). Post-hoc analysis revealed that these three measures were significantly predicted by IOS at timepoint 3 independently of the corresponding baselines, as reflected in the significant direct relationship between change in IOS and the changes in Physical Health, GAD7 and Flourishing illustrated here.

Figure 2. Direct and indirect effects between (A) Physical Health, (B) Anxiety/logGAD7 and (C) Flourishing scores at timepoint 1 and timepoint 3, mediated by Inclusion of Other in Self (IOS: collective-bonding) score at timepoint 3 and controlling for baseline (timepoint 1) IOS, giving the relationship coefficients. Direct effects are partial relationships controlling for the other variables. Any significant associations are indicated as \*  $p < 0.05$ , \*\*  $p < 0.005$ , \*\*\*  $p < 0.0001$  (two-tailed). Note that MLM found a significant partial relationship between IOS at timepoint 3 and logGAD7 at timepoint 3 despite the non-significant direct relationship shown in (B) between these variables.

Figure 1A

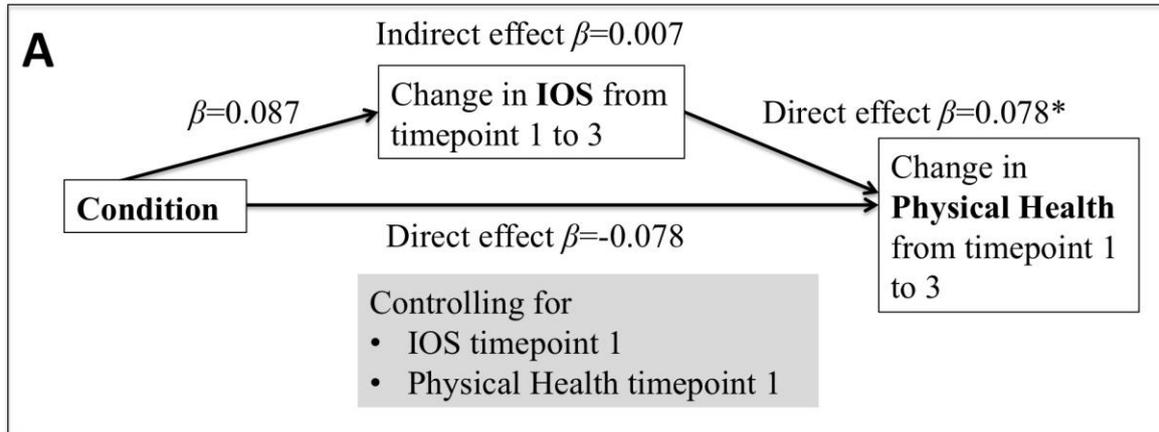


Figure 1B

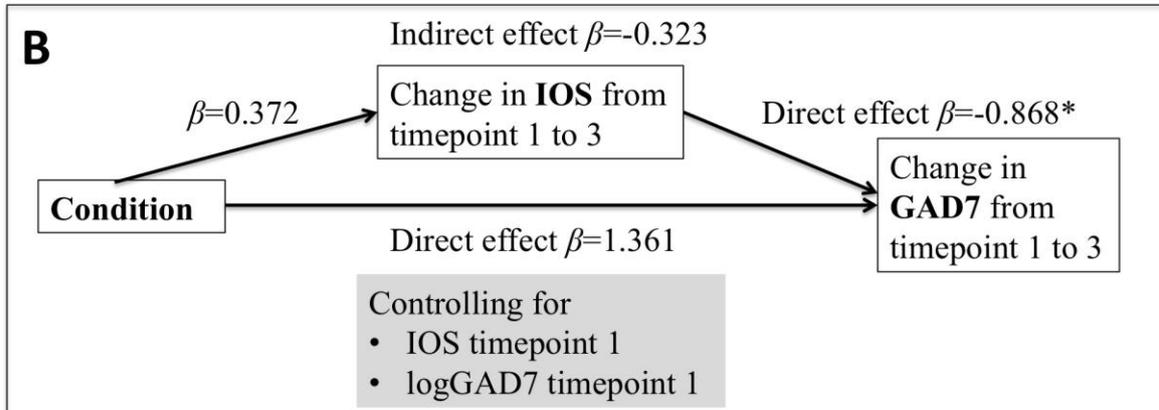


Figure 1C

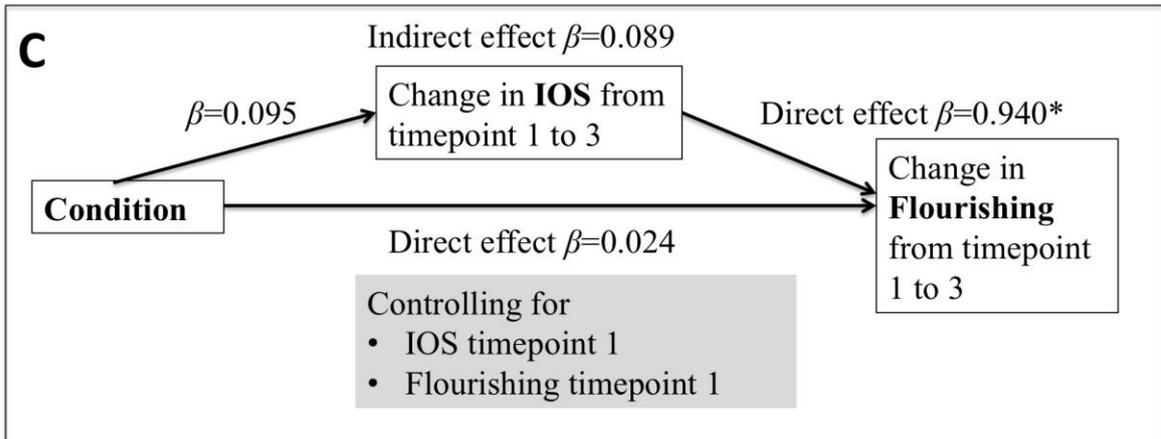


Figure 2A

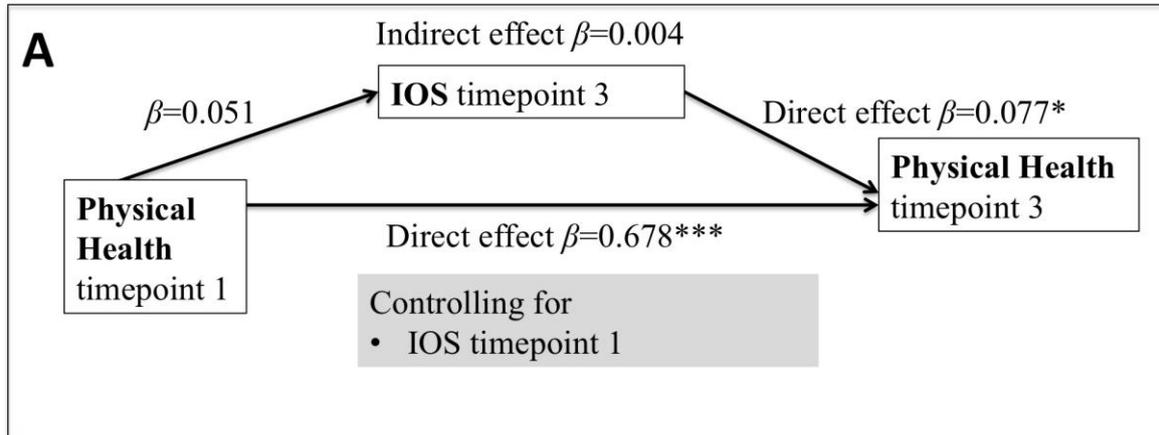


Figure 2B

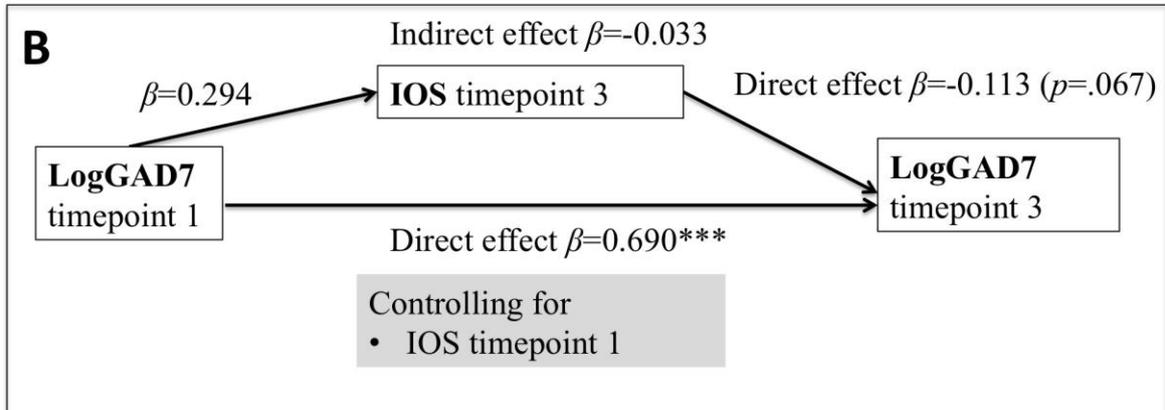


Figure 2C

