Singing for respiratory health: theory, evidence and challenges

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Summary

The premise that singing is a health promoting activity for people with respiratory conditions of chronic obstructive pulmonary disease (COPD) and asthma is a growing area of interest being investigated by researchers from various disciplines. The preliminary evidence, a theoretical framework and identification of methodological challenges are discussed in this perspective article with an eye to recommendations for further research to advance knowledge. After a brief summary of main research findings on singing in healthy people to provide background context, research is reviewed on singing in people with COPD and asthma. Studies include published research and as yet unpublished work by the authors. Methodological challenges arising from the reviewed studies are identified such as attrition from singing or control groups based on weak and strong, respectively, beliefs about singing’s effectiveness. Potential solutions for these problems are considered with further recommendations made for other singing research.

Key words: singing, respiratory health, asthma, COPD

INTRODUCTION

Given that singing often involves holding notes without taking extra breaths, the notion that singing could assist people with respiratory illness might seem counterintuitive. How is it that people with chronic obstructive pulmonary disease (COPD) or asthma (the two most common respiratory conditions to be investigated using singing interventions) with their associated symptoms of breathlessness can sing in the first place, let alone benefit from it? This question is addressed by first summarizing (i) the impact of COPD and asthma on people living with these conditions, and (ii) the potential health and well-being impacts and benefits of singing for healthy people as conceptualized within a biopsychosocial theoretical framework (Gick, 2011). A summary of research on singing for people with COPD or asthma follows and includes a discussion of methodological challenges associated with the studies. Finally, recommendations are made for future research in the area of singing for respiratory health and well-being.

BIOPSYCHOSOCIAL IMPACTS OF COPD AND ASTHMA

Although both COPD and asthma affect the airways and can impact breathing, they are different diseases. COPD is...
a late-onset, preventable, commonly progressive chronic disease characterized by airflow limitation of the airways due to narrowing and structural changes caused by inflammation (GOLD, 2014). An inflammatory response of the lungs and airways in response to inhalation of noxious stimuli such as cigarette or wood burning smoke is normal, but enhanced and chronic in those with COPD. Airway obstruction leads to difficulty in expiration, or exhaling, normally not a process requiring attention, and moving air out of the lungs such that air can get trapped in the airways. COPD includes symptoms of breathlessness and coughing, as well as mucus production. Worldwide, COPD is a leading cause of morbidity and mortality; prevalence of smoking and low socioeconomic status are factors in the development of COPD.

Asthma is a chronic early-onset disease characterized by inflammation and constriction of the bronchial airways leading to the lungs, with symptoms that include wheezing and coughing, feelings of breathlessness and tightness in the chest (Freitas et al., 2013). Worldwide prevalence of asthma is estimated at 300 million, with an annual mortality rate of 250 000 (Croisant, 2014). Prevalence is similar in developed and non-developed countries; however, there are differences in mortality, disease severity and prevalence trends. Mortality is more common in lower income countries because of poorer access to appropriate medication, and higher rates of smoking in non-developed countries are contributing to more disease severity and a trend of increasing prevalence (contrasted with stable rates in developed countries; Croisant, 2014). Common triggers setting off asthma episodes include plant pollen and animal dander (Freitas et al., 2013) so people with asthma must be vigilant in monitoring their environment and prepared with medication for unexpected episodes.

Both COPD and asthma are negatively associated with psychological well-being and quality of life. Social isolation that in part may result from restriction of activities due to breathlessness is associated with COPD (Skingley et al., 2014b) and isolation and feeling different has been associated with asthma in youth (Letourneau et al., 2012). Similar to other chronic illnesses such as diabetes, depression occurs in COPD and asthma at rates higher than the general population (Thomas et al., 2011). Anxiety and depression may predispose people to asthma as well as result from it, and, moreover, are associated with worse asthma outcomes (Thomas et al., 2011). Panic and anxiety in particular are much higher in those with asthma than in the general population (Ritz et al., 2013). Anxiety also may affect perception of symptoms such as breathlessness that are associated with COPD and asthma. Indeed, hyperventilation is a breathing pattern common to both anxiety and asthma; hyperventilation due to anxiety may then result in its attribution to asthma, triggering more anxiety (Thomas et al., 2011; Ritz et al., 2013). Overmedication or lack of adherence to medication as a result of altered perceptions (e.g. interpreting lack of symptoms as a license to not take medication) are behavioral factors that may contribute to outcomes (Ritz et al., 2013).

SINGING, HEALTH AND WELL-BEING

Newspapers, magazines and online blogs offer plenty of anecdotal evidence extolling the benefits of singing for psychological well-being; researchers, however, adopt a more cautious tone. Clift et al. (Clift et al., 2010) reviewed health and well-being outcomes of group singing, and Gick (Gick, 2011) provided a review of physical, psychological and social factors associated with group and solo singing. These reviews included studies of outcomes with healthy people who sing and studies of singing interventions targeting particular populations. Both reviews concluded that despite promising findings, especially for well-being outcomes resulting from singing, a causal association between singing and outcomes is precluded because much of the research has methodological limitations (e.g. no control group, no random assignment to singing). Some examples from these two reviews and relevant work published since, as well as unpublished data are summarized below as a brief overview; interested readers are referred to the reviews for more details. After this summary, findings specific to COPD and asthma are presented.

Singing is a multi-faceted experience readily conceptualized with a biopsychosocial framework. As summed up by one long-time choir member (Nicol, unpublished data): ‘Singing’s got emotional and physical and social and just all these benefits rolled into one. Stress reducer, enjoyment, connections, spiritual, meditative. There’s so many aspects to singing’.

Multiple psychological well-being benefits from singing are reported across studies, such as increases in positive mood (Clift and Hancox, 2001; Bailey and Davidson, 2005). Professional and amateur singers taking a singing lesson reported increased energy (Grape et al., 2003); amateur singers sometimes report an increased sense of self-expression (Grape et al., 2003). Choral singers also had significantly higher scores on quantitative measure of positive mood, personal growth, vitality, and purpose after rehearsing for 2 h (Busch and Gick, 2012). In addition to psychological well-being, people often report increased social well-being from regular singing in group situations such as community choirs (Clift and Hancox, 2001), including those for people who are homeless (Bailey and Davidson, 2005) or elderly (Skingley and...
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Bungay, 2010; Clements-Cortés, 2014). Relevant to the present interest in singing for respiratory health are findings that some people also report a physical well-being outcome, that their breathing seems stronger after singing (Clift and Hancox, 2001; Skingley and Bungay, 2010). Temporary increases in immune response (e.g. salivary immunoglobulin A) may occur after choral singing in amateurs (Kreutz et al., 2004) or professionals (Beck et al., 2000). Biological stress responses such as cortisol or heart rate may vary with professional versus amateur status, and choral versus solo singing (Clift et al., 2010; Gick, 2011).

PRELIMINARY CONSIDERATIONS FOR SINGING AS INTERVENTION FOR COPD AND ASTHMA

Singing has received recent research attention as a treatment for asthma and COPD (Clift et al., 2010; Gick, 2011), perhaps in part because of singing’s promise for increased well-being in healthy people as summarized above. Perhaps more important, the breathing control used in formal singing training may be similar to that used in controlled breathing instruction for people with COPD (Holland et al., 2012) and asthma (Bruton and Thomas, 2011). In particular, singing involves contracting the diaphragm to control muscles on inhaling and controlling respiratory muscles on exhaling (Leanderson and Sundberg, 1988), and this controlled breathing is not limited to only formal singing training. Indeed, cortical control of the vocal tract, abdominal muscles and diaphragm has been demonstrated in untrained singers (Gunji et al., 2007; see also Gick, 2011). Intuitively, controlled breathing is needed in order to hold notes or to sing the next phrase if there is no time to take a break.

Given breathing’s important role in singing, it is pertinent to briefly consider the evidence on the effectiveness of breathing training, and other similar breath-focused interventions before examining the evidence on singing as an intervention for asthma and COPD. People with asthma often have poor symptom control and try non-pharmacological treatment such as breathing exercises to better manage the disease (Arden-Close et al., 2013). Indeed, encouraging slow exhalation and involving the abdomen or diaphragm more than the chest is often recommended as adjunctive treatment for asthma, especially for those failing to improve with pharmacological treatment (Bruton and Thomas, 2011; Arden-Close et al., 2013). However, a recent review concluded that breathing training, including abdominal or diaphragmatic breathing, may improve quality of life and psychological impacts, but not physiological symptoms (Bruton and Thomas, 2011). Bruton and Thomas (Bruton and Thomas, 2011) also noted there is insufficient evidence that participants begin studies with breathing that needs correction.

For people with COPD, pulmonary rehabilitation typically consists of multicomponent treatments of education and exercise, which sometimes include breathing training such as diaphragmatic breathing (Holland et al., 2012). Contrasted with the benefits noted above for breathing training for asthma, Holland et al.’s (Holland et al., 2012) recent Cochrane review of breathing training for COPD reports preliminary although inconsistent evidence for improvement in exercise tolerance but little or no improvement in quality of life or breathlessness. In addition, two studies showed that breathing training added to a regular ‘entire body’ exercise treatment program did not provide any additional benefits. More divergent findings included one study that found just 15 min of diaphragmatic breathing resulted in increased breathlessness (see also Lord et al., 2010, for negative effects of diaphragmatic breathing for severe COPD), whereas another study employing diaphragmatic breathing training for 4 weeks demonstrated improvements in both breathlessness and quality of life. Holland et al. concluded that more research employing longer periods of training is needed before definitive conclusions can be drawn about breathing training and COPD.

In the present review of singing for asthma and COPD, the length of treatment is noted given its possible importance in the breathing studies described above, and the aforementioned association between breathing and singing. Breathing training employed in the service of singing contrasted with breathing training conducted on its own may have different effects however, just as breathing training during exercise may have different effects than breathing training on its own for COPD (Holland et al., 2012). The review also notes whether singing interventions explicitly employed breathing training as well as considers mechanisms other than breathing that might explain the effects of singing interventions (e.g. the positive experience of singing with others noted above).

REVIEW OF CURRENT EVIDENCE ON SINGING AS AN INTERVENTION FOR COPD AND ASTHMA

Some of the studies reviewed below have been included in existing reviews (Clift et al., 2010; Gick, 2011). Accordingly a brief summary is provided and interested readers are referred to the original articles or the reviews for more information. More detail is provided for studies
not previously reviewed or published. These additional studies were obtained by searching citations and reference lists of existing studies, and PsychInfo, PubMed and Cochrane Database of Systematic Reviews databases.

COPD studies are grouped according to the presence and type of control groups, followed by the few studies available on asthma and singing. After summarizing the main details of each study, an integration and critique of the overall findings is provided.

COPD: no control groups
Two COPD studies employing no control groups implicitly (Engen, 2005) or explicitly (Morrison et al., 2013) assessed the feasibility of using singing as an intervention before conducting more controlled studies. Engen’s (Engen, 2005) pioneering study investigated singing combined with vocal and breathing warm-up exercises in three men and four women with varying degrees of COPD (average age of 72) recruited from pulmonary rehabilitation programs or outpatient gerontology clinics. Participants met twice a week for 6 weeks and were taught both breathing support (use of abdominal muscles to support the voice) and breathing control (slow expiration). Results indicated that participants switched from a predominantly chest mode of breathing to a predominantly diaphragmatic style of breathing that was taught in the intervention. In addition, both breathing support (intensity of speech) and single breath counting (counting for as long as possible without taking a new breath) improved over the course of the study, although walking distance and forced expiratory volume in the first second (FEV1) did not change. While promising, the small number of participants in addition to the lack of control group were limitations of this study.

A larger number of participants with COPD was employed by Morrison et al. (Morrison et al., 2013) in their uncontrolled feasibility study. A 10-month, weekly singing intervention enrolled 106 participants with COPD of varying stages of severity. Breathing exercises were included as part of the singing intervention. Results indicated significant improvements between baseline and the end of the study in FEV1% and forced vital capacity (FVC) % (values expressed as a percentage of expected values), as well as in total and impact subscales of respiratory quality of life. No improvements were found in breathlessness or more general quality of life measures. In addition to reporting quantitative evidence, Morrison et al. (Morrison et al., 2013) also analyzed participants’ comments about their experiences in the program and their assessment of its benefits. Of particular interest are comments relating to the improvements in breathing and breathing control.

Despite the length of the study, Morrison et al. (Morrison et al., 2013) reported that attrition was comparable to that found in other COPD singing studies. Morrison et al. further emphasized that follow-up studies randomly assigning participants to singing and control groups will assess possible factors that might be associated with willingness to participate in a singing intervention. Interest or willingness to sing, as well as dropouts from control groups, will be returned to later in the discussion of methodological challenges of singing programs.

COPD: studies with control groups
Research on singing with people with COPD has varied in the nature of control groups. Studies using standard care controls are reviewed first, followed by those with group control activities.

Singing versus standard care controls
Both Lord et al. (Lord et al., 2010) and Goodridge et al. (Goodridge et al., 2013) used standard care as control conditions. In the study of Lord et al. (Lord et al., 2010), 28 participants with COPD were randomly assigned to singing or a control group that received usual care. All participants, including those in the control group, also received a 30-min standard breathing training session to manage breathlessness. Singing sessions were held twice weekly for a total of 6 weeks and were taught by a singing instructor who included relaxation and vocal exercises as part of the intervention. Improvement in quality of life was found in both singing and control groups, suggesting that merely being part of a study may afford quality of life improvement. Only the singing group decreased in anxiety and increased in self-reported health. Given that the control group did not perform another non-singing group activity, perhaps anxiety decreased in the singing group not from singing but from doing something with other people. None of the participants in either group improved in breathing measures such as single breath counting.

Similar to Lord et al. (Lord et al., 2010), Goodridge et al. (Goodridge et al., 2013) designed an 8-week study with patients with severe COPD and compared outcomes of those receiving singing treatment, which included vocal exercises and breathing training, to those in a control group receiving standard pulmonary rehabilitation treatment of education and exercise. The first 14 participants were assigned to singing with the remaining 7 assigned to standard care after reaching maximum enrollment for the singing group. Interestingly, two participants assigned to the control condition declined to participate because they wanted to sing, a point that will be returned to later. Although participants reported enjoying the singing program, no differences were obtained between groups in
quality of life or illness perceptions, or physical measures such as exercise tolerance as measured by distance walked in 6 min. Despite not using random assignment to groups, the lack of baseline differences between groups suggests that this was not a factor in the obtained outcomes. Goodridge et al. (Goodridge et al., 2013) noted that their measures may not have been sensitive enough to detect changes and the length of treatment may not have been long enough. Another possible limitation might be low power to detect effects, given the small sample size of the control group.

Singing versus control activities
In contrast to Lord et al. (Lord et al., 2010) and Goodridge et al. (Goodridge et al., 2013), Bonilha et al. (Bonilha et al., 2009) and Lord et al. (Lord et al., 2012) used alternate activities as control conditions. In Bonilha et al. (Bonilha et al., 2009), 30 outpatient participants in their seventies with moderate to severe COPD were randomly assigned to singing or handicraft control conditions that lasted for 30 weeks. The singing intervention included preparatory breathing exercises that consisted of a fast inhale followed by a controlled exhale. Quality of life improved in both singing and control conditions. However, only the singing group demonstrated improvement in maximal expiratory pressure (exhaling with as much effort as possible after a deep inhale), while the control group declined in the same measure. Singing did not result in improvement in other physiological measures such as FEV1.

Lord et al.’s (Lord et al., 2012) follow-up study of Lord et al. (Lord et al., 2010) continued with twice weekly sessions, but lasted slightly longer (9 weeks instead of six) and overcame the limitations noted in the 2010 study by having the control condition watch films and discuss them in a group setting. Similar results were obtained as in Lord et al. (Lord et al., 2010). While participants assigned to singing reported higher self-rated health, there were no differences in breathing outcomes between singing and control groups.

Asthma
There are fewer studies on singing in people with asthma. Two published studies were identified, of which one used an alternate activity control condition (Wade, 2002) and the other (Eley and Gorman, 2010) used singing because didgeridoo playing—the intervention for Australian aboriginal males with asthma—was taboo for females. More specifically, Wade (Wade, 2002) compared vocal exercises followed by singing, to music listening that was combined with progressive muscle relaxation exercises, as interventions for children with asthma. Twice weekly sessions over 4 weeks were conducted where nine children served as their own controls in a within-participants design that counterbalanced the order of conditions. Wade reported that lung functioning as measured by peak expiratory flow rates (PEFR; the speed of air upon exhaling) either was maintained or improved in the vocal exercises/singing condition and primarily declined in the listening/relaxation condition. However, results were reported individually with no statistical analysis. In addition, singers were able to choose the songs that varied in tempo, while listeners were provided with slow-tempo songs only, apparently to be consistent with relaxation. Vocal exercises were also not described and it is unclear if they included specific breathing control.

In contrast to Wade (Wade, 2002), breathing exercises were explicitly taught in conjunction with singing in Eley and Gorman’s (Eley and Gorman, 2010) six-month intervention for a mixed age group of Australian aboriginal females with asthma. A trained singer assisted by an aboriginal singer conducted the weekly group sessions. The authors report that PEFR but not FEV1 improved in the total group of singers, which included only adolescents and adult women because all primary school girls dropped out of the study. Interpretation is limited due to lack of a control group for singing females, and no breakdown for adolescent versus adult women who remained in the study.

In addition to the published studies, singing in people with asthma was examined in two recently completed, unpublished pilot studies by the first author (Daugherty and Gick, unpublished results; Gick and Daugherty, submitted for publication). These projects served as preliminary studies of singing for adults with asthma, given that the little singing research on asthma had been done primarily with children. In the first study, 93 young (M = 19.4, SD = 1.53) university students with self-reported, primarily mild (n = 62) asthma completed a survey about participation in and perception (as helpful for asthma) of activities that including singing. Most (98%) participants reported exercising or participating in sports, and 65% reported engaging in singing. Of those who reported participating in both singing and exercising (n = 54), more participants endorsed exercise (85%) as opposed to singing (34%) as being helpful to control their asthma, p < 0.001 using McNemar’s test.

Similar results about perceptions of singing as less helpful than other activities were found in Gick and Daugherty’s (submitted for publication) second pilot singing intervention, which was prompted by the observation that most existing studies with COPD or asthma included explicit breathing instructions as part of the singing intervention. Consequently, the effect of singing without breathing instruction is unclear. While some view it as necessary
for singing (e.g. Bonilha et al., 2009), explicit breathing instruction is not necessarily included in community singing programs or for participants who might sing on their own, without formal training. Thus one purpose of the research was to determine whether breathing instruction was necessary for improvement as a result of singing, and whether breathing instruction added anything to singing alone.

In Gick and Daugherty’s (submitted for publication) intervention study, participants were assigned to one of three conditions: singing alone without breathing instruction, singing combined with breathing instruction or breathing alone without singing. Participants in each condition met for 4 weeks in weekly group sessions with encouragement to practice at home. Results indicated that participants in all three conditions improved significantly in an objective measure of breathing—PEFR that was collected by a portable device—as well as self-reported breathlessness and vitality over the course of the four sessions. Furthermore, overall distress and negative mood declined from the beginning to the end of the study, and improvement was obtained on both the symptoms and impacts subscales of the respiratory quality of life measure. There were no differences in any well-being or asthma results among conditions (see Gick & Daugherty, submitted for publication, for more details of procedure and results). Having some activity in each group also helped control for attention to participants, which may in part be responsible for equivalent obtained improvements (Bruton and Thomas, 2011).

However, despite these lack of differences in outcomes, and important for the present purposes, participants’ beliefs that singing would be effective were significantly lower as measured at baseline (before any intervention) than their baseline beliefs of breathing effectiveness in all conditions. In particular, their breathing effectiveness beliefs all scored 3 (moderate belief it would help) or above on a 4-point scale (4 = strong belief it would help) for both completers and non-completers of all conditions. This result is consistent with Arden-Close et al.’s (Arden-Close et al., 2013) findings that participants believe breathing retraining will help their asthma. In contrast to the uniformly high breathing beliefs, non-completers of the singing condition who dropped out of the study had lower beliefs that singing would be helpful (1.5/4, which is halfway in between (i) believing singing will not work and (ii) not sure if singing will work) than completers of the singing condition (2.5/4, halfway in between not sure and moderately sure singing would work). In addition, non-completers of the breathing condition had higher beliefs that singing would be helpful than completers of the breathing condition. One participant explicitly stated that the reason for dropping out of the breathing condition was because of a desire to sing (this point will be returned to later).

Summary of COPD and asthma singing research
Overall, there are few studies of singing interventions for people with asthma or COPD. Most studies are fairly short in duration (from 4 to 8 weeks) with few participants, and many studies lack randomly assigned control participants. Although most participants reported enjoying the singing interventions, there were limited or inconsistent improvements in asthma or COPD symptoms such as breathlessness or objective breathing measures such as PEFR or FEV1. Bonilha et al.’s (Bonilha et al., 2009) and especially Morrison et al.’s (Morrison et al., 2013) study that had a larger number of participants and more power to find results did find some improvement in spirometry measures for people with COPD. However, there was no control group in Morrison et al. (Morrison et al., 2013), and participants recruited were those interested in singing. Further research with participants randomly assigned to singing and control conditions, and that assesses potential confounds with recruitment of interested participants will determine whether this positive result obtained with longer singing programs is reliable for all participants with COPD or just those interested in singing (Morrison et al., 2013). Although Gick & Daugherty (submitted for publication) did find some improvement in breathlessness and one spirometry measure (PEFR), there was no control group doing no activity, and singing provided no additional benefits (other than practice or its enjoyment, discussed further below) over breathing exercises in participants with asthma.

In addition, there is little understanding of mechanisms responsible for any obtained improvements, and multiple lenses exist for investigating those mechanisms. There are biomedical accounts (mechanisms such as breathing function; Gick, 2011); psychosocial explanations (e.g. well-being, belonging, purpose, competency; Gick, 2011); artistic perspectives (e.g. creativity, beauty; Clements-Cortés, 2014). Bonilha et al. (Bonilha et al., 2009) suggested that further to possibly strengthening respiratory muscles, singing might afford people with COPD the opportunity to become desensitized to feelings of breathlessness that might occur during singing, thereby reducing their anxiety about it. However, because all of the COPD studies employed explicit breathing instructions with singing, it is unclear whether breathing instructions are required for improvements found with singing interventions. All but one of the asthma studies employed breathing with singing as well. The PEFR, breathlessness and vitality improvements found in Gick and Daugherty’s (submitted for publication) study of asthma participants who sang without explicit breathing instructions suggests that they may not be necessary. While this result potentially bodes well for community singing programs that may not employ formal
breathing instruction or vocal exercises, it also suggests that breathing may not be the necessary mechanism underlying improvements, unless breathing naturally occurring in singing is sufficient for improvements such that additional breathing training is superfluous.

Furthermore, given the known role of diaphragmatic breathing in reducing anxiety (Gick, 2011), it is possible that obtained effects are mediated by reduction in distress, especially given that distress also decreased in Gick & Daugherty (submitted for publication). One participant in the singing plus breathing condition reported that singing helped her fall asleep at night. Further research with a larger number of participants that would allow statistical modeling to determine underlying mechanisms mediating the effects of the interventions, that also includes participants with more severe asthma and that employs a no treatment control is needed to better understand Gick & Daugherty’s (submitted for publication) findings on the role of breathing in singing. It is also unclear whether potential benefits of singing without explicit breathing exercises would generalize to people with more severe asthma or the more severe illness of COPD.

Although participants singing alone or those singing with breathing exercises in Gick & Daugherty (submitted for publication) did not show additional improvements over those engaging in breathing alone, singing resulted in more practice or more enjoyment of practice. Participants in most studies of COPD and asthma also reported enjoying the social contact in group singing where this was measured. The value of singing may thus be in its enjoyment and not having to do repetitive explicit breathing exercises that on their own may be boring or aversive to some people, despite their generally positive views of the value of breathing training as a non-pharmacological treatment for their condition (Arden-Close et al., 2013; Skingley et al., 2014b). Singing added to standard treatment (e.g. Goodridge et al., 2013) may help increase treatment adherence, which is a problem with chronic illnesses like asthma and COPD (Dunbar-Jacob and Mortimer-Stephens, 2001).

METHODOLOGICAL CHALLENGES IN CONDUCTING SINGING RESEARCH AND SUGGESTED SOLUTIONS

Based on the preceding summary of research, four challenges in conducting research on singing with people with asthma or COPD were identified. They are described in the following section alongside potential solutions for each challenge.

Attrition from control and singing groups
Some participants assigned to control groups that do not involve singing may drop out because they wanted to sing (Gick and Daugherty, submitted for publication; Goodridge et al., 2013). Similarly, beliefs in effectiveness of singing for asthma were lower than beliefs in effectiveness of breathing exercises for asthma, which may have contributed to dropping out of the study in the singing condition (Gick and Daugherty, submitted for publication). How do researchers recruit participants or keep them if they have low beliefs about singing’s effectiveness?

A corollary of attrition from both control and singing groups is that people completing the singing condition are those who believe that it will help, while those completing the control condition are those who do not believe singing will help or who were not overly motivated to sing. Confounding of beliefs and/or motivation with condition might undo any random assignment of participants to conditions, making causal conclusions about singing more difficult. Thus controlling attrition is important.

Skingley et al.’s (Skingley et al., 2014a) report of experiences of healthy older people in singing control groups, and corresponding suggestions to reduce attrition from them, provide some useful guidelines that might be applied to reduce attrition from both singing and control groups in asthma and COPD research. A first suggestion is to offer controls the opportunity to sing following the control period of waiting (a wait-listed control) or control activities (e.g. breathing); conversely, control activities (e.g. breathing) can be offered to participants randomly assigned to singing groups following the singing intervention.

Additional suggestions for reducing attrition from singing control groups include emphasizing research contributions made by control participants (e.g. helping others); communicating with control participants to reassure them of their value in participation and collecting data on allocation preferences before being assigned to conditions in order to statistically control for preferences in outcome analyses (Skingley et al., 2014a). Collecting data on a priori beliefs about effectiveness prior to condition assignment would also be useful, as was done in Gick & Daugherty (submitted for publication). Potential benefits of control activities (e.g. relaxation from breathing) could also be emphasized to motivate singing controls to remain in the study.

Analogously, emphasizing the possible psychological and social benefits of singing, while being appropriately cautious about respiratory benefits, may motivate singing participants to remain in the study without misleading them about potential effects on their asthma symptoms. Future studies might consider collecting beliefs about effectiveness after participation in the study in order to assess whether beliefs have changed, and any association of final beliefs or change in beliefs to health and well-being outcomes. Understanding of beliefs or other factors that
might predict who benefits most from singing is a fruitful area for future research.

Length of singing interventions
The length of singing interventions may need to be longer than usually studied (4–8 weeks) to be effective. Given that the length of music therapy interventions is positively associated with outcomes (Gold et al., 2009; see also Gick, 2011), does this dose–response relationship hold for singing as well? If so, is a long intervention possible given costs to administer lengthy programs that additionally may have attrition over time?

Recruiting more participants than needed to handle attrition problems, as was done in Morrison et al. (Morrison et al., 2013), is ideal but may not always be possible. Collaborative interventions among multiple partners (e.g. AIRS; Advancing Interdisciplinary Research in Singing, airsplace.ca) each of whom only has to contribute some resources or recruit some participants might be a worthy avenue to explore in future research. In addition, including stabilization as a measure for COPD is suggested, given the disease’s progressive nature.

Conducting non-medical interventions for medical conditions
COPD and asthma are treated by medical personnel such as doctors and nurses, and also physiotherapists, respiratory therapists and exercise therapists (e.g. Goodridge et al., 2013) who are part of pulmonary rehabilitation teams; support groups such as the British Lung Foundation (Morrison et al., 2013) also play a role in managing respiratory care. Is it feasible for researchers with potentially little knowledge of these conditions (e.g. music therapists, health psychologists) to conduct singing research with these patients?

Similar to the suggested solution for length of study, collaboration among professionals from different disciplines, including music therapy, education, psychology and medicine, might be one way to approach the challenge of using non-medical interventions like singing to treat medical conditions such as COPD. A respiratory therapist, physiotherapist, nurse or doctor who can advocate for singing or at least is willing to explore its efficacy might be needed to access hospital patient samples and to convince funding agencies of the study’s value. In addition, music therapists who are part of the team might increase the perceived legitimacy of the singing intervention (i.e. skillful implementation by credentialed professionals) and appeal to potential participants interested in complementary therapies and non-pharmacological treatments. Medical professionals who are part of the team might lend increased legitimacy to potential participants with low beliefs in singing’s potential effectiveness. Importantly, knowledge and training provided by medical and pulmonary rehabilitation teams to singing facilitators, such as that provided in Morrison et al. (Morrison et al., 2013), is needed to ensure patient safety.

Finite length of interventions
Interventions are limited to a certain time period. What happens when they are over if participants no longer sing? Is it ethical to abandon participants once the study is over (Skingley et al., 2011)?

Skingley et al. (Skingley et al., 2011) suggested that participants may be motivated to continue singing on their own through self-funded means (e.g. collecting contributions from the group and hiring someone to lead the singing). Similarly, participants might be encouraged to sign up for existing community choirs or singing groups. Recordings of songs practiced in the intervention could also be made available with the intent to facilitate participants continuing to sing on their own, to ‘tide them over’ until a new singing arrangement occurs.

Further to these points, however, the long-term effects of singing interventions have yet to be established. Few studies have assessed follow-up after the intervention is over, and it is unclear whether improvements would be maintained if singing does not continue after the study. Assessing long-term outcomes obviously requires more resources and involves logistical problems in terms of maintaining contact with participants. However, as much as possible, assessing long-term outcomes and their associations with continuation of singing would be important information. Positive results in the long term would also be persuasive in convincing patients, medical professionals and funding agencies of the value of singing.

CONCLUSIONS
Singing for respiratory health remains promising but inconclusive at this stage, similar to previous conclusions in published reviews (Clift et al., 2010; Gick, 2011) about singing for health and well-being. Most studies do not show improvements in respiratory health but instead in quality of life or well-being, which have positive immediate impact and might further affect respiratory health over time. Selection bias may be present in some studies as a result of recruitment processes, or attrition from singing and control conditions due to low belief in singing or high motivation to sing, respectively. Nonetheless, engaging in an enjoyable activity with others that may benefit well-being might be useful for some people suffering from respiratory illness, especially if they are isolated due to their illness.
Suggested solutions for future research and to overcome methodological challenges include assessment of beliefs and preferences before assignment to conditions, with reassessment of beliefs at the end of the study; conducting analyses of who benefits from singing and why; offering singing activity to control participants and control activities to singing participants following the initial intervention period to reduce attrition; emphasizing positive benefits of participation in both singing and control conditions; using collaborative, multidisciplinary (including medicine) interventions that are long enough to have an effect to minimize individual disciplinary resource needs, assist with any legitimacy concerns and ensure patient safety; and assessing long-term outcomes in conjunction with continuation (or not) of singing. These methodological suggestions also may be useful for singing interventions intended for health outcomes other than respiratory health.

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