Risk mitigation for South Australian choirs: a rapid literature review

Methods and study summaries

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Authorship

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Contents

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Appendix 2: Literature Review Methodology

This section summarized the methodology used to find and critically appraise the literature in this rapid review. A summary of the limitations of the review is also provided. The scope of the literature review was agreed with Adelaide Choral Network to focus on risk mitigation strategies specific to singing in groups as well as any research pertinent to the steps in the pathway of infection with COVID-19 during rehearsals.

Database searches

A literature search was conducted in September 2020 within the publicly available databases in Table 3.

Table 3: Databases searched

Databases searched	Description	Search Results (No. articles	No. articles retained in review
CEBM Oxford COVID evidence	The Oxford University Centre for Evidence-Based Medicine (CEBM). Rapid evidence reviews, data analysis and thought-provoking writing relating to the coronavirus pandemic, updated regularly.	1	1
CEBM Oxford open evidence reviews	The Oxford University Centre for Evidence-Based Medicine (CEBM). The aim of the open reviews is to provide accessible summaries of the evidence on particular aspects of COVID-19. Systematic and regular searches are undertaken for studies, assessing the quality of the studies and their implications.	36	1
CDC/MMWR	The Morbidity and Mortality Weekly Report (MMWR) series is prepared by the Centers for Disease Control and Prevention (CDC). The MMWR series is the agency's primary vehicle for scientific publication of timely, reliable, authoritative, accurate, objective, and useful public health information and recommendations.	127	2
Cochrane Collaboration Library	The Cochrane Library is a collection of databases that contain different types of high-quality, independent evidence to inform healthcare decision-making. The Cochrane Library is owned by Cochrane and published by Wiley.	0	0
Elsevier COVID Resource Centre	Elsevier's free health and medical research on the novel coronavirus (SARS-CoV-2) and COVID-19	169	20
Google Scholar	Google Scholar is a freely accessible web search engine that indexes the full text or metadata of scholarly literature. The Google Scholar index includes most peer-reviewed online academic journals and books, conference papers, theses and dissertations, preprints, abstracts, technical reports, and other scholarly literature.	606	29
Guidelines International Network	The Guidelines International Network is an international scientific association of organisations and individuals interested and involved in development and application of evidence-based guidelines and health care information	11	0
Lancet COVID resource centre	This resource centre brings together new 2019 novel coronavirus disease (COVID-19) content from across The Lancet journals as it is published.	89	19
PubMed	PubMed is a free search engine accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. The United States National Library of Medicine at the National Institutes of Health maintain the database as part of the Entrez system of information retrieval.	16	11
TRIP	TRIP (Turning Research into Practice) is a clinical search engine designed to allow users to quickly and easily find and use high-quality research evidence to support their practice and/or care.	112	7
Wellcome open research	Wellcome Open Research provides a place to rapidly publish any results worth sharing. All articles benefit from rapid publication, transparent peer review and editorial guidance on making all source data openly available.	12	0
WHO Global research database	The global literature cited in the WHO COVID-19 database is updated daily (Monday through Friday) from searches of bibliographic databases, hand searching, and the addition of other expert-referred scientific articles. This database represents a comprehensive multilingual source of current literature on the topic.	41	4

Keywords

A search strategy with the following keywords was designed to explore the focus questions in Table 1, derived from areas discussed by Professor Jonathon Reid, School of Chemistry, University of Bristol in a podcast on his research into the risks of singing (Davis et al. 28 July 2020). The search was limited to 2020 and combinations of the following keywords were used to search the databases in Table 3.

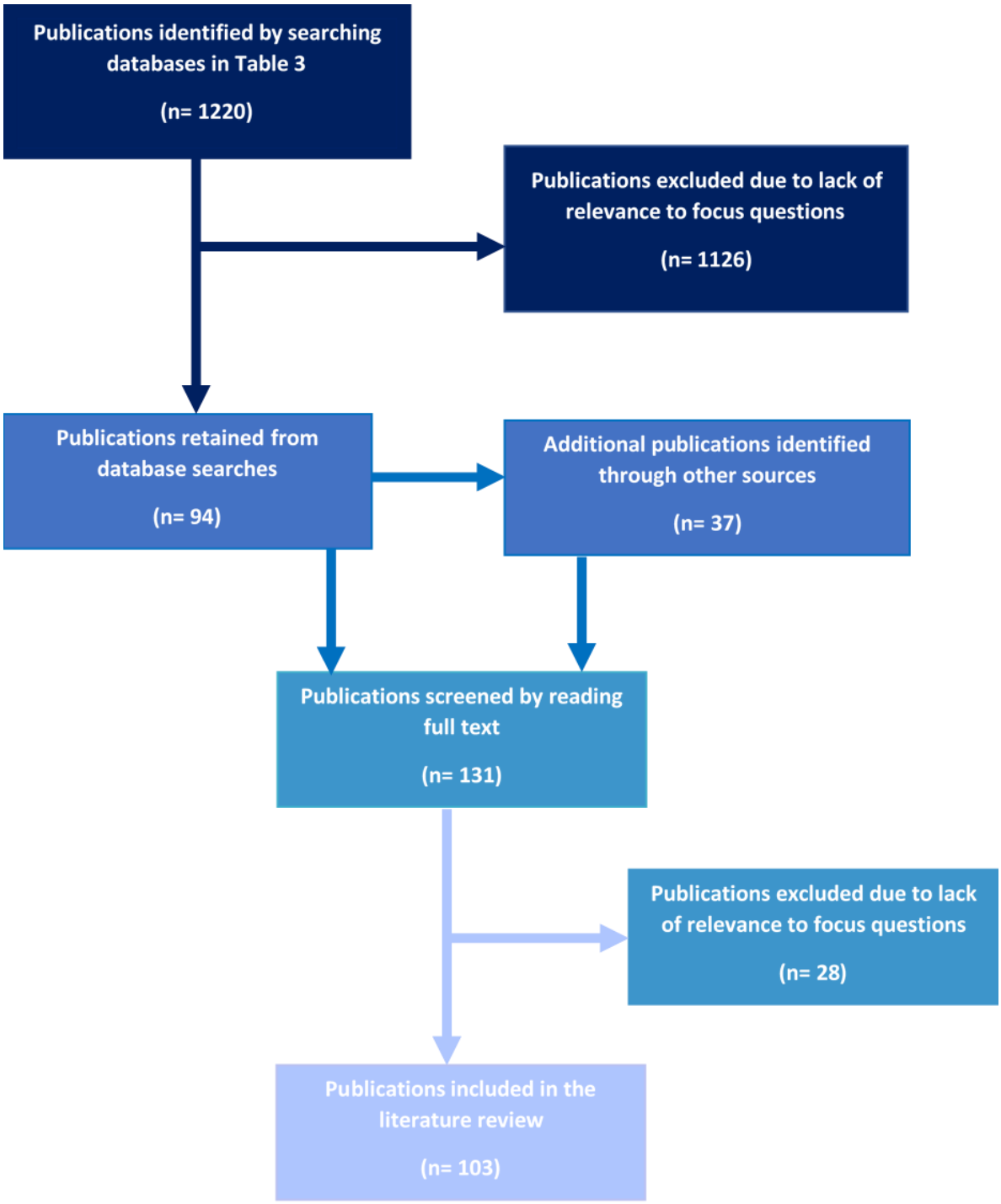
- (COVID or CORONAVIRUS) and (CHOIR or CHORAL SING*)
  and each of the following individual terms

- (VENTILATION)
- (RISK MITIGATION)
- (AEROSOL)
- (FOMITE) or (CLEAN*)
- (DISTANC*)
- (MASK)

The search was stopped when fewer new relevant articles were found with each subsequent search. 1220 articles were returned in the searches. After screening for relevance by title and abstract 94 were retained in the review. A further 37 articles were found by searching the references of articles or were recommended by a reviewer of this paper. Of a total of 131 articles 28 were considered not relevant to this review after screening by reading the article. The final review included 103 research publications (Figure 3).

Resources prevented a broader search and therefore limited the scope of the review. If an update of this review is undertaken it will be important in the context of increased future research output on COVID-19 to broaden search terms on aerosol to (AEROSOL) or (DROPLET) or (PARTICLE) or (NUCLEI) and for coronavirus to (COVID or CORONAVIRUS or CORONAVIRUS INFECTIONS or SARS-CoV-2).

Figure 3: Publication selection strategy flowchart



Peer review

Peer review was undertaken for 55% percent of the literature included in this rapid review. Many articles had been made available prior to publishing to enable timely sharing of evidence on COVID-19. Lack of peer review does not necessarily indicate a poor research study. It could be expected that a proportion of articles were still undergoing peer review. However, caution is advised in using and interpreting the information in this review. Table 4 in Appendix 3 denotes whether a study had been peer-reviewed at the time of this review.

Critical appraisal

Only 18 studies (18%) pertained to singing in groups and therefore the literature review was broadened to enable consideration of all questions.

1. Internal validity

Internal validity is the degree to which the findings are correct for the sample in the study (Rychetnik et al. 2004). It was beyond the scope of this study to undertake a detailed critical appraisal of the quality of each study. However, the Joanna Briggs Institute critical appraisal checklists were used to evaluate observational studies from the field of public health, meta-analyses, systematic reviews and literature reviews. Theoretical modelling and experimental studies from the area of science relating to airborne particle behaviour were not evaluated because this was beyond the capability of the reviewer. A score of 70% denoted a higher quality study. While most studies achieved >70%, literature reviews consistently scored below 70% due to not including the detail of their search strategy.

1.1 Meta-analyses, systemic reviews and literature reviews

The critical appraisal checklist for systematic reviews and research synthesis (Aromataris et al. 2015) was used to appraise systematic reviews, literature reviews and meta-analyses. The quality of each article in Table 4 is expressed as the percentage of the following 11 questions in the checklist that were answered as 'yes'.

1. Is the review question clearly and explicitly stated?
2. Were the inclusion criteria appropriate for the review question?
3. Was the search strategy appropriate?
4. Were the sources and resources used to search for studies adequate?
5. Were the criteria for appraising studies appropriate?
6. Was critical appraisal conducted by two or more reviewers independently?
7. Were there methods to minimize errors in data extraction?
8. Were the methods used to combine studies appropriate?
9. Was the likelihood of publication bias assessed?
10. Were recommendations for policy and/or practice supported by the reported data?
11. Were the specific directives for new research appropriate?

1.2 Observational studies from the field of public health

The critical appraisal checklist for case series (Munn et al. 2020) was used to appraise observational studies from the field of public health. The quality of each case series article in Table 4 is expressed as the percentage of the following 10 questions in the checklist that were answered as 'yes'.

1. Were there clear criteria for inclusion in the case series?
2. Was the condition measured in a standard, reliable way for all participants included in the case series?
3. Were valid methods used for identification of the condition for all participants included in the case series?
4. Did the case series have consecutive inclusion of participants?
5. Did the case series have complete inclusion of participants?
6. Was there clear reporting of the demographics of the participants in the study?
7. Was there clear reporting of the clinical information of the participants?
8. Were the outcomes or follow-up results of cases clearly reported?
9. Was there clear reporting of the presenting site(s)/clinic (s) demographic information/
10. Was statistical analysis appropriate?

1.3 Editorials, commentary, correspondence, discussion papers and risk management guidance

Several studies classified as editorial, correspondence, blog, commentary, correspondence, discussion paper or risk management guidance were evaluated using the JBI critical appraisal tool for expert opinion (McArthur et al. 2015).

1.4 Cross-sectional studies

Two cross-sectional studies were evaluated with the JBI critical appraisal tool for analytical cross-sectional studies (Moola et al. 2020).

2. Generalisability

External validity is the extent to which the study is true for the general population (Rychetnik et al. 2004). Well-designed systematic reviews, meta-analyses and randomized controlled trials are considered to have better internal validity due to their design and size than, observational studies including cohort and case-control studies, which in turn are considered better than experimental studies and expert opinion (Murad et al. 2016). Most studies in this review were classified as

- theoretical modelling,
- experimental studies from the area of science relating to airborne particle behaviour,
- reviews of the literature
- observational studies of outbreaks from the field of public health.

There were very few randomized controlled trials, meta-analyses or systematic reviews that reported on the questions of interest to this rapid review. Therefore most studies in this review were considered less generalisable and caution is advised in using and interpreting information from this review. However due to its recent emergence, this the only evidence existing directly relating to COVID-19. Therefore the scientific evidence about COVID-19 transmission in the community is described as fragmented and emerging. It was noted in the process of conducting this review that experimental and

observational research was focussed on gaining real-life measurements of, for example, particle emission from singers. These measurements are beginning to be used in theoretical models that can predict, for example, the minimum infectious dose. As this process of scientific research progresses there will eventually be greater certainty about the characteristics of COVID-19 that will inform changes to advice concerning singing in groups.

Limitations

The review was limited by the resources available to the Adelaide Choral Network in September and October of 2020. There has been no attempt to provide an exhaustive review of all literature pertaining to COVID-19 and community transmission events involving singing and choirs, rather to identify agreed themes.

Only journal articles in the public domain were included. The review was largely limited to papers published in 2020. Only 55% of the literature had been peer reviewed at the time of completing this review.

Most of the studies or commentary reviewed were of an observational or theoretical nature or were secondary reporting of research. Detailed information about each study can be found in Appendix 3. Therefore caution is advised about using and interpretating the information in this review.

Although every attempt has been made to clearly synthesize and explain scientific information in this rapid review, no attempt has been made to express scientific concepts in plain language in the recognition that many choral singers also have significant professional experience in the sciences. The risk management guidance informed by this rapid review of the scientific literature is written in plain language.

Appendix 3: Table 4 Study summaries

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
1. What quantity of aerosol and droplet is emitted from singers in comparison to speaking and breathing?								
Alsved, M et al, 2020, 'Exhaled respiratory particles during singing and talking', Aerosol Science and Technology,	24 Aug 2020	Singing	1. To investigate aerosol and droplet emissions during singing compared to talking and breathing 2. To examine the presence of SARS-CoV-2 in the emitted air 3. To test the efficacy of masks to reduce emissions	Experimental (from the airborne particle sciences)	- 12 volunteer singers (7 professional and 5 amateur) participated in measurement of aerosol and droplet emission - Singing generated more aerosol and droplets than talking - Louder singing had higher emissions than softer singing - Loud singing with exaggerated consonants had the highest emissions - Singing with masks reduced emissions	Not evaluated	Yes	Emission rates from singing documented.
Anderson, EL et al 2020, 'Consideration of the aerosol transmission for COVID-19 and public health. Commentary.' *Risk Analysis,* vol. 40, no. 5, pp. 902-907.	1 May 2020	Other	To review evidence for the likelihood of aerosol transmission of SARS-CoV-2	Literature review	- Evidence supporting aerosol transmission of SARS-CoV-2 included: • Case reports of asymptomatic transmission in the context of studies that show particles <1µm can be aerosolized • Empirical data showing SARS-CoV-2 can be suspended in aerosol	50% (due to search strategy not reported)	Yes	Aerosol transport of SARS-CoV-2 is likely
Althouse, BM et al, 2020, 'Stochasticity and heterogeneity in the transmission dynamics of SARS-CoV-2', arXiv:2005.13689v1[q-bio.PE]	27 May 2020	Other	To describe the potential types of superspreading events, how they influence transmission of COVID-19, and to provide recommendations for control	Theoretical modelling	- 4 types of super-spreading events were described • Biological described as individuals with high emission capability • Behavioural described as situations of multiple contacts • High-risk environments including hospitals • Opportunistic situations including choirs	Not evaluated	No	Interesting and supportive of control measures tailored to the characteristics of choirs

[1] The literature review was conducted in September 2020. Some studies may have been published after the period of this review.

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					- Opportunities to interrupt future super-spreading events included using risk-stratification in populations and location to target public health interventions			
Anfinrud, P et al, 2020, 'Visualizing speech-generated oral fluid droplets with laser light scattering.' New England Journal of Medicine DOI: 10.1056/NEJMc2007800.	15 Apr 2020	Other	To measure droplet emission during speech	Experimental (from the airborne particle sciences)	- Droplet size ranged was 20 -500 µm - "th" generated the most droplets - Number of droplets increased with volume - Masks reduced emissions	Not evaluated	Yes	Droplet emission was reduced using a mask
Asadi, S et al, 2019, 'Aerosol emission and super-emission during human speech increase with voice loudness', *Scientific Reports*, https://doi.org/10.1038/s41598-019-38808-z	20 Feb 2019	Other	To measure particle emission in different types of speech phonation	Experimental (from the airborne particle sciences)	- Volume of speech increased the particle emission rate in the four different languages tested - Particle size distribution was not affected by language spoken or volume - Some individuals had a much larger emission rate and behaved as super-emitters	Not evaluated	Yes	Supports the role of volume in increasing emissions Individuals noted to be possible super-emitters
Asadi, S et al, 2020, 'Effect of voicing and articulation manner on aerosol particle emission during human speech' *PLoS ONE,* vol 15, no. 1, pp. e0227699, https://doi.org/10.1371/journal.pone.0227699	27 Jan 2020	Other	To systematically investigate the effect of different phones (speech sounds) on the emission of particles	Experimental (from the airborne particle sciences)	- Large study of 56 participants - Vowels had a higher particle emission possibly due to lack of obstruction from the mouth and more extended time taken to speak them - Disyllabic words including plosive consonants eg gaga yielded more particles than voiceless fricatives eg s, h, f	Not evaluated	Yes	Speech may contrast with singing regarding voiceless fricatives
Bahl, P et al, 2020, Epub ahead of print. 'Droplet and aerosols generated by singing and the risk of COVID-19 for choirs', Clin Infect Dis, doi: 10.1093/cid/ciaa1241.	18 Sep 2020	Singing (Australian)	To describe the droplet spread from a singer using an image-based flow diagnostic system.	Experimental (from the airborne particle sciences)	- Visualisation of one singer singing a major scale using solfege, counting from 1- 10 and coughing voluntarily. - 75% of droplets moved less than 0.5m/s distributed in all directions - The majority of droplets expelled during singing followed the ambient airflow pattern behaving as aerosol	Not evaluated	Yes	Defines the velocity of particles emitted from singers

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Becher, L et al, 2020, 'First update. Risk assessment of the spread of breathing air from wind instruments and singers during the COVID-19 pandemic'.	23 Jul 2020	Other	To visualise the air spread associated with wind instruments and singing using the schlieren method	Experimental (from the airborne particle sciences)	- Singing with a lot of articulation generates more air spread - Changes in pitch did not generate more air spread	Not evaluated but noted to be brief report	Uncertain	Supportive of other authors findings of increased airborne particle emission with plosive consonants
Fenelly, KP, 2020, 'Particle sizes of infectious aerosols: implications for infection control', Lancet Respir Med, vol. 8, pp914-24, doi.org/10.1016/S2213-2600(20)30323-4	24 Jul 2020	Other	To review scientific literature on aerosols generated by individuals with respiratory infections and to discuss the optimal use of masks in a healthcare setting	Editorial	- Evidence of aerosol production for tuberculosis and other infectious respiratory disease supported the likelihood of aerosol transmission of SARS-CoV-2. - Surgical masks did not protect the wearer but did reduce exposure to infectious aerosols in other individuals.	100%	No	Supports aerosol transmission but doesn't evaluate singing
Gregson, FKA et al in press, 2020 'Comparing the respirable aerosol concentrations and particle size distributions generated by singing, speaking and breathing', Chemrxiv, doi.org?10.26434/chemrxiv.12789221.v1.	Sep 2020	Singing	To measure the amount and weight of aerosol and droplet emitted in breathing, speaking, coughing and singing in 25 professional singers.	Experimental (from the airborne particle sciences)	- Both speaking and singing show steep increases in aerosol production as measured by mass concentration with increasing volume.	Not evaluated	No	Incorporate advice about volume in guidance
Kähler, CJ et al, 2020, 'Singing in choirs and making music with wind instruments – Is that safe during the SARS-CoV-2 pandemic?', University of the Bundeswehr Munich, Germany		Singing	To examine the spread of both droplet and aerosol from singers and wind players using laser illumination	Experimental (from the airborne particle sciences)	- The air around a singer was only set in motion in the immediate vicinity of the mouth when singing. Therefore a physical distance of 1.5m was advised. - Staggered arrangement of singers was recommended to assist maintenance of physical distancing - Social behaviours such as hugging may contribute to direct contact transmission	Not evaluated but little evidence is cited for claims	No	A weaker study of emissions from singers

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					- Fans were not recommended in an enclosed rehearsal room due to their role in mixing air			
Koch, WH, 2020, 'Applying aerosol science principles to airborne COVID-19 virus droplets', Technology resources international, inc., Sterling.	7 Aug 2020	Other	To review the literature explaining the behaviour of small droplets emitted during breathing, speaking, coughing and sneezing	Literature review	- Modern (since 2016) distributions of particle size now peak at 1micron due to the ability of modern equipment to detect small aerosol particles - Speech emitted a median of 1 particle/s at quiet volume, 3 for intermediate and 5.5 for loud. All were higher emissions than breathing. - It was noted that droplet sizes vary considerably - Droplet emission was shown to extend from 12 - 20 feet, over twice the 6 ft recommended by CDC for physical distancing - Settling time was dependent on droplet size with most 70µm particles settling out of the air by 5 seconds and travelling less than 3 ft.	44% (due to search strategy not reported)	No	Incorporate comparative evidence regarding breathing, speaking, coughing and sneezing. Excellent diagrams of airborne particle behaviour
Morawska, L et al, 2009, 'Size distribution and sites of origin of droplets expelled from the human respiratory tract during expiratory activities', Aerosol Science, vol. 40, pp256-269.	2009	Other	To describe the droplet sizes and concentrations in liquid produced during different respiratory activities.	Experimental (from the airborne particle sciences)	- Airborne particles consisting of secretions from the respiratory tract were produced in 2 size distribution modes, one with most particles of below 0.8 µm at average concentrations of 0.75cm-3 and another at 1.8µm and concentration of 0.14 cm-3 - Speech caused modes of 3.5 and 5µm in concentrations of 0.04 and 0.16cm-3	Not evaluated	Yes	Speech caused respiratory particle emissions higher than breathing. Singing was not tested
Murbe, D et al, 2020, preprint 'Aerosol emission is increased in professional singing', Technische		Singing	To measure aerosol and droplet emission rates and size distributions from professional singers	Experimental (from the airborne	- Respiratory particle emission rates for singers varied between 753.4 and 6093.14particles/s for 8 professional	Not evaluated	No	Very relevant but low sample size

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Universität Berlin, 10.14279/depositonce-10375.3				particle sciences)	singers in comparison to 4.71-84.76P/s for mouth breathing - Singers emitted >99% of particles as aerosol (<5µm diameter) - Female singers showed higher median particle source strengths (concentration x airflow) than male - Emission rates were higher with louder volumes			
Somsen, GA et al, 2020, comment, 'Small droplet aerosols in poorly ventilated spaces and SARS-C0V-2 transmission', Lancet, vol. 8, pp. 658-9, doi.org/10.1016/S2213-2600(20)30245-9	27 may 2020	Other	To better understand the behaviour of airborne respiratory particles in coughs and speech	Commentary	- Aerosol sized particles were emitted from both coughing and speaking, and predominated in speaking - Droplet velocity on coughing ranged from 2 to 7 m/s at the start of the cough - Large droplets fell to the ground within 1s - Particles <5µm took 9min to fall to the ground when emitted from a height of 160cm - Airborne times for halving of aerosol particles in relation to good and poor ventilation was 30s and 5minutes respectively	100%	No	Supports avoidance of poorly ventilated public spaces.
Stadnytskyi, V et al, 2020, 'The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission', *Proc. Natl. Acad. Sci*, vol., 117, pp. 11875–11877, doi.org/10.1073/pnas.2006874117.	13 May 2020	Other	To derive quantitative estimates for the number and size of aerosol particles emitted after speech	Experimental (from the airborne particle sciences)	- Aerosol particles were noted to dehydrate after emission due to evaporation, causing concentration of virus and slowing the fall of the aerosol - The distance a droplet fell was dependent on its volume and the speed of emission - Speed of emission was affected by phonation. - The concentration and particle count were increased for louder volumes. - 'th' was noted to produce more airborne particles	Not evaluated	Yes	Aerosol generating activities such as speaking can deliver a significant dose of virus.

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					- The model showed that 1min of loud speaking generated at least 1000 virion containing aerosol particles that remained airborne for >8min			
Tang, S et al, 2020, 'Aerosol transmission of SARS-CoV-2? Evidence, prevention and control', Environment International, doi.org/10.1016/j.envint.2020.106039	7 Aug 2020	Other	To review the evidence of aerosol emission of COVID-19	Literature review	- Smaller droplet sized particles (<5µm) have been shown to travel further before eventually sedimenting out onto surfaces - The viral load was said to be higher in the lungs than the upper respiratory tract - Survival times for SARS-CoV-2 in aerosol ranged from 90 minutes in an experimental situation to 16 hours - Although coughing and sneezing released higher numbers of airborne particles, breathing and speaking were noted to be more extended activities and therefore critical routes for virus emission - There was a reported 37% probability that a 50µm droplet prior to dehydration will contain at least one virus, reducing to 0.37% for a 10 µm particle - Surfaces including hospital tables, bed rails, floors and ventilation grates have been shown to be contaminated with SARS-CoV-2 RNA. - The authors reported Somsen et als research showing that with effective ventilation of a room, the number of airborne particles can be halved in 30 seconds, but this could take up to 1-4 minutes with poor ventilation and 5 min with no ventilation	44% (due to search strategy not reported)	Yes	Comprehensive review article summarizing research relevant to this review

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
2. What is the infectious potential of aerosol and droplets emitted from singers?								
Basu, S, 2020, preprint, 'Exposure to a COVID-19 carrier: transmission trends in respiratory tract and estimation of infectious dose', medRxiv, doi.org/10.1101/2020.07.27.20162362.	31 Jul 2020	Other	To use human respiratory physiology and inhaled airflow to estimate the minimum infectious dose of SARS-CoV-2	Theoretical modelling	- Most SARS-CoV-2 in airborne particles of 2.5-19µm was noted to enter the body through the upper airway nasopharynx. This area acted as a seeding zone for the lungs - A minimum infectious dose was calculated to be in the range of 100 virions	Not evaluated	No	Understanding of how infection takes place
Bax, A et al, 2020, 'SARS-CoV-2 transmission via speech-generated respiratory droplets', Lancet Infectious Disease, https://doi.org/10.1016/S1473-3099(20)30726-X	11 Sep 2020	Other	Rebuttal of criticism of their research	Correspondence	- Research confined to one speaker was justified as the original study was said to investigate the process of emission of airborne particles	100%	No	Not the original study but supportive of emission of aerosols associated with speaking
Buonanno, G et al, 2020, 'Quantitative assessment of the risk of airborne transmission of SARS-CoV-2 infection: Prospective and retrospective applications', Environmental International, doi.org/10.1016/j.envint.2020.106112	6 Sep 2020	Other	To test a model of risk of infection from an asymptomatic infected SARS-CoV-2 person in an indoor microenvironment,	Theoretical modelling	- A retrospective assessment of the Skagit Valley outbreak was undertaken. - Modelling showed that airborne transmission was the main route of contagion. - It was shown that the outbreak could have been explained by the environmental conditions rather than a super-emitter.	Not evaluated	Yes	A new methodology for modelling emission and exposure which can be used to support the management of an epidemic
Chong, KL et al, 2020, in press 'Extended lifetime of respiratory droplets in a turbulent vapour puff and its implications on airborne disease transmission', Medrxiv,, doi.org/10.1101/2020.08.04.20168468.	4 Aug 2020	Other	To estimate the lifetime of SARS-CoV-2 in emitted droplets using numerical simulations	Theoretical modelling	- Classical estimates of the lifetime of aerosol droplets may be too low - Reduction of environmental humidity indoors may reduce the lifetime of infectious aerosol and droplet - Aerosol particles were found to be small enough to penetrate to the lower lung - Ventilation that reduced the ambient humidity would effectively decontaminate	Not evaluated	No	Comparative estimates are given which may be useful to other theoretical models

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					air. This argument was based on a finding that the lifetime of airborne particles of 10µm was extended by 30 times on the traditional estimates in an ambient environment of 50% humidity - At the start of a cough, most 100µm droplets fallout within 200 milliseconds reaching between 0.1 and 0.7m from the face - Face masks reduce droplet input into an indoor environment and can also reduce inhalation of respiratory droplets			
De Olivera, PM et al, 2020, preprint, 'Evolution of spray and aerosol from respiratory releases: theoretical estimates for insight on viral transmission', doi.org/10.1101/2020.07.23.20160648.	24 Jul 2020	Other	To model the airborne particle emission from coughing and speaking including estimating: • the size distribution and life-time of the aerosol and droplet cloud • the emitted viral dose and likelihood of infection	Theoretical modelling	- 1 hour post emission of a cough or speaking only aerosol was left in the air - An upward ventilation flow sustained a higher viral dose at face - Downward ventilation is considered optimal to remove droplets from face height	Not evaluated	No	Comprehensive model
Giovanni, A et al, 2020, 'Transmission of droplet-conveyed infectious agents such as SARS-CoV-2 by speech and vocal exercises during speech therapy: preliminary experiment concerning airflow velocity', European Archives of Oto-Rhino-Laryngology, https://doi.org/10.1007/s00405-020-06200-7	16 Jul 2020	Other	To determine the velocity of exhaled air during vocal exercises	Experimental (from the airborne particle sciences)	- Average initial velocities of airborne particle emissions from speakers demonstrated between • 77 and 180cm/s for long exhalation • 100 and105cm/s for 't' whispered • 99 and 132cm/s for 'f' isolated and brief • 94 and108 cm/s for f sustained • 28 and 38 cm/s for 'a'	Not evaluated	Yes	Evidence of different particle emission speeds on spoken phonation

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Heneghan, C et al, 2020, 'COVID-19: What proportion are asymptomatic?', blog	6 Apr 2020	Other	To determine the proportion of people with SARS-CoV-2 who were asymptomatic	Blog	- There were no definitive studies establishing the proportion of asymptomatic individuals - Heneghan examined 21 outbreaks reporting the percentage of asymptomatic individuals to be between 5-80%	100%	No	The likelihood of an asymptomatic infectious individual being at a rehearsal is not known.
Karimzadeh, S et al, 2020, 'Review of infective dose, routes of transmission, and outcomes of COVID-19 caused by SARS-CoV-2 virus: comparison with other respiratory viruses', www.preprints.org.	25 Jul 2020	Other	To summarise the literature on infective dose, viral load, route of transmission, exposure, and outcome in coronaviruses, influenza, rhinovirus, coxsackievirus, adenovirus and respiratory syncytial virus.	Literature review	- The extent of human susceptibility to SARS-CoV-2 has not been well described - There was some evidence that increased dose of virus at exposure correlated with higher viral load and severe symptoms - Higher viral load measures did not reflect the severity of COVID-19 - The minimum infective dose of COVID-19 in humans, was determined to be higher than 100 particles.	78%	No	Confirms lack of firm data on minimum infectious dose
Kohanski, MA et al, 2020, 'Review of indoor aerosol generation, transport, and control in the context of COVID-19', International Forum of Allergy & Rhinology, DOI: 10.1002/alr.22661	1 Jul 2020	Other	To review the literature on indoor aerosol and droplet viral respiratory transmission for otorhinolaryngology practice.	Literature review	- Indoor transmission of SARS-CoV-2 was noted to be influenced by • Aerosol and droplet properties • Indoor airflow • Virus-specific factors • Host-specific factors	22% (due to search strategy not reported)	Yes	Good summary of aerosol mitigation strategies although not specific to singing.
Kolinski, JM et al, 2020 in press, '	3 Aug 2020	Other	To quantitatively analyse 20 superspreading events involving 200 infected and 1000 exposed people	Theoretical modelling	- The model supports aerosol transmission of SARS-CoV-2. - The model uses the rate of aerosolized virus shed by an infected person (using H2N2 characteristics) and the virus destabilisation rate for SARS-CoV-2 to describe a minimum infective dose similar to other respiratory viruses - The average virion shedding rate for other coronaviruses was 32 600 virions / hour	Not evaluated	No	Supportive of aerosol transmission routes

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Ong, SWX et al, 2020, 'Transmission modes of severe acute respiratory syndrome coronavirus 2 and implications on infection control: a review', Singapore Medical Journal, doi.org/10.11622/smedj.2020114	30 Jul 2020	Other	To summarise the literature on transmission routes for SARS-CoV-2	Literature review	- Multiple transmission routes for SARS-CoV-2 included: • Environmental contamination • Airborne through aerosol or droplet • Stool shedding • Bioaerosols containing faecal material from toilets	50% (due to search strategy not reported)	Yes	Supportive of aerosol transmission routes
Vuorinen, V et al, 2020, 'Modelling aerosol transport and virus exposure with numerical simulations in relation to SARS-CoV-2 transmission by inhalation indoors', Safety Science, https://doi.org/10.1016/j.ssci.2020.104866	11 Jun 2020	Other	To model the spread of aerosols in closed environments and the potential for infection	Theoretical modelling	- Theoretical exposure times to inhale approximately 100 aerosols ranged from 1 second to 1 hour depending on the situation.	Not evaluated	Yes	Estimate of infection times in indoor environments
3. What is the infectious potential of fomites in choral rehearsal settings?								
Azuma, K et al, 2020, 'Environmental factors involved in SARS-CoV-2 transmission: effect and role of indoor environmental quality in the strategy for COVID-19 infection control', Environmental Health and Preventive Medicine, https://doi.org/10.1186/s12199-020-00904-2	3 Nov 2020	Other	To review the environmental factors in buildings, spatial dynamic and building operational factors involved in SARS-CoV-2 transmission, and including a strategy to prevent transmission in a building environment	Literature review	- Contamination may occur by direct deposition of the virus on a surface by an infected person or by settling of contaminated airborne particles onto a surface. - Survival of SARS-CoV-2 on dry inanimate surfaces was 1 - 7 days, with the presence of proteins found in human sputum increasing the survival to 7 days - A minimum rate of 30m^3/h per person provides protective ventilation in closed rooms - Sunlight has been noted to rapidly destroy SARS-CoV-2 on fomites	56% (Due to search strategy not reported)	Yes	Provides information about persistence of SARS-CoV-2 on fomites and building ventilation strategies

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Chia, PY et al, 2020, 'Detection of air and surface contamination by SARS-CoV-2 in hospital rooms of infected patients', Nature Communications, | https://doi.org/10.1038/s41467-020-16670-2	29 May 2020	Other	To determine airborne particle size and surface contamination in a hospital environment	Observational study (cross-sectional) from public health sciences	- Concentrations of SARS-CoV-2 virus RNA in the air were in the range of 1840 to 3380 RNA copies/m3 - 56% of hospital rooms had at least one environmental surface contaminated by viral RNA - There was a correlation between the level of contamination and the intensity of symptoms in people with COVID-19 occupying the space	88%	Yes	Provides information about surface contamination with SARS-CoV-2
Duda-Chodak, A et al, 2020 inpress, 'COVID-19 pandemic and food: Present knowledge, risks, consumers fears and safety', Trends in Food Science & Technology, safety, doi.org/10.1016/j.tifs.2020.08.020.	29 Aug 2020	Other	To analyse the current state of knowledge about SARS-CoV-2 and food borne infections	Literature review	- Viruses have been demonstrated to transmit through food. - Food packaging has the potential to act as a fomite	40% (due to search strategy not reported)	Yes	Provides information about the risk of food sharing at gatherings
Jefferson, T et al, 2020, 'SARS-CoV-2 and the role of orofecal transmission: Evidence brief', Analysis of the transmission dynamics of COVID-19: An open evidence review, http://www.cebm.net/evidence-synthesis/transmission-dynamics-of-covid-19/.	17 Jul 2020	Other	To conduct an open evidence review on oro-faecal viral transmission	Literature review	- SARS-CoV-2 can also be transmitted through the oro-faecal route as it is excreted in urine and faeces - 29 relevant studies (23 published and 6 preprints) reported that approximately - 12% of patients with SARS-CoV-2 infection reported gastrointestinal symptoms, including diarrhoea, nausea, and vomiting.	50% (due to search strategy not reported)	Uncertain	Oro-faecal is a possible route of transmission of SARS-CoV-2
National Collaborating Centre for Methods and Tools, 2020, 'Rapid review: What is known about how long the virus can survive with potential for infection on surfaces?', https://www.nccmt.ca/knowledge-	31 July 2020	Other	To summarize what is known about how long the virus can survive with potential for infection on surfaces	Literature review	- There is no conclusive evidence about SARS-CoV-2 survival times on surfaces, or whether that virus would be infectious - Evidence of virus survival was greater on smoother surfaces such as plastic or steel than cardboard or cotton	90%	No	The shorter survival of the virus on cardboard may have application to contamination

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repositories/covid-19-rapid-evidence-service.								of musical scores
Santarpia, JL et al, preprint, 'Aerosol and surface transmission potential of SARS-CoV-2', Medrxiv, doi.org/10.1101/2020.03.23.20039446	3 Jun 2020	Other	To describe viral contamination in a hospital treating patients with SARS-CoV-2	Observational study (from public health sciences)	- Widespread contamination with SARS-CoV-2 viral DNA was found on many surfaces. - Some testing of surfaces and air supported airborne transmission.	100%	No	Support for aerosol transmission
4. Under what circumstances have people become infected with COVID-19 during choral rehearsals?								
Charlotte N, 2020, 'High rate of SARS-CoV-2 transmission due to choir practice in France at the beginning of the COVI-19 pandemic', *Medrxiv*, https://doi.org/10.1101/2020.07.19.20145326	5 Aug 2020	Singing although an early outbreak in March 2020	To describe a case of high transmission linked to an indoor choir rehearsal in France in March 2020	Observational study (from public health sciences)	- 27 participants attended a choir rehearsal on 12 March 2020. - The venue was indoor 45 m2 and non-ventilated. - No choir member reported having been symptomatic in the prior 10 days. - Mean age of participants was 66.9 yrs. - 70% of participants were diagnosed with COVID-19 in the following 12 days.	100%	No	Indicative of high attack rates in choral rehearsals where risk mitigation strategies were not used.
Alberta COVID-19 Scientific Group, 2020, Rapid Evidence Report. Singing as a risk for transmission of SARS-CoV-2 virus, Alberta Health Services,	22 May 2020	Singing although an early review	To investigate the evidence for singing as a risk for transmission of SARS-CoV-2	Literature review	Recommendations included: • Given the risks of singing, albeit paucity of evidence, a precautionary approach is recommended. • Singing may pose a risk due to multiple contributing factors. • Multiple mitigation strategies should be strictly followed and reinforced. • When reductions in COVID-19 measures are introduced, singing should not be re-established in the first round unless new evidence emerges	90%	No	Include the need for multiple risk mitigation strategies in choir rehearsals Note the precautionary approach to re-establishing singing within the context of this early study

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Naunheim, MR et al in press 2020, 'Safer singing during the SARS-CoV-2 pandemic: What we know and what we don't.' *Journal of Voice*, https://doi.org/10.1016/j.jvoice.2020.06.028	29 Jun 2020	Singing	To provide guidance about risk mitigation for all forms of singing including choral based on the best available data	Literature review	- Findings are based on epidemiological studies and 'common sense' - Specific empirical research about the risks of choral singing was noted to be needed - Recommendations included: • Rehearse outside when possible, inside with windows and doors open, or fans blowing air away from singers • Use face masks • Physical distancing of 6 feet (1.5m) • Rehearse in shifts or small groups (cohorting) • Shorten rehearsal times • Limit extraneous activities • Wipe down items • Screen for symptoms • Avoid direct contact • Practice meticulous hygiene • Unwell singers should be directed to stay home	40% (due to search strategy not reported) Authors acknowledge weakness of the reported study designs	Yes	Include the risk mitigation strategies recommended in ACN guidance,
Hamner, L et al 15 May 2020, 'High SARS-CoV-2 Attack rate following exposure at a choir practice – Skagit County, Washington, March 2020.', *MMWR*, vol 69, no. 19, pp 606-610.	15 May 2020	Singing	To provide an epidemiological report of an outbreak at a choir rehearsal	Observational study (from public health sciences)	Circumstances of the rehearsal reported included: • One individual with onset of symptoms 3 days previously attended the rehearsal on 10 March 2020 • A point-source exposure on 10 March was considered likely • There were no known cases in the community at the time of the rehearsal, although undertesting may have been an issue	90%	Yes	The choir mitigated further spread by quick communication to members and notification to the public health department.

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					• There were several opportunities for droplet and fomite transmission including sharing snacks and stacking chairs together, (contrasts to Miller's report of the same outbreak) • Only 61 of 122 members attended the rehearsal through personal choice • 32 of 60 members were confirmed positive for COVID. Another 20 members had probable COVID-19 making an attack rate of 53-87% • Seating was not consistent with 6ft physical distancing (contrasts to Miller's report) • 45min rehearsal with all 61 singers. Then they split into 2 groups in different rooms followed by a break, followed by 50min full rehearsal • Rehearsal duration was 2 ½ hours • Median age of those who were ill was 69yrs • 85% of cases were female • Mean interval from illness to hospitalisation was 12 days • 75.5% of patients with severe illness were > 65yrs • 22.6% of patients had 2 or more underlying medical conditions			

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Blaisdell, LL et al, 2020, 'Preventing and mitigating SARS-CoV-2 transmission – Four overnight camps, Maine, June-August 2020, *MMWR*, vol. 69, no. 35, pp 1216-1220	4 Sep 2020	Other	To describe the success of non-pharmaceutical interventions (NPI) in 4 summer camps in Maine comprising 1022 attendees from 41 states and international locations	Observational study (from public health sciences)	- Secondary transmission of COVID-19 was avoided using multilayered prevention and mitigation strategy. This included pre-camp testing, small segregated cohorts and quarantine of attendees testing positive and their contacts	90%	Yes	Support for multilayered swift mitigation strategies
Furuse, Y et al, 2020, 'Clusters of coronavirus disease in communities, Japan, January-April 2020', *Emerging Infectious Diseases*, vol.26, no.9, pp2176-2179.	9 Sep 2020	Singing	To describe 61 COVID-19 clusters in Japan.	Observational study (from public health sciences)	- Events involving singing at karaoke parties were among the 61 clusters investigated - The largest non-healthcare-related cluster was a live music concert involving >30 people. Confirmed cases of COVID-19 included performers, audience and event staff.	80%	Yes	Singing in a live music event and karaoke parties were associated with transmission
Ghinai, I et al, 2020, 'Community transmission of SARS-CoV-2 at two family gatherings- Chicago, Illinois, Februrary-March 2020', *MMWR*, vol.69, no15, pp446-450.	17 Apr 2020	Other Noting it was an early outbreak	To describe an occurrence of community transmission in Chicago, Illinois	Observational study (from public health sciences)	- A report of 16 cases of COVID acquired during a family gathering. - Median incubation period was 4 days - 3 deaths - CDC physical distancing and protective self-isolation for people at risk of poor outcomes are recommended	80%	Yes	Accessory evidence
James, A et al early release 19 May 2020, 'High COVID-19 attack rate among attendees at events at a church-Arkansas, March 2020', *MMWR*, vol 69, https://www.cdc.gov/mmwr/volumes/69/wr/mm6920e2.htm?s_cid=mm6920e2_w.	19 May 2020	Singing Noting it was an early outbreak	To describe an outbreak at faith-based activities during the period 6-11 Mar 2020	Observational study (from public health sciences)	- Age specific attack rates were • 6.3% (≤ 18 yrs) • 59% (19-64 yrs) • 50% (≥65 yrs) - Primary transmission to 35 of 92 people - Secondary transmission to 26 people - The church was closed after symptoms were noted but this was 6 days after the events of initial exposure - Activities in several gatherings included social contact, buffet food and singing - 6 of 7 people were hospitalized and the 3 people who died were >65 yrs	70%	Yes	Note fast action after the outbreak to cease activities and notify public health services was not enough to stop secondary transmission

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Leclerc, QJ et al, 2020, 'What settings have been linked to SARS-CoV-2 transmission clusters?', Wellcome Open Research, vol.5, pp83, https://doi.org/10.12688/wellcomeopenres.15889.2	1 May 2020	Other	To gather information on reported clusters of COVID-19 to determine the settings in which SARS-CoV-2 transmission has occurred	Observational study (from public health sciences)	- The setting with the greatest number of reported clusters was households. - The majority of reports were from China and Singapore. - Most clusters were associated with indoor or indoor/outdoor settings. - Most clusters involved transmission to less than 100 people. - The largest clusters were within hospitals, aged care homes, large co-habiting venues, food processing plants, prisons, schools, shopping and ship settings. - 15 religious gatherings were identified comprising in total 570 cases. These occurred in USA, Singapore, South Korea, China, India, Netherlands and Germany. Secondary transmission, for example, the Shincheonji Church of Jesus in South Korea, may range up to 5000 cases. - Characteristics of large transmission events were a large number of attendees in confined spaces with close physical contact	30% definitely un-representative but possibly other details published elsewhere	Yes	Context for transmission events in community settings
O'Keeffe, J, 2020, 'COVID-19 risks and precautions for choirs', BC National Collaborating Centre for Environmental Health, Vancouver.	10 Jul 2020	Singing	To provide a brief overview of the risks of singing in groups, and the precautions that might minimise those risks	Literature review	Outbreaks in choral rehearsals or gatherings with singing included • Skagit Valley Washington • Concergebouw auditorium, Netherlands • Berlin Cathedral • Japan • Korea • Michigan, USA Common factors included • Large groups	70%	No	Critical analysis of the risks of singing in groups

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					• Enclosed spaces • Poor ventilation • Long duration of contact • Social interactions with direct contact • Sharing of food, drinks or equipment • Shared transport			
Pung, R et al, 2020, 'Investigation of three clusters of COVID-19 in Singapore: implications for surveillance and response measures', Lancet, vol.395, pp1039-46.	16 Mar 2020	Other although an early cluster	To investigate the first community transmission events for SARS-CoV-2 in Singapore	Observational study (from public health sciences)	- Three clusters were reported - 1 cluster was in church attendees. - The study reported common factors of direct social contact and indirect contact through contaminated fomites. - The authors concluded that a swift response to contact tracing and quarantine would be required to contain transmission	90%	Yes	Include church based transmission events Note the success of swift responses to confirmed cases
Szablewski, CM et al, 2020, 'SARS-CoV-2 transmission and infection among attendees of an overnight camp – Georgia, June 2020', MMWR, vol. 69, no, 31, pp1023-1025, doi:10.15585/mmwr.mm6931e1	7 Aug 2020	Singing	To describe an outbreak at a summer camp for children in Georgia, USA	Observational study (from public health sciences)	- An outbreak in an overnight camp in Georgia involved 138 trainees, 120 staff members and 363 campers - The attack rate was 44% despite the implementation of public health recommended risk mitigation strategies. - Age-based attack rates were 51% (6-10 yrs), 44% (11-17 yrs) and 33% (18-21yrs) - Attack rates were increased with length of stay at the camp and larger numbers of attendees in a cabin. - Daily singing and vigorous cheering were noted in the camp activities. - Risk mitigation included: • All attendees including staff were required to provide documentation of a negative test for SARS-CoV-2in thee 12 days before arrival.	80%	Yes	Include as an activity involving singing where adherence to public health guidance was unsuccessful in preventing an outbreak.

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					• Staff but not children wearing masks • Cabin cohorting - There was no attempt to open windows and doors for increased ventilation in buildings			
Van Damme, W et al, 2020, 'The COVID-19 pandemic: diverse contexts; different epidemics – how and why?' BMJ Global Health, vol.5, e003098, doi:10.1136/bmjgh-2020-003098	4 July 2020	Other	To understand why COVID-19 varies in disease behaviour in different contexts	Discussion paper	- The COVID-19 pandemic has played out differently in different contexts. - Climate, population structure, social practices and pre-existing immunity are all factors in variable transmission events. - In comparison, measles took 1000s of years to reach all communities. SARS-CoV-2 has spread to all countries in a few months despite measles being more transmissible. Increased travel and more dense communities are said to have played a role in this fast spread.	Not evaluated	Yes	Tables are a good resource. This paper gives a good qualitative overview of the challenges of responding to this pandemic
Wei, WE et al, 2020 Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. MMWR, vol.69, pp411–415, DOI: http://dx.doi.org/10.15585/mmwr.mm6914e1external icon.	10 Apr 2020	Other	To review clinical and epidemiological features of 7 clusters of COVID-19 from 23 January -16 March in Singapore to determine whether presymptomatic transmission occurred.	Observational study (from public health sciences)	- The findings suggest that transmission can occur due to exposure to pre-symptomatic individuals. - 2 of the 7 clusters involved singing classes. - Possible routes of transmission included aerosol, droplet and fomite - Risk mitigation strategies cannot rely on limiting contact with persons with symptoms - Social distancing may be a more important risk mitigation strategy	100%	Yes	Note that risk mitigation strategies cannot rely on asking persons with symptoms to avoid rehearsals Social distancing may be a more important risk mitigation strategy
Yong, SEF et al, 2020, 'Connecting clusters of COVID-19: and epidemiological and	21 Apr 2020	Singing	To elucidate the chain of SARS-CoV-2 transmission in 3 cluster events in Singapore	Observational study (from	- Three reported clusters, 2 in church attendees are linked to 1 individual through serological testing	90%	Yes	Church based transmission event

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serological investigation', Lancet, vol.20, pp809-815				public health sciences)	- Church B had 17 cases arising from contact with 1 individual - Social contact and singing are mentioned as possible routes of transmission			
Groups at risk of poor outcomes								
Armitage, R and Nellums, LB, 27 2020 'The COVID-19 response must be disability inclusive', *The Lancet*, https://doi.org/10.1016/ S2468-2667(20)30076-1.	Mar 2020	Other	NA	Commentary	- People living with disability are affected by COVID-19 through increased inequities in access to health services and public health messaging, and increased susceptibility to COVID-19	83%	No	Include disability inclusiveness in guidance
Hatcher, et al, 2020, 'COVID-19 among American Indian and Alaska native persons – 23 states, January 31-July 3, 2020', MMWR, vol. 69, no. 34, pp1166-1169.	28 Aug 2020	Other	To describe the prevalence of COVID-19 in American Indian and Alaskan Native people	Observational study (prevalence study) from public health sciences	- American Indian and Alaskan Native people in 23 American states were at 3.5 times risk of infection with COVID-19	89%	Yes	Note ethnicity as a risk factor
Jordan, RE et al, 2020, 'Who is most likely to be infected with SARS-CoV-2?', *Lancet*, vol. 20, pp995-996.	15 May 2020	Other	To summarize what is known about who is most likely to be infected with SARS-CoV-2	Editorial Commentary	- Prevalence in UK was reported to be: • 5% (<18yrs) • 18.2% (40 + years) - Higher risk of infection was noted in • Men • People with black cultural heritage • People with obesity - Increased mortality was noted in • People of older age • Men • People with ethnic minority cultural background • People with obesity • People living in greater deprivation - Comorbidities and smoking played a role in poor prognosis -	100% Source studies show limitations including being unrepresent ative of the total population,	No	Reports on studies not the focus of this review

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Children								
Ahmed, M et al, 2020, 'Multisystem inflammatory syndrome in children: A systematic review', EClinical Medicine, doi.org/10.1016/j.eclinm.2020.100527	13 Aug 2020	Other	To systematically review the clinical characteristics and outcomes for children with multisystem inflammatory syndrome	Systematic review	- Multisystem inflammatory syndrome was noted to be a rare new complication of SARS-CoV-2 infection in children.	100%	Yes	
American Academy of Pediatrics, 2020, 'COVID-19 planning considerations: Guidance for school re-entry.'		Other	To support school re-entry during the coronavirus disease 2019 (COVID-19) pandemic.	Risk management guidance	- Risk control measures determined by American Academy of Pediatrics for American schools and preschools.	Not evaluated	No	Informs control measures for children while at school
Götzinger, F et al, 2020, 'COVID-19 in children and adolescents in Europe: a multinational, multicentre cohort study', Lancet Child and Adolescent Health, vol. 4, pp653-61.	25 June 2020	Other	To capture data on children and adolescents with SARS-CoV-2 across Europe to inform health care planning	Observational study (from public health sciences)	- Children were less effected by SARS-CoV. - A small proportion of children developed severe disease, but fatal outcomes were rare	80%	Yes	Confirms the rare occurrence of severe COVID-19 in children
Kim, L et al, 2020, 'Hospitalization rates and characteristics of children aged <18 years hospitalized with laboratory-confirmed COVID-19 – COVID-NET, 14 states, March 1-July 25, 2020', MMWR, vol. 69, no. 32, pp1081-1088	14 Aug 2020	Other	To describe the characteristics of children aged <18 years hospitalized with confirmed COVID-19	Observational study (from public health sciences)	- A higher rate of admissions for SARS-CoV-2 was found in children from Hispanic and African-American cultural backgrounds. - Hospitalizations were also increased for children with obesity, chronic lung disease, and those aged <2 years with a history of prematurity	80%	Yes	Additional information on the characteristics of children at risk
Li, X et al, 2020, 'The role of children in transmission of SARS-CoV-2: a rapid review', Journal of Global Health, vol. 10, no. 1, doi: 10.7189/jogh.10.011101.	June 2020	Other	To summarize the literature on SARS-CoV-2 in children, outbreaks in schools and studies estimating the prevalence of COVID-19 in children	Literature review	- Children were considered to be probably less frequently infected by SARS-CoV-2 - Prolonged faecal shedding in children highlighted the possible increased risk of faecal-oral transmission in children - Seroprevalence studies will establish whether children are infected and asymptomatic, or not as infected as adults	90%	Yes	Additional information on routes of transmission for children

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Orben, A et al, 2020, 'The effects of social deprivation on adolescent development and mental health', Lancet, vol. 4, pp 634-40.	12 June 2020	Other	To review the literature on the consequences of social deprivation in adolescence	Commentary	- Physical distancing has been noted to reduce adolescents' face-to-face contact at a time when developmentally they have an increased need for peer interaction	100%	Uncertain	Secondary effects on children of control measures should be anticipated
Rajapakse, N et al, 2020, 'Human and novel coronavirus infections in children: a review', Paediatrics and international child health, doi.org/10.1080/20469047.2020.1781356	8 Jun 2020	Other	To review the literature on corona virus infections in children	Literature review	- Children were noted to be more likely to be asymptomatic or have mild illness. - Prolonged faecal shedding in children highlights the possible increased risk of faecal-oral transmission in children	40% (due to search strategy not reported)	Yes	Additional information on routes of transmission for children
Viner, RM et al, 2020, 'School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review', Lancet, vol.4, pp 397-404.	6 April 2020	Other	To determine whether school closures assisted suppression of corona virus outbreaks in China, Hong Kong, and Singapore	Systematic review	- Closures of schools were not found to assist very much with outbreak control	78%	Yes	Support for the ineffectiveness of school closures
5. What aspects of indoor ventilation are effective in preventing infection during choral rehearsals?								
Azimuddin, A et al, 2020, 'Shifting approach to environmentally mediated pathways for mitigating COVID-19: A review of literature on airborne transmission of SARS-CoV-2', www.preprints.org, doi:10.20944/preprints202007.0194.v1	9 Jul 2020	Other	To summarize the current evidence about airborne transmission of SARS-CoV-2 and the available control measures	Literature review	- The authors provided evidence that established airborne transmission of SARS-CoV-2. - Theoretical modelling reviewed in the paper attempted to incorporate multiple variables including airflow, humidity, temperature, spatial patterns, virus titres and length of exposure. - Further research was recommended addressing UV, heat inactivation, and improved ventilation technologies	40% (due to search strategy not reported)	No	Good summary of mitigation strategies for airborne particle transmission of COVID-19

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Bazant, MZ et al, 2020, 'Beyond six feet: A guideline to limit indoor airborne transmission of COVID-19', medRxiv doi.org/10.1101/2020.08.26.20182824	1 Sep 2020	Other	To develop a theoretical model of risk of indoor infection with COVID-19	Theoretical modelling	- A mathematical model of the risk of exposure in an indoor space was developed using room geometry, ventilation rate and respiratory activity. - Several case scenarios were tested using the model. In the worst-case scenario of close contact and using the features of the Washington choral outbreak, the time it would take for exposure via aerosol exposure was estimated to be 1 hour. - Face masks were noted to almost completely eliminate the risk of exposure to a respiratory jet by slowing the momentum of the particles in the emission. However, the risk associated with ambient pathogen remained.	Not evaluated	No	
Blocken, B et al, 2020, 'Can indoor sports centers be allowed to re-open during the COVID-19 pandemic based on a certificate of equivalence?', Building and environment, doi.org/10.1016/j.buildenv.2020.107022	31 May 2020	Other but important because equivalent activities to singing	A discussion of the challenges in safely re-opening indoor sports centres after lockdown	Literature review	- The concept of a certificate of equivalence was discussed. This would involve rating venues in advance of use for the control measures in place and capacity to accommodate events. For example a venue may be certified for indoor activities that generate aerosol because it had high-intensity ventilation.	30% (due to search strategy not reported)	Uncertain	Ideas for control measures from indoor activities with risks similar to choral singing
Corriea, G et al, 2020, 'Airborne route and bad use of ventilation systems as non-negligible factors in SARS-CoV-2 transmission', Medical Hypotheses, doi.org/10.1016/j.mehy.2020.109781	14 April 2020	Other	To review the literature regarding airborne transmission of SARS-CoV-2 and the role of ventilation systems in propogations	Literature review	- The authors summarised the evidence for airborne transmission through aerosol and large droplets. - Ventilation systems operating without HEPA filters, with poor maintenance and low air exchange may be responsible for outbreaks via aerosol transport	40% (due to search strategy not reported)	No	Ventilation systems should be well maintained and operated to ensure adequate air exchange

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Hartmann, A et al, 2020, 'Risk assessment of rehearsal rooms for choir singing regarding aerosols loaded with virus', Hermann-Rietschel-Institut, DOI: http://dx.doi.org/10.14279/depositonce-10388		Singing	To determine concentrations of aerosol in 3 German concert halls	Theoretical modelling	- Shortening rehearsals to 30min with a 15min ventilation break, reducing the number of singers and utilising either natural or mechanical ventilation were suggested - The effectiveness of opening windows was suggested to be dependent on weather conditions	Not evaluated	No	Suggestion of ventilation breaks after 30 min of rehearsal in rehearsal rooms with no mechanical ventilation
Hayashi, M et al, 2020, 'Measures against COVID-19 concerning summer indoor environment in Japan', Japan Architectural Review, doi: 10.1002/2475-8876.12183	27 Jul 2020	Other	To summarize the literature on ventilation of Japanese spaces	Literature review	- Air-conditioning systems were noted to have the facility to maximise the intake of fresh air - It was recommended that 24 hour air-conditioning be used. Alternatively it was recommended to start the air conditioning system several hours before the occupancy and ensure it was not turned off until the room was not in use - The authors discussed the benefits of air purifiers - When using open windows as the main ventilation strategy, air should travel from the open window past individuals to another window or door - High efficiency particulate air filters (HEPA) were noted to be routinely used in surgical theatres. They collected 99.97% of particles >0.3µm - Fans that assist inflow through windows were helpful	30% (due to search strategy not reported)	Yes	Innovative solutions for both natural and mechanical ventilation including in hot weather

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Kähler, CJ et al, 2020, 'Can mobile indoor air cleaners effectively reduce an indirect risk of SARS-CoV-2 infection by aerosols?', CJ et al, 2020, 'Can mobile indoor air cleaners effectively reduce an indirect risk of SARS-CoV-2 infection by aerosols?' doi:10.13140/RG.2.2.14081.68963	7 Aug 2020	Other	To design and test a portable indoor air cleaner	Experimental (from the airborne particle sciences)	- This paper described the experimental trial of a portable air cleaner. It halved aerosol particle concentrations sized 0.1-0.3µm in 6-15 minutes depending on the rate of air flow in a room of 80m^2. - The shape of the room and objects in the room were demonstrated to negatively influence the filtration of all areas of the room. In these cases the authors suggested multiple air cleaners	Not evaluated	No	A possible control measure to reduce aerosols generated during rehearsals
Li, Y et al, 2007, 'Role of ventilation in airborne transmission of infectious agents in the built environment – a multidisciplinary systematic review.', *Indoor Air*, vol 17, pp2-18.	2007	Other	To review the literature on airborne transmission of infections	Systematic review	- The authors found strong and sufficient evidence to demonstrate that ventilation in buildings was associated with the spread of infectious diseases including measles, tuberculosis, and SARS-C oV-1.	100%	Yes	Excellent underlying evidence for the spread of infectious diseases through airborne means.
Li, Y et al, 2020, 'Aerosol transmission of SARS-CoV-2. Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant', *medRxiv*, doi.org/10.1101/2020.04.16.20067728.	22 Apr 2020	Other	To investigate the role of aerosol in a transmission event in a restaurant in Guangzhou.	Theoretical modelling	- Aerosol transmission was implicated via the airflow and seating pattern of patrons.	Not evaluated	No	Early evidence of aerosol transmission
Miller, SL et al, 2020, 'Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event', Indoor Air, doi: https://doi.org/10.1101/2020.06.15.20132027.	15 Jun 2020	Singing	To use the Skagit Valley outbreak at a choir rehearsal to model the amount of infectious emission during a choir rehearsal and the loss rate of airborne virus through ventilation, fomite deposition or biological decay	Theoretical modelling	- Reported viral loads in the mouth ranged from 102 to 1011 copies per mL of respiratory fluid. Viral loads varied peaking at onset of symptoms - Circumstances of the rehearsal included: • One individual with onset of symptoms 3 days previously attended the rehearsal on 10 March 2020	Not evaluated	No	Note variability in the amount of emission of aerosol

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					• No known community transmission was reported at the time of the rehearsal • Precautions included use of hand sanitizer, no hugging or handshaking. Physical distancing was implemented at the rehearsal • Only 61 of 122 members attended the rehearsal through personal choice • 32 of 60 were confirmed positive for COVID. Another 20 probable cases resulted in attack rates of between 53 and 87% • Seating was broadly distributed across 120 chairs • It was a 45min rehearsal with all 61 singers, then splitting into 2 groups in different rooms. This was followed by a break, then by a 50min full rehearsal • Rehearsal duration was 2 ½ hours • Heating was provided by a commercial forced-air furnace with 3 supply air registers situated 2.4m above the floor and a single return at 0.15m above the floor. It was not used throughout the rehearsal. The furnace was fitted with outside make-up air and combustion air. It was not known how much outside air was supplied that evening. The furnace also had a filter which had an efficiency of 30-65% for airborne particles of 1µm or larger • No exterior doors were open - An emission rate of 970 quanta per hour of virus was modelled theoretically.			

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Melikov, AK et al, 2020, 'Intermittent occupancy combined with ventilation: An efficient strategy for the reduction of airborne transmission indoors', Science of the total environment, vol. 744 https://doi.org/10.1016/j.scitotenv.2020.140908	15 Jul 2020	Other	To test an improved combined control measure using intermittent breaks in occupancy and ventilation systems that don't meet the requirement for energy efficiency under pandemic conditions	Theoretical modelling	- Some building ventilation systems may not be able to operate efficiently on maximum intake of outdoor air in which case other means of introducing outdoor air may be used, for example, intermittent occupancy or window installed fans.	Not evaluated	Yes	
Ontario Medical Advisory Secretariat, 2005, 'Air cleaning technologies: an evidence-based analysis', Ontario Technology Assessment Series, vol. 5, no. 17, pp. 52	2005	Other	To summarize literature on the effectiveness of indoor air cleaners	Literature review	- Positioning of air cleaners maximised their effectiveness - In combination with filtration or UV decontamination air cleaners were reported to be of variable effectiveness but could work up to 99% efficiency.	100%	Yes	A possible control measure to reduce aerosols generated during rehearsals
Qian, H et al, 2010, 'Natural ventilation for reducing airborne infection in hospitals', Building and environment, vol. 45, pp.559-565, doi:10.1016/j.buildenv.2009.07.011	2010	Other	To undertake a field measurement study of natural ventilation in a tuberculosis hospital	Experimental (from the airborne particle sciences)	- Ventilation rates achieved in a hospital setting through natural ventilation in combination with open windows and fans creating negative pressure resulted in 69 ac/h. - This was much higher than mechanical ventilation.	Not evaluated	Yes	
6. How effective are cleaning protocols in preventing viral persistence on fomites in choral rehearsals?								
Gharpure R, et al. 2020, 'Knowledge and Practices Regarding Safe Household Cleaning and Disinfection for COVID-19 Prevention — United States, May 2020'. MMWR vol. 69, pp705–709,	5 June 2020	Other	To survey adult USA citizens regarding knowledge and practice about household cleaning and disinfection	Observational study (Cross-sectional) from public health sciences	- There has been a sharp increase in calls to poison centres regarding cleaners and disinfectants since COVID-19. - Knowledge and practice gaps in safe preparation, use and storage of cleaning products were identified to have occurred since the onset of COVID-19 in USA	100%	Yes	Pertinent to the likely compliance with environmental disinfection protocols

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
doi.org/10.15585/mmwr.mm6923e2external.								
Liu, Y et al, 2020, 'Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals', Nature, vol. 582, pp557-561.	27 Apr 2020	Other	To measure the viral RNA in aerosols in two Wuhan hospitals	Experimental (from the airborne particle sciences)	- The levels of SARS-CoV-2 in aerosol in hospitals ranged between 1 and 113 particles per m^{-3}. - Aerosol transmission is considered feasible - Re-aerosolisation in toilet areas may have accounted for high virus concentrations.	Not evaluated	Yes	Supports effective cleaning which can reduce virus deposited on surfaces after aerosol sedimentation
Meyer, J et al, 2020, in press, 'An evaluation of cleaning practices at a teaching hospital', American Journal of Infection Control, doi.org/10.1016/j.ajic.2020.06.187	2020	Other	To assess the surface cleaning practices in hospitals using UV marker technology	Experimental study (from public health sciences)	- Surface cleaning protocols in hospital patient's rooms were followed on average 63%.	63%	Yes	Demonstrates the need for diligence in cleaning protocols
Brurberg, KG, 2020, 'COVID-19 epidemic: Contact based transmission of SARS-CoV-2 – a rapid review', Oslo, Norwegian Institute of Public Health.	Apr 2020	Other	To summarize systematic reviews and primary studies of the direct transmission of corona viruses including SARS-CoV-2 via infected fomites	Literature review	- SARS-CoV-2 can survive on inanimate surfaces and remain infectious for several days. - UV irradiation or heating reduced the virus	50% (poor reporting)	Uncertain	Demonstrates the need for diligent cleaning protocols
Kanamori, H, 2020 inpress, 'Rethinking environmental contamination and fomite transmission of SARS-CoV-2 in the healthcare', Journal of Infection, doi.org/10.1016/j.jinf.2020.08.041	30 Aug 2020	Other	To urge caution in interpreting environmental contamination reports	Commentary	- Environmental contamination with SARS-CoV-2 RNA was argued to not necessarily infer that infectious material was present. - A randomised controlled trial by Mitchell et al reported by Kanamori found that an approach to cleaning which included: • communication with and training of staff • audits of effectiveness • choice of product • no touch cleaning technique	100%	No	Information about potential infectiousness of environments contaminated with viral RNA

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					was associated with improved cleaning in hospitals and a reduction in vancomycin-resistant enterococci in hospitals			
Kraay, ANM et al, 2020, ' Risk of fomite-mediated transmission of SARS-CoV-2 in child day-cares, schools, and offices: a modelling study', Medrxiv, doi.org/10.1101/2020.08.10.20171629.	13 Aug 2020	Other	To summarise the literature on surface cleaning and decontamination strategies.	Theoretical modelling	- The authors report fomite contamination to be a substantial source of risk, particularly in schools and child day-care centres. - Combining surface cleaning and decontamination with strategies to reduce pathogen shedding on surfaces was reported to help mitigate this risk. - Sampling to check the quality of cleaning may be important to ensure cleaning was achieving the aim of irradicating SARS-CoV-2.	Not evaluated	No	Sampling of cleaning may assist in determining how successful cleaning protocols have been
van Doremalen, N et al, 2020, correspondence, 'Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1', New England Journal of Medicine, vol. 382, pp.1564–1567.	16 Apr 2020	Other	To evaluate the stability of SARS-CoV-2 and SARS-CoV-1 on various surfaces	Experimental (from the airborne particle sciences)	- SARS-CoV-2 remained viable in aerosols for 3 hours - SARS-CoV-2 was stable on plastic and stainless steel. Viable virus was detected 72 hours later on these surfaces. - SARS-CoV-2 could not be measured on cardboard after 24 hours. - The median half-life of SARS-CoV-2 in aerosol was 1.2 hours - On stainless steel the half-life was 5.6 hours and on plastic 6.8 hours	Not evaluated	Yes	Key paper on fomite contamination
Vardoulakis, S et al, 2020, 'Commentary. Covid-19 environmental transmission and preventive public health measures', Australian and New Zealand Journal of Public Health, doi: 10.1111/1753-6405.13033.	2020	Other	To summarise the state of knowledge about SARS-CoV-2 in Australia	Commentary (Australian)	- Pertinent points included: • Extensive testing, contact-tracing and community containment has been effective in suppressing COVID-19 in Australia • Face masks may provide benefits due to reducing transmission from the host • Portable air cleaners may not be effective in suppressing airborne	100%	Yes	Australian advice. Excellent summary of control measures in Table 1

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
					transmission because they need long contact times to deactivate viruses. More research was needed on air cleaners • Hand hygiene is critical • The combination of multiple measures and their timing has been shown to be critical to transmission of COVID-19			
Yao, M et al, 2020, 'On airborne transmission and control of SARS-CoV-2', Science of the total environment, https://doi.org/10.1016/j.scitotenv.2020.139178	4 May 2020	Other	To analyse the impact of ozone, high temperature and low humidity on the survival of SARS-CoV-2 in aerosol	Theoretical modelling	- Regression analyses showed an effect on SARS-CoV-2 of • ozone concentration from 48.83-94.67µg/m3 • decreased humidity from 23.33-83.67% • temperature from 13.17-19 degrees Celsius.	Not evaluated but very poorly written	Yes	Additional ideas to deactivate SARS-CoV-2 in aerosol
7. What is the consensus for safe physical distancing in the choral rehearsal setting?								
Chu DK et al 2020, 'Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis.' *Lancet* , vol 395, no. 10242, pp.1973-1987, doi: 10.1016/S0140-6736(20)31142- 9.	27 June 2020	Other	To conduct a meta-analysis of physical distancing associated with the transmission of coronaviruses (SARS-CoV-1, MERS and SARS-C0V-2)	Meta-analysis	- A reduction of 82% in risk of transmission was found at a 1m distance from the source, and every 1m further away doubled the protection	100%	Yes	Important to note a large reduction in risk with each 1m increase in distance from a source
Echternach, M et al, 2020, 'Impulse dispersion of aerosols during singing and speaking', Medrxiv, doi: https://doi.org/10.1101/2020.07.21.20158832.	24 Jul 2020	Singing	To analyse the impulse dispersion dynamics of aerosols in professional choir singers using video of e-cigarettes in a controlled situation	Experimental (from the airborne particle sciences)	- Impulse dispersion to the front was greater than to the sides. - Physical distancing of 2m to the front and 1.5m to the side was recommended for singers	Not evaluated	No	A distance of 2-2.5m to the front and 1.5m to the side should be recommended for choir rehearsals and

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								singing a religious services. This is the best available evidence.
Irish Health Information and Quality Authority, 2020,'Rapid review of public health guidance on protective measures for vulnerable groups in the context of COVID-19', Health Information and Quality Authority, Dublin.	13 Jul 2020	Other	To review public health guidance from different countries for groups at high risk of severe illness from COVID-19	Literature review	- Groups at risk of poor outcome included: • People aged > 70 years • People with chronic illness including diabetes, high blood pressure, severe respiratory conditions, people in receipt of therapies that weaken the immune system - Diligence regarding risk mitigation strategies was advised for groups at risk of poor outcome	33% (due to search strategy not reported)	No	Good source of international information about vulnerable groups
Jones, NR et al, 2020, 'Two metres or one: what is the evidence for physical distancing in covid-19?', *Medrxiv*, doi: 10.1136/bmj.m3223.	25 Aug 2020	Other	To present evidence that current physical distancing advice is based on outdated science	Discussion paper	- Studies critically examining the basis of the 1-2m physical distancing recommendation found it to have originated from outdated research - More recent research has established much longer possible travel distances for airborne particles carried by strong airflows - It was recommended that multiple control measures integrated within a risk management strategy would provide the best protection	100%	Yes	Important emphasis on multiple control measures
Kamal, R et al, 2020, 'What is the evidence for social distancing during global pandemics? A rapid summary of current knowledge', Oxford Centre for Evidence Based Medicine, www.cebm.net/oxford-covid-19.	19 Mar 2020	Other	To conduct an open evidence review on the effectiveness of physical distancing	Literature review	- Evidence supported physical distancing as a means of delaying spread - Physical distancing should be part of a package of interventions - The effectiveness of individual control measures was likely to be limited.	56% (due to aspects of the search strategy not reported)	Uncertain	Physical distancing is an important control measure

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Qureshi, Z et al, 2020, 'What is the evidence to support the 2-metre social distancing rule to reduce COVID-19 transmission?', Oxford Centre for Evidence Based Medicine, https://www.cebm.net/covid-19/what-is-the-evidence-to-support-the-2-metre-social-distancing-rule-to-reduce-covid-19-transmission/	22 June 2020	Other	To summarise the evidence for the 2m physical distancing rule	Literature review	- Studies critically examining the basis of the 1-2m physical distancing recommendation found it to have originated from outdated research. Recent research has established much longer possible travel distances for airborne particles carried by strong airflows - The use of multiple control measures has been noted to achieve suppression of outbreaks - Control measures have included duration of exposure, number of individuals, indoor versus outdoor settings, level of ventilation and whether face coverings are worn.	78%	No	Support for multiple integrated control measures
Bourouiba, L, 2020, 'Turbulent gas clouds and respiratory pathogen emissions. Potential implications for reducing transmission of COVID-19', *JAMA*, vol 323, no 18, pp 1837-1838	12 May 2020	Other	To report on research suggesting a new model for respiratory emissions	Commentary	- Exhalations are made up of a multiphase turbulent gas cloud (a puff) that has its own particle dynamics - The higher humidity of the puff may extend the lifetime of aerosols due to lower evaporation rates in the puff	100%	Yes	Novel theories for aerosol behaviour that may increase infectivity
Bourouiba, L et al, 2014, 'Violent expiratory events: on coughing and sneezing', *J Fluid Mech*, vol 745, pp 537-563	24 Mar 2014	Other	To use experimental and theoretical modelling to describe the airborne particle emissions from violent expirations	Theoretical modelling	- Multiphase gas cloud dynamics may play a role in the extended distances travelled by airborne particles	Not evaluated	Yes	Novel theories for aerosol behaviour
8. What is the evidence for the effectiveness of masks in singing settings?								
Beesoon, S et al, 2020, 'Universal masking during COVID-19 pandemic: Can textile engineering help public health? Narrative review of the evidence?', Preventive Medicine, doi.org/10.1016/j.ypmed.2020.106236	11 Aug 2020	Other	To review the textiles used in masks	Literature review	- Characteristics of a good mask included a good filtration efficiency, low breathing resistance, as well as the mask being hypoallergenic, comfortable, washable and affordable - Konda et al reported in Beesoon et al found that tightly woven cotton fabrics	30% (due to search strategy not reported)	Yes	Pertinent information about the best textiles with which to make masks

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					filtered particles <300nm to 82% and 98% for particles >300nm - Multiple layers of different textiles increased filtration efficiencies for particles of 10nm-10 µm diameter to over 80%			
Cheng, Y et al, 2020, preprint, 'Distinct regimes of particle and virus abundance explain face mask efficacy for COVID-19', Medrxiv, doi.org/10.1101/2020.09.10.20190348.	11 Sep 2020	Other	To explain the effect of abundance regimes on the efficacy of masks.	Theoretical modelling	- In a virus limited regime, mask efficacy and is increased. - Also in a virus limited regime the more preventive measures used, the more effective each measure became - Masks were noted to be an effective suppression strategy if used by the population	Not evaluated	No	Highly relevant to the low prevalence situation in South Australia where virus limited regimes are likely
European Centre for Disease Prevention and Control, 2020, 'Using face masks in the community', Stockholm, ECDC.	8 April 2020	Other	To provide guidance on the suitability of face masks in the community in order to reduce the potential for pre-symptomatic or asymptomatic transmission of COVID-19.	Risk management guidance	- Washable masks were considered decontaminated after washing in 60 degree celsius water. - It was recommended that care be taken to avoid touching the mask if possible while wearing it - Surgical and non-medical masks were worn to protect others and did not necessarily confer protection to the wearer. This was attributed to the incorrect fitting and removal of the mask - A correctly fitted face mask was noted to cover the full face from the bridge of the nose to below the chin	100%	No	Good summary of mask use in low prevalence circumstances
Fisher, KA et al, 2020, 'Factors associated with cloth face covering use among adults during the COVID-19 pandemic – United States, April and May 2020', MMWR, vol. 69, no 28, pp933-937.	17 Jul 2020	Other	To investigate the factors associated with compliance of face mask use in USA	Cross-sectional	- Clear and consistent messaging about the purpose and process of wearing masks has been associated with higher rates of compliance	71%	Yes	Reports on the likely compliance with face mask wearing

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Greenhalgh, T, 2020, 'Face coverings for the public: Laying straw men to rest', Journal of Evaluation in Clinical Practice, vol. 26, pp1070-1077.	6 May 2020	Other	Rebuttal of criticism of their research	Commentary	- A mask that is 60% effective at blocking viral emission from the wearer and worn by 60% of the population reduced the reproductive rate of COVID-19 resulting in effective community suppression - Cotton weaves with high thread count or double layer of two different fabrics provided high filtration efficiency	100%	Yes	
Kähler, CJ et al, 2020, 'Fundamental protective mechanisms of face masks against droplet infection', Journal of Aerosol Science, https://doi.org/10.1016/j.jaerosci.2020.105617	28 Jun 2020	Other	To show using fluid physics how effective masks are at protecting against droplet infection	Experimental (from fluid physics science)	- Most people were thought not to wear and remove their mask in a way that minimises transmission - Leakage of airborne particles from the sides of masks or from poorly fitted masks was demonstrated in experimental testing - The use of any mask was found to prevent the wearer from touching their face frequently which was theorized to assist with preventing transmission via the hands	Not evaluated	Yes	Evidence on the effectiveness of masks that may be helpful to their use by singers
Ollila, HM et al, 2020, 'Face masks prevent transmission of respiratory diseases: A meta-analysis of randomized controlled trials', medRxiv, doi.org/10.1101/2020.07.31.20166116.	4 Aug 2020	Other	To determine the efficacy of masks worn by the general public in non-hospital and non-household settings	Meta-analysis	- Five randomised controlled trials of face masks were found for years prior to 2020. - Face masks decreased infections across all studies.	91%	No	Masks may be a helpful control measure for choral singers
Sommerstein, R et al 2020, 'Risk of SARS-CoV-2 transmission by aerosols, the rational use of masks, and protection of healthcare workers from COVID-19', Antimicrobial Resistance and Infection Control, doi.org/10.1186/s13756-020-00763-0.	2020	Other	To determine the risk of SARS-CoV-2 transmission by aerosols To evaluate the use of masks and discuss additional measures to protect health care workers	Literature review	- High quality surgical masks were noted to be as effective as face filtering pieces 2 in preventing droplet infection of health care workers - Inappropriate doffing and donning of masks was considered to contribute to transmission - Multiple control measures including hand hygiene was recommended	40% (due to search strategy not reported)	Yes	Masks may be a helpful control measure for choral singers within the context of multiple control measures

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
9. Implications for Risk Mitigation								
Duckett, S et al, 2020, Go for zero. How Australia can get to zero COVID-19 cases. Grattan Institute.	12 Sep 2020	Other	To summarize and discuss the health, social and economic costs associated with widespread COVID-19 infection, lockdowns and low level community transmission	Discussion paper	- A calibrated response depending of the number of new cases was recommended - Masks should be mandatory during high-risk activity when there are active cases in the community - The authors reproduced Jones et al's matrix for integrating multiple control measures	100%	No	Discussion of control measures for low prevalence conditions such as SA
Kucharski, AJ et al 2020, 'Effectiveness of isolation, testing, contact tracing, and physical distancing on reducing transmission of SARS-CoV-2 in different settings: a mathematical modelling study', Lancet Infect Diseases, doi.org/10.1016/ S1473-3099(20)30457-6	16 Jun 2020	Other	To estimate the reduction in transmission under different combinations of control measures and stratification by setting	Theoretical modelling	- The use of multiple risk mitigation measures was estimated to achieve control of outbreaks. - A high proportion of cases and their contacts would need to self-isolate to bring the reproductive number lower than 1. In combination with moderate physical distancing, self-isolation and contact tracing control of an outbreak could be achieved more efficiently	Not evaluated	Yes	Support for multiple control measures
MacIntyre, CR, 2020, 'Case isolation, contact tracing, and physical distancing are pillars of COVID-19 pandemic control, not optional choices', Lancet Infect Diseases, doi.org/10.1016/ S1473-3099(20)30512-0	16 Jun 2020	Other (Australan)	To provide argument for the effectiveness of multiple control measures in controlling an outbreak.	Commentary	- The use of surveillance testing, contact tracing and quarantining of contacts, with physical distancing of 1-2m, travel restrictions and face masks provided the best chance of suppression of significant outbreaks, in comparison to relying solely on one of these control measures.	100%	No	Support for multiple control measures
Spahn, C, Richter et al B, 2020, 'Risk assessment of a coronavirus infection in the field of music.' Frieberger Institut fur Musickermedizin an der	17 July 2020	Singing	To conduct a risk assessment specific to wind playing and singing	Risk management guidance	- Louder volumes of singing produced more aerosol and droplet than softer vocalisations - Increased phlegm may contribute to increased infectiousness of singers	100%	No	Highly relevant discussion of control measures for choirs and

Citation[1]	Date	Importance (Singing focus, Other focus)	Study Aim	Type of study	Findings	Quality of Evidence (% relevant JBI checklist answered yes)	Peer reviewed (Yes/No/ Uncertain)	Relevance to this review
Hochschule fur Musik Frieburg, Frieberg.					- Carbon dioxide traffic light monitoring system for the effectiveness of ventilation was recommended for choir rehearsals - Poor ventilation was noted in several choir outbreaks - A minimum of 4-8 air changes/hour was recommended - Exploring outdoor rehearsals was advised - Singing in churches was considered possible with physical distancing and masks - Ventilation in churches with at least 10m ceilings was considered to be good - Population based mask use was noted in successful suppression of outbreaks - Multiple control measures were advised - Control measures differentiated to the local conditions was advised - Additional control measures such as regular testing, risk assessment questionnaires, and rapid testing were suggested			instrumental groups

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