

COVID-19 Scientific Advisory Group

Rapid Evidence Report

Topic: Singing as a risk for transmission of SARS-CoV-2 virus

For asymptomatic/presymptomatic and symptomatic people with COVID-19, does singing pose a risk of transmission of COVID-19, and how can this be mitigated (e.g.; additional physical distancing, masks, other)?

Context

- A number of media reports (Feder, 2020; Salaun, 2020; Reader, 2020; Lanese, 2020; Kasulis, 2020) regarding COVID-19 infection and transmission from choir members has prompted questions from the public regarding the risk of transmission of SARS-CoV-2 virus via singing.
- Report by the Centre for Disease Control and Prevention (CDC) on the Washington choir COVID-19 outbreak (March 2020) confirms that 53 of 61 choir members who attended a choir practice March 10, 2020 became infected with SARS-CoV-2 (32 confirmed and 20 probable cases). One member, identified as the index patient, reported cold-like symptoms on March 7, 2020 and tested positive for the SARS-CoV-2 virus. Of the 53 infected, three were hospitalized and two died. Virus transmission was most likely due to close proximity during the practice and potentially augmented by the act of singing. The authors comment that the attack rate was higher than seen in other clusters and describe the outbreak as a COVID-19 super-spreading event (Hamner *et al.*, 2020)
- Current COVID-19 guidance from the Government of Alberta to reduce risk in small gatherings (less than 15 people) includes a ban on singing, including religious gatherings, citing that "...as infected people can transmit the virus through their saliva or respiratory droplets while singing" (Government of Alberta, 2020).
- Current COVID-19 guidance from the Government of Canada defines religious services as non-essential gatherings. Recommendations include measures to reduce or avoid time spent by individuals in such settings. However, there is also recognition that such gatherings may provide needed support and have cultural implications. As such, there appears to be openness to leaving the occurrence of such gatherings to the discretion of individual groups, and these gatherings will commence at some point.
- The information in this rapid review is intended for the Chief Medical Officer of Alberta to support an evidence-based response to public inquiries regarding choir activities.

Key Messages from the Evidence Summary

- While limited in quantity, published literature suggests that singing could be an aerosol generating respiratory activity, and that singing may generate more respiratory particles (including aerosols) than normal talking.
- There is a gap in the scientific knowledge regarding the aerosolization of COVID-19 in particular for such activities.

- The evidence that COVID-19 is transmitted through singing is largely limited to media reports, and it is uncertain whether the transmission that occurred in these settings was related to aerosolization through singing, or through droplet or contact transmission.

Committee Discussion

The review was discussed by the Scientific Advisory Committee on May 1, 2020. The committee agreed it is unclear whether the risk of transmission of the SARS-CoV-2 virus via singing may be caused by aerosolizing of respiratory particles, or large droplets being expelled, or a combination, or social behaviors associated with close groups (close contact, handshaking, hugging etc.). However, there appeared to be agreement that this possibility should not be excluded, given the lack of evidence. One committee member highlighted the literature on tuberculosis and singing as it provides some evidence that singing can be an aerosol-based mode of transmission for other diseases. However, another committee member cautioned comparing TB transmission to SARS-CoV-2 transmission. The initial recommendations were modified to acknowledge this challenge. There was agreement that restrictions on singing should be maintained while COVID-19 is circulating within the community, even when relaxations start to be introduced.

Practical considerations and guidance

Given the paucity of research on this topic and poor understanding of aerosol generating respiratory activities and their relationship to pathogen transmission, it is challenging to develop evidence-based recommendations for the public regarding singing and mitigation strategies to prevent the transmission of the SARS-CoV-2 virus while singing in group settings (e.g. choir, religious service).

Based on available evidence, the position of the World Health Organization (2020) is that COVID-19 is primarily transmitted through via respiratory droplets (>5-10 μm in diameter) from close contact with an infected (symptomatic) person or indirect contact via fomites on surfaces of objects used on the infected person or in their immediate environment. Transmission via aerosol particles (<5 μm in diameter) may occur, but this is typically felt to be restricted to specific circumstances. Several studies suggest that aerosol is a plausible mode of transmission (Morawska & Cao, 2020; van Doremalen *et al.*, 2020).

Another important issue for consideration is the link suggested between singing and potential religious gathering based outbreaks. Although singing often occurs during religious services, attendance does not necessarily mean participating in a choir or singing. Given the proximity with which people are during a religious service, other modes of transmission of COVID-19 (including droplets and contact via fomites) are possible, rather than just assuming aerosol transmission via singing. When religious gathering places are opened, physical distancing, hand hygiene and attention to cleaning will remain critical. In particular, patients with any symptoms suggestive of COVID-19 including especially any upper respiratory or influenza like illness symptoms, should follow isolation precautions and should not be attending public gatherings.

Recommendations

Given the potential risk associated with singing and SARS-CoV-2 transmission, albeit paucity of evidence, a precautionary approach is recommended:

1. Since singing may pose a risk of transmission due to multiple contributing factors, restrictions on singing in a group setting (e.g. choir, religious service) should be maintained, particularly in indoor or enclosed environments.
2. Since the action of singing in group settings (e.g. choir, religious service) occurs in close proximity to others, prolonged contact and direct contact via actions such as handholding and sharing materials such as books, appropriate social distancing, hand hygiene before and after the activity, considerations of masking (when social distancing is not possible), and any other relevant public health recommendations should be strictly followed and reinforced. Individuals with any respiratory symptoms should not take part and should be under isolation as per public health guidance.
3. When reductions of current COVID-19 public health measures are introduced, restrictions regarding singing as discussed in this context should be maintained and not included in the initial round(s) of measures reduced unless new evidence emerges suggesting there is no significant potential additive risk.

Summary of Evidence

An exhaustive literature search was conducted by two librarians from Knowledge Resources Service (KRS). The literature for this review was retrieved from a database search which included Medline, PubMed, CINAHL, TRIP Pro, Google Scholar, Google, LitCOVID, CEBM, WHO, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, BMJ Best Practices, Medrxiv Preprints, covidevidence.com, and Ebsco COVID Protal. The search was not date limited.

24 articles were identified from the initial search and 8 additional resources. A second search was conducted which specifically focused on epidemiological studies and research on expiration when singing. The search did not produce any additional references. A third search was conducted which was a cited reference search in regard to the Loudon and Roberts (1968) study identified in the first search. No additional references emerged from this citation-based search.

Eight articles and 3 additional resources from the first search were included in the review after screening for inclusion and exclusion criteria. Of the 8 articles, 3 are included in the evidence summary below. One resource listing from the search was included as it was an epidemiological report. Editorials, opinion pieces and commentary articles were excluded from the evidence summary. The remaining five articles and two resources identified in the literature search are included for context and background purposes. The remaining articles (13) included in this review were identified by cross checking reference lists of the articles in the initial search results. Two articles included in the evidence summary below were identified through the cross checking process.

Limitations of this review

Key limitations of this review are: 1) the paucity of research evidence and apparent knowledge gap on the topic of aerosol generating respiratory activities in context of pathogen transmission, specifically in relation to singing and COVID-19, 2) rapid turnaround time for this review, which precludes potential inclusion of studies related to other respiratory infections (notably influenza and tuberculosis) and via respiratory activities such as talking or loud talking, and 3) the only primary research study included in

this review should be interpreted with caution given the sample size and results based on use of technology/equipment that has likely advanced since time of publication (1968).

Evidence Challenges and Gaps

There is no research that investigate singing specifically in relation to transmission risk of the SARS-CoV-2 virus. There is also a paucity of scientific evidence on singing as an activity that poses risk of transmission of other infectious diseases such as influenza and tuberculosis. More broadly, the area of aerosolization of respiratory expirate is limited and has seemingly attracted little scientific attention to date (Morawska, 2006).

Given the paucity of scientific evidence specific to COVID-19 and singing, a comparison of singing to other respiratory activities, notably coughing and sneezing, was considered, however not pursued. The rationale being that the limited research available classifies singing as an aerosol generating respiratory activity (Loudon & Roberts, 1968; Morawska *et al.*, 2009; Chao *et al.*, 2009; Asadi *et al.*, 2019; Atkinson *et al.*, 2019; Patterson & Wood, 2019), whereas coughing and sneezing is determined to cause infection primarily via respiratory droplets. Research on tuberculosis and singing indicates singing as a source of transmission and is supportive of the theory that singing may generate aerosols that carry the infectious pathogen (Bates *et al.*, 1965). However, a direct comparison to the SARS-CoV-2 is challenging given the significant difference in the infectious agents – tuberculosis is a bacterium and airborne whereas SARS-CoV-2 is a virus and current evidence indicates it is generally spread through respiratory droplets, though it can be carried in aerosols in specific circumstances (as stated under practical recommendations).

If singing is accepted as a significant aerosol generating activity, it is important to consider that other factors may influence or impact the transmission via aerosol include generation process, composition of the expirate (which will be a mix of various droplet sizes), volume of the particles produced in the expirate, pathogen concentration, and environmental conditions (Nicas *et al.*, 2005; Morawska, 2006 ; Atkinson *et al.*, 2009; Asadi *et al.*, 2019; Asadi *et al.*, 2020;). In addition, what is produced during a respiratory activity varies greatly within and between individuals (Atkinson *et al.*, 2009; Asadi *et al.*, 2019). This individual variability is also relevant in relation to the phenomenon of “superspreaders” – defined in this literature, although discussed in a limited way, as individuals who infect many more than the average, generating significantly more secondary cases (Atkinson *et al.*, 2009; Asadi *et al.*, 2019).

There are currently no epidemiological reports or studies available on transmission of the SARS-CoV-2 virus within singing groups (e.g. choirs). The epidemiological reports identified as relevant to the question include service attendance, singing and choir participation. However, as noted above (under practical considerations), singing does not necessarily occur at all religious events.

Evidence from secondary and grey literature

Epidemiological reports

The epidemiological report on the March 2020 Washington choir outbreak was published by the Centers for Disease Control and Prevention (CDC) in the Morbidity and Mortality Weekly Reports publication (Hamner *et al.*, 2020). The public health investigation was based on interviews with choir members and hospital records, and included choir members who attended practice on March 3 and/or March 10, 2020. The findings of the investigation identified one individual as symptomatic, presenting

with cold-like symptoms (who likely became ill on March 7) at the March 10 practice, who tested positive for the SARS-CoV-2 virus (RT-PCR testing). Seventy eight members attended the March 3 practice and 51 ended up ill; 50 of the 51 then attended the March 10 practice. There were 61 attendees at the March 10 practice, including the symptomatic (index) patient. Of those who attended the March 10 practice, 52 became ill (excluding the index patient). Point-source exposure is considered highly probable given the exposure to a symptomatic case, calculated odds of becoming ill based on practice attendance, and that illness onset for 49 of the 52 ill members began March 11-15. Of the total 53 ill members, 32 were confirmed and 20 were probably cases, reflecting an attack rate of 53.3% for confirmed cases and 86.7% for all cases. Of those who fell ill, three were hospitalized, two of whom died. Findings suggest that transmission was likely caused by close proximity among members during the rehearsal and possibly augmented by singing, which may emit aerosols. The authors conclude that the high (secondary) attack rate observed in this choir cluster may indicate that certain settings may be prone to higher transmission. They describe the outbreak as a super-spreading event.

A report published by the Centers for Disease Control and Prevention (CDC) in the Morbidity and Mortality Weekly Reports authored by Wei et al (2020) reports on 7 clusters of COVID-19 cases in Singapore, using clinical and epidemiologic data from 243 reported cases between January 23 and March 16, 2020. One of the seven clusters (Cluster A) describes transmission in a place of worship, where 5 individuals became infected. A second cluster (cluster F) traced transmission between 3 patients and includes a singing class and religious services as points of contact. Investigations did not identify another sources that could have transmitted the virus to those infected in these clusters. In these two clusters, pre-symptomatic exposure is suspected based on contact tracing of symptom development (1-3 days before source patients developed symptoms).

Guidelines

There is are no explicit guidelines specific to singing in relation to COVID-19.

Evidence from the primary literature

Epidemiological studies

a) COVID-19 – Singing and worship settings

There are no conclusive epidemiological studies or reports that could verify or dispute the media report suggesting a link between singing in close proximity and (increased risk of) SARS-CoV-2 transmission. However, the following 2 reports discuss religious service attendance as a point of contact among infected individuals.

Pung *et al.* 2020 report on three COVID-19 clusters in Singapore, based on epidemiological methods and clinical data used in the investigation. In one of the clusters the sources of exposure was a religious setting, which has a membership of 227. Of these 191 were contacted during the investigation and 5 individuals tested positive for SARS-CoV-2 virus (based on medical records) and the date of virus transmission was identified as Jan, 19 2020. The authors attribute the probable cause of transmission as close or prolonged contact within the clusters investigated.

Yong *et al.* (2020) identified three linked clusters which included two places of worship and a family gathering, using traditional epidemiological methods, serology analyses, and R-PCR testing. It appears that the Site A was initiating point of the transmission and the clusters were linked by two travelers from China who attend a service at Site A on Jan 19, 2020. The link was through one infected person who

attend services service in Site B, and an individual from Site B who then attended a family gathering. A total of 28 transmission were identified, of which five occurred in Site A, 17 were linked to Site B, and six to the family gathering. The authors conclude that transmission occurred primarily through close contact with a symptomatic individual and describe the setting as similar to other social settings such as schools and family gatherings.

b) Other infectious diseases (tuberculosis and influenza) – Singing and choirs

Kari-Purkayastha *et al.* (2009) report on high attack rates for influenza A (H1N1) observed in several settings in England, including a choir, where 169 choir members were exposed to 2 infected individuals over several hours in a 2 day period, resulting in further infection of 6 members. Symptomatic exposure was determined and aerosolization of respiratory secretions was cited as a contributing factor to the spread in the choir setting.

Mangura *et al.* (1998) report on an epidemiological investigation of a tuberculosis outbreak in a gospel choir in the United States. Of the 306 choir members, 5 cases of tuberculosis were identified and 19% were identified as reactors. The tenors in the choir were twice as likely to be infected, which the authors suggest may be partially explained by a combination of proximity among the tenors, the physical position of the tenors during a performance or practice in relation to the other singers, and aerosolization as the implicated mode of viral transmission.

Sacks *et al.* (1985) reported on a tuberculosis outbreak in a high school where a choir was one of several exposure points to a TB indexed patient. The choir met once per week for an hour. Testing was conducted on 11 of 17 choir members. Of the 11, 3 only had contact with the index patient through the choir and 2 (67%) were tuberculin reactors. The authors discussed that the aerosols generated by singing increased viral transmission was a possible explanation for the high positive tuberculin skin tests observed.

Primary studies

a) Singing and COVID-19 infection

No studies investigating singing and the risk of transmission of the SARS-CoV-2 virus were identified.

b) Singing and transmission of other infectious pathogens

There is a paucity of research on that investigate the respiratory activity of singing as a possible mechanism for transmission of infectious agents. The only directly relevant study is by Loundon and Roberts (1968) aimed to measure the number and size of droplets expelled while singing. Procedures were the same as those used for previous experiments on cough and talking. A series of experiments were conducted on 3 subjects. The reported number of droplets produced by singing was 4014, compared to 10,587 and 42,837 for talking and coughing, respectively. However, the proportion of droplet nuclei (or aerosols) was comparable between singing and coughing and approximately six times higher compared to normal talking. Although this research is consistently cited in research on transmission of infectious pathogens, the results need to be interpreted with caution. Key limitations are the small sample sizes (3 subjects) and sophistication of equipment compared to modern methods.

Evolving Evidence

There is limited evidence on the risk of transmission of SARS-CoV-2 via singing. Most of the associations are made within media reports where infections or “mini-outbreaks” occurred in individuals

who shared a common feature of having attended a meeting where group singing took place (e.g. choir practice). Current scientific knowledge related to this potential source of transmission is limited and determinations of aerosol transmission of COVID-19 continues to be discussed. Regular updates are recommended if new literature emerges on this topic, particularly given the implications if aerosol generation is established as a mode of transmission for singing and potentially related respiratory activities such as “loud speaking”.

Date question received by advisory group: April 26, 2020

Date report submitted to committee: April 30, 2020

Date of first assessment: May 1, 2020

Date of re-assessment and update: May 22, 2020

Authorship and Committee Members

This review was written by Ania Kania-Richmond and Heather Sharpe. It was scientifically reviewed by Nelson Lee, John Conly, Ryan Cooper (external reviewer), and Joseph Kim (external reviewer). The full Scientific Advisory Group was involved in discussion and revision of the document: Braden Manns (co-chair), Lynora Saxinger (co-chair), Alexander Doroshenko, Shelley Duggan, Elizabeth MacKay, Andrew McRae, Jeremy Slobodan, James Talbot, Brandie Walker, and Nathan Zelyas.

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COVID-19 Scientific Advisory Group Rapid Evidence Report

Appendix

List of Abbreviations

AHS: Alberta Health Services

CDCP: Centre for Disease Control and Prevention

COVID-19: Coronavirus Disease-2019

SAG: Scientific Advisory Group

KRS: Knowledge Resource Services

WHO: World Health Organization

Methods

Literature Search

A literature search was conducted by Lauren Seal and Nicole Loroff from Knowledge Resources Services (KRS) within the Knowledge Management Department of Alberta Health Services. KRS librarians searched databases for articles published from [state dates of publications of interest], and included: Medline, PubMed, CINAHL, TRIP Pro, Google Scholar, Google, LitCOVID, CEBM, WHO, Cochrane Library, Oxford CEBM, CDC, NICE, NIH, BMJ Best Practices, Medrxiv Preprints, covidvidence.com, and Ebsco COVID Portal.

The search was not date limited.

Briefly, the search strategy involved combinations of keywords and subject headings including:

- "COVID-19" OR coronavirus OR "corona virus" OR "SARS-COV-2" OR "severe acute respiratory syndrome"
- Transmission
- Aerosol* OR droplet OR infect*
- Singing OR sing OR choir OR choral OR vocaliz* OR music
- Tuberculosis+ OR influenza+
- Coughing OR sneezing

Articles identified by KRS in their search were initially screened by title and abstract against the inclusion/exclusion criteria listed in Table 1 below. 24 articles were identified from the initial search and 8 additional resources. A second search was conducted which specifically focused on epidemiological studies and research on expiration when singing. The search did not produce any additional references. A third search was conducted which was a cited reference search in regard to the Loudon and Roberts (1968) study identified in the first search. No additional references emerged from this citation-based search.

Eight articles and 3 additional resources from the first search were included in the review after screening for inclusion and exclusion criteria. Of the 8 articles, 3 are included in the evidence summary below. One resource listing from the search was included as it was an epidemiological report. Editorials, opinion pieces and commentary articles were excluded from the evidence summary. The remaining five articles and two resources identified in the literature search are included for context and background purposes. The remaining articles (13) included in this review were identified by cross checking reference lists of the articles in the initial search results. Two articles included in the evidence summary below were identified through the cross checking process.

Table 1. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
[numerated list of inclusion criteria] <ul style="list-style-type: none"> - Singing - Respiratory expirate of singing - Transmission via singing - Risk of transmission - Aerosolization - COVID-19 spread in singing groups (choirs, churches) - Any jurisdiction - Not date limited - Epidemiological studies - Guidelines, reviews, trials, abstracts, letters published in academic journals. - English language - Other infectious diseases (tuberculosis, influenza) 	<ul style="list-style-type: none"> - Article is not from a credible source - Article does not have a clear research question or issue - Presented data/evidence is not sufficient to address the research questions - Coughing - Sneezing

Critical Evaluation of the Evidence

Exclusion criteria for study quality were adapted from the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). Potential articles were evaluated on three criteria: 1) Peer reviewed or from a reputable source; 2) Clear research question or issue; 3) Whether the presented data/evidence is appropriate to address the research question. Preprints and non-peer reviewed literature (such as commentaries and letters from credible journals) are not excluded out of hand due to the novelty of COVID-19 and the speed with which new evidence is available.

Table 2 below is a narrative summary of the body of evidence included in this review. The categories, format, and suggested information for inclusion were adapted from the Oxford Centre for Evidence-Based Medicine, the Cochrane Library, and the AGREE Trust (Urwin, Gavinder & Graziadio, 2020; Viswanathan et al, 2012; Wynants et al., 2020; Brouwers et al., 2010).

The research included in this review to respond to the research question includes 6 epidemiological reports and 1 primary study with an experimental design. Of the 6 epidemiological reports included, 5 were published in peer reviewed journals (Pung *et al.* 2020; Yong *et al.*, 2020; Kari- Purkaystha, 2009; Mangura *et al.*, 1998; Sacks *et al.*, 1985) and 1 was a report (Wei, *et al.* 2020) published by the Centers for Disease Control and Prevention (not peer reviewed). The only primary research study included is by

Loudon & Roberts published in 1968. Quality of this study is considered low, due to small sample size and limited methodological description; however, it is included given that it is consistently referenced in the research specific to singing and transmission of infectious pathogens.

Table 2. Narrative overview of the literature included in this review.

	Description
Volume	“X systematic reviews were included (x were pre-review), X RCTs were included (x were pre-review), X prospective cohort studies were included (x were pre-review), X retrospective observational studies were included (x were pre-review), X case series were included (x were pre-review), X guidelines from reputable sources were included.”
Quality	<p>For studies, consider issues such as:</p> <ul style="list-style-type: none"> • Appropriateness of study designs to research questions. • Sample sizes. • Risk of bias (Selection bias (randomization, case matching, as appropriate to study design); Sponsor/source bias; Reporting bias/ adequacy; Attrition bias (e.g. loss to follow up); Performance bias (e.g. fidelity to protocol); Detection bias (use of valid and reliable tools/measures; blinding of assessors).(2) <p>Individual studies may provide low quality evidence for one outcome but high quality evidence for another.</p> <p>Distinct quality considerations apply to systematic reviews, scoping reviews, qualitative studies, mathematical modelling, etc. Writers should use their discretion and consult other assessment guidelines as they find necessary.</p> <p>In addition, Wynants et. al. (2020) note specific issues in early COVID-19 literature they reviewed:</p> <ul style="list-style-type: none"> • Time frames (controls could have the outcome of interest after the study period) • Lack of similarity of controls to intervention group (e.g. comparing outcomes with pneumonia patients rather than other COVID-19 patients receiving different treatment). <p>For guidelines, consider (Brouwers et al. 2010):</p> <ul style="list-style-type: none"> • Their source. • Conflicts of interest and independence of authors. • Whether they are based on systematic reviews or other systematically gathered evidence. • Whether stakeholders and/or patients engagement is described. • Whether the values and goals of impacted populations, as demonstrated by evidence (e.g. qualitative studies, surveys), are described. • Whether the implications and potential unintended harms that may stem from following recommendations are discussed. • Consideration of health equity.

Applicability	Are these studies from areas where population health, healthcare system and/or COVID-19 responses are similar to Alberta? Is the study evidence directly applicable to the review questions?
Consistency	Is the data reported across sources consistent (similar effect sizes, same direction of effect, similar recommendations)?

Search Strategy

Medline/PubMed

- 1 exp Coronavirus/ or exp Coronavirus Infections/ or coronaviru*.mp. or "corona virus*".mp. or ncov*.mp. or n-cov*.mp. or "novel cov".mp. or COVID-19.mp. or COVID19.mp. or COVID-2019.mp. or COVID2019.mp. or SARS-COV-2.mp. or SARSCOV-2.mp. or SARSCOV2.mp. or SARSCOV19.mp. or Sars-Cov-19.mp. or SarsCov-19.mp. or SARSCOV2019.mp. or Sars-Cov-2019.mp. or SarsCov-2019.mp. or "severe acute respiratory syndrome cov 2".mp. or "2019 ncov".mp. or "2019ncov".mp. (20991)
- 2 Influenza, Human/ (48508)
- 3 influenza.mp. (108695)
- 4 exp Tuberculosis/ (190769)
- 5 1 or 2 or 3 or 4 (318167)
- 6 exp Disease Transmission, Infectious/ (67498)
- 7 transmission.mp. (509294)
- 8 transmit*.mp. (175798)
- 9 infectiousness.mp. (1380)
- 10 infectivity.mp. (25965)
- 11 exp Aerosols/ (31073)
- 12 aerosol.mp. (31051)
- 13 droplet*.mp. (43351)

14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (757077)

15 exp Singing/ (860)

16 sing.mp. (1223)

17 choral.mp. (160)

18 choir.mp. (279)

19 vocaliz*.mp. (14916)

20 Music/ (13886)

21 15 or 16 or 17 or 18 or 19 or 20 (30260)

22 5 and 14 and 21 (9)

1 exp Coronavirus/ or exp Coronavirus Infections/ or coronaviru*.mp. or "corona virus*".mp. or ncov*.mp. or n-cov*.mp. or "novel cov".mp. or COVID-19.mp. or COVID19.mp. or COVID-2019.mp. or COVID2019.mp. or SARS-COV-2.mp. or SARSCOV-2.mp. or SARSCOV2.mp. or SARSCOV19.mp. or Sars-Cov-19.mp. or SarsCov-19.mp. or SARSCOV2019.mp. or Sars-Cov-2019.mp. or SarsCov-2019.mp. or "severe acute respiratory syndrome cov 2".mp. or "2019 ncov".mp. or "2019ncov".mp. (20991)

2 Influenza, Human/ (48508)

3 influenza.mp. (108695)

4 exp Tuberculosis/ (190769)

5 1 or 2 or 3 or 4 (318167)

6 exp Singing/ (860)

7 sing.mp. (1223)

8 choral.mp. (160)

9 choir.mp. (279)

10 vocaliz*.mp. (14916)

- 11 Music/ (13886)
 12 6 or 7 or 8 or 9 or 10 or 11
 13 5 and 12 (78)

CINAHL

- S1 (MH "Coronavirus+")
 S2 (MH "Coronavirus Infections+")
 S3 coronaviru*
 S4 "corona virus"
 S5 ncov*
 S6 n-cov*
 S7 COVID-19 OR COVID19 OR COVID-2019 OR COVID2019
 S8 SARS-COV-2 OR SARSCOV-2 OR SARSCOV2 OR SARSCOV19 OR SARS-COV-19 OR SARSCOV-19 OR SARSCOV2019 OR SARS-COV-2019 OR SARSCOV-2019
 S9 "severe acute respiratory syndrome cov 2" OR "severe acute respiratory syndrome coronavirus**"
 S10 "2019 ncov" OR 2019ncov OR Hcov*
 S11 (MH "Influenza+") 20,935
 S12 (MH "Tuberculosis+") 24,133
 S13 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 49,193
 S14 (MH "Singing") Expanders - Apply equivalent subjects
- Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
- Search Screen - Advanced Search
- Database - CINAHL Complete 3,380
- S15 sing OR choral OR choir OR vocaliz* 4,068
 S16 (MH "Disease Transmission+") 15,303
 S17 (MH "Aerosols") 3,133
 S18 transmission OR transmit* OR droplet* OR infectiousness OR infectivity 94,760
 S19 S16 OR S17 OR S18 98,593
 S20 (MH "Music") 10,932

S21 S14 OR S15 OR S20 14,909
 S22 S13 AND S19 AND S21 6

TRIP Pro/Google Scholar/Google

("covid-19" OR coronavirus OR "corona virus" OR "SARS-COV-2" OR "severe acute respiratory syndrome" OR tuberculosis OR influenza) AND (transmission OR transmit OR aerosol OR droplets OR infectivity OR infectiousness) AND (sing OR singing OR choral OR choir OR muse OR vocalizing OR vocalization)

("covid-19" OR coronavirus OR "corona virus" OR "SARS-COV-2" OR "severe acute respiratory syndrome" OR tuberculosis OR influenza) AND (sing OR singing OR choral OR choir OR muse OR vocalizing OR vocalization)

("covid-19" OR coronavirus OR "corona virus" OR "SARS-COV-2" OR "severe acute respiratory syndrome" OR tuberculosis OR influenza) AND (sing OR singing OR choral OR choir OR vocalize OR vocalization OR vocalizing OR music)

LitCovid/CEBM/WHO/NEJM/CochraneLibrary/ LitCovid/Oxford CEBM/CDC/NICE/WHO/National Institute of Health/BMJ Best Practice /Medrxiv Preprints/Cochrane/covidevidence.org/Ebsco COVID Portal

(sing OR singing OR choral OR choir OR vocalize OR vocalization OR vocalizing OR music)

(transmit OR transmission) AND (music or sing or singing or vocalize or vocalization or vocalizing OR speech)

Reference List

Asadi, S., Wexler, A., Cappa, C.D., Berredá, S., Bouvier, N.M., Ristenpart, W.D. (2019). Aerosol emission and superemission during human speech increase with voice loudness. *Nature*, Scientific Reports, 9, 2348. Retrieved from: <https://www.nature.com/articles/s41598-019-38808-z>

Asadi, S., Bouvier, N., Wexler, A.S., Ristenpart, W.D. (2020). The coronavirus pandemic and aerosols: Does COVID-19 transmit via expiratory particles? *Aerosol Science and Technology*, 54(6):635-638. Retrieved from: <https://www.tandfonline.com/doi/full/10.1080/02786826.2020.1749229>

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