# Evidence Search Service Results of your search request

**Covid-19 transimission risk by singers and wind or brass instrumentalists**

**ID of request:** 24189  
**Date of request:** 7th July, 2020  
**Date of completion:** 9th July, 2020

If you would like to request any articles or any further help, please contact:  Ms Sarah Rudd at [Sarah.Rudd@nbt.nhs.uk](mailto:Sarah.Rudd@nbt.nhs.uk)

Please acknowledge this work in any resulting paper or presentation as: Evidence search: Covid-19 transimission risk by singers and wind or brass instrumentalists. Ms Sarah Rudd. ( 9th July, 2020). BRISTOL, UK: North Bristol Library and Information Service.

**Sources searched**  
Brass Bands England (1)  
Centre for Evidence-Based Medicine (2)  
EMBASE (3)  
European Centre for Disease Prevention and Control (1)  
Google (4)  
Gov.uk (3)  
MEDLINE (2)  
Nature Communications (1)

**Date range used** (5 years, 10 years): -   
**Limits used** (gender, article/study type, etc.): -   
**Search terms and notes** (full search strategy for database searches below):

**Tme Spent:** 3 hours

**Google:**covid 19 musician guidelines for reopening

covid 19 wind musician guidelines

uk covid guidelines for live music and

**Google Scholar:** "coronavirus OR "covid-19" OR "2019nCoV" OR "2019-nCov" oR "WN-cov" OR "nCoV" OR "SARS-CoV-2" OR "Hcov-19" "" or "" or "transmission" or "" or "aerosol"

 "coronavirus OR "covid-19" OR "2019nCoV" OR "2019-nCov" oR "WN-cov" OR "nCoV" OR "SARS-CoV-2" OR "Hcov-19" "" or "" or "transmission" or "" or "aerosol" or "cough" or "coughing" or "shout" or "shouting" or "super spreader" or "superspreader"

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## Summary of Results

There is not a substantial amount of specific evidence published on the transmission of covid-19 through singing or the playing of instruments. It is likely that the published guidance on this comes from existing evidence on the transmission of covid-19 through aerosol generating activities (see the CEBM Summary "What is the evidence to support the 2-metre social distancing rule to reduce COVID-19 transmission?" and "Transmission Dynamics of COVID-19" (search for eg in the search box). Other guidance and rapid reviews state similar views.

There are only a few, recently published articles considering the transmission of covid-19 through singing/playing. It is likely that this is an area that has not yet had time to develop. Organisations such as Brass Bands England have begun to prepare their own guidance for members based on available evidence and government guidance, and I have included this below.

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## A. National and International Guidance

#### Cabinet Office

**Coronavirus outbreak FAQs: what you can and can't do** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=8f9699bb444d58414abbbef0b85c65eb)

1.23 Can I go to the theatre or a concert? At this stage, it is not yet safe for live performances, including dramatic, musical or comedy performances, to take place in front of a live audience. This is because of the increased risk of transmission associated with these types of activities or as a result of patrons needing to raise their voices to be heard over background music. There may be an additional risk of infection in environments where you or others are singing, chanting, shouting or conversing loudly. This applies even if others are at a distance to you. You should therefore avoid environments that require you to raise your voice to communicate with anyone outside your household.

#### Ministry for Housing, Communities and Local Government

**COVID-19: Guidance for small marriages and civil partnerships** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=8671e6552c6c2066e09fad1836c9a066)

Singing, chanting and the use of musical instruments People should avoid singing, shouting, raising voices and/or playing music at a volume that makes normal conversation difficult or that may encourage shouting. This is because of the potential for increased risk of transmission from aerosol and droplets. Therefore, spoken responses during marriages or civil partnerships should also not be in a raised voice. Activities such as singing, chanting, shouting and/or playing of instruments that are blown into should be specifically avoided. This is because there is a possible additional risk of transmission in environments where individuals are singing or chanting as a group, and this applies even if social distancing is being observed or face coverings are used. Where required for the marriage or civil partnership, only one individual should be permitted to sing or chant, and the use of plexi-glass screens should be considered to protect guests, as this will further prevent transmission and the screen can be easily cleaned. We recognise the importance of communal singing in marriages or civil partnerships, and as this should not happen at this time, we suggest you consider using recordings that may be available to you. You are advised only to play musical instruments that are not blown into. Organs can be played for a ceremony, as well as general maintenance, but should be cleaned thoroughly before and after use. The government and the medical and scientific communities are urgently engaged in research around transmission risk and how such activities can best be managed safely, and further guidance will follow when available.

#### Ministry of Housing, Communities and Local Government

**COVID-19: guidance for the safe use of places of worship during the pandemic** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=713225a1ed073f8d514dd19fd6d3aa56)

Activities such as singing, chanting, shouting and/or playing of instruments that are blown into should be specifically avoided in worship or devotions and in rehearsals. This is because there is a possible additional risk of transmission in environments where individuals are singing or chanting as a group, and this applies even if social distancing is being observed or face coverings are used. .... You are advised only to play musical instruments that are not blown into.

## B. Synopses or Summaries

#### Centre for Evidence-Based Medicine

**What is the evidence to support the 2-metre social distancing rule to reduce COVID-19 transmission?** (2020)

Zeshan Qureshi, Nicholas Jones, Robert Temple, Jessica PJ Larwood, Trisha Greenhalgh, Lydia Bourouiba

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=0d37a92c7bce0196cd390c4f6b28fd21)

....Even volume of speech may impact on droplet spread and subsequent risk of transmission, making the process of predicting mode of transmission problematic.22 Clusters of coronavirus have occurred during prolonged ‘violent exhalation events’ such as singing or fitness dance classes in confined locations.23 24 For example, Hamner et al report that a two and a half hour choir rehearsal with one symptomatic person led to 32 confirmed and 20 probable COVID-19 cases among the 61 singers, even though all singers avoided any direct physical contact.24

**Transmission Dynamics of COVID-19 (Analysis of the Transmission Dynamics of COVID-19: An Open Evidence Review.)** (2020)

Jefferson T., Spencer EA, Plüddemann A., Roberts N., Heneghan C.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=219a83867f84f70294f2b0afb420bf94)

n the midst of the COVID-19 pandemic, uncertainty on the characteristics of a novel disease reigns. One of the most important aspects of these uncertainties regards the mode and circumstances of transmission of this newly identified agent. The explosive nature of COVID-19 transmission, initially shown by the number of new cases and later by admissions and deaths, remains unexplained. The age distribution and the speed of transmission does not fit with what is known of “seasonal” coronaviridae. Such uncertainties prevent a rational response to the threat and promote extreme actions such as total lockdown of whole countries. One of the principal uncertainties regards the means by which COVID-19 is transmitted, with special regard to the factors which may accelerate or delay its spread, the mode of transmission, the role of asymptomatic infected people, its speed, the possible interactions with wildlife or livestock, urban or rural environments and population density. The first part of the Open Evidence Synthesis will consist of a search of the evidence and description with tabulation of the findings. In the second phase, as we make more information available, it may be possible to either define a mode of transmission or to set out a series of hypotheses to be tested by further work. We will set out the policy implications and recommendations in line with our evidence extractions. Because of the public health importance of this work and its evolving nature, we will post extractions and summaries of all included studies on this site with brief comments. We post summaries as soon as they are available in the table below, which is searchable by transmission mode and by the quick search function.

#### European Centre for Disease Prevention and Control (ECDC)

**Transmission of COVID-19** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=a0f9b14d0a4e4bb510276ec9960496c3)

Crowded and confined indoor spaces Several outbreak investigation reports have shown that COVID-19 transmission can be particularly effective in crowded, confined indoor spaces such as workplaces including factories, churches, restaurants, ski resorts, shopping centres, worker dormitories, cruise ships and vehicles, or events occurring indoor such as, parties, and dance classes, [171]. They indicated that transmission can be linked with specific activities, such as singing in a choir [172] or religious services that may be characterised by increased production of respiratory droplets through loud speech and singing.

#### German Society for Music Physiology and Musicians' Association

**Make music during the SARS-CoV-2 pandemic Recommendations of the German Society for Music Physiology and Musicians Medicine (DGfMM) to protect against infection when playing music** (2020)

Carl Firle , Hans-Christian Jabusch , Anke Grell, Isabel Fernholz, Alexander Schmidt , Anke Steinmetz

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=8656deb5e76733794ecaaf5a9d7ff50f)

Preliminary note: • There is currently no evidence-based information on the transmission of SARS-CoV-2 while making music • These recommendations are based on previous knowledge of SARS-CoV-2 and scientific research in the field of music (regular updates sought) The recommendations described here summarize the scientific findings to date together and are not to be understood as binding instructions. They serve the Risk assessment of infection with SARS-CoV-2 while making music. The apply nationwide or in the federal states regulations that the musicians / institutions with ministries, Coordinate authorities and company doctors and implement them for their area. Goal: • Assessment of the risk of infection with SARS-CoV-2 when playing instruments and singing • assessment of Risk potential different Instrument groups / Vocal formations in different musical Occupations and Teaching situations

#### Music Industries Association

**COVID-19: Advice for the musical instrument industry** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=7950ccfd9f63c0ce783a41826e73c683)

Musical instrument businesses across the country have questions in relation to the Coronavirus. The MIA has collated guidance from Public Health England, the Government and MIA Members and partners to help the industry deal with the outbreak…

#### Slipped Disk

**A full assessment of the Covid risk of playing wind instruments** (2020)

Adam T. Schwalje; Henry T. Hoffman

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=455a227f33c828a8f2072fb4a90c6bc0)

COVID-19 is a severe and dangerous disease. Its heart-wrenching infectivity and virulence hit home for many musicians, as we learned of the several choirs which were affected by superspreading events early in the pandemic. One was in Amsterdam, where 102 of 130 participants wound up with coronavirus infection; one in Washington state, where 52 of 60 participants were infected, and at least two others in Europe. Several choir members unfortunately died as a result. These were early hints that singing itself might be risky. The risks were strong enough that an alarm was raised by Dr. Lucinda Halstead and others in a National Association of Teachers of Singing webinar (NATS), leading many including the Metropolitan Opera to forego their upcoming seasons. Because of similarities to singing, there is concern that wind players might also be at additional risk, above the background risk, for spread of COVID-19. It is vitally important to be clear about the current uncertainties in COVID-19 risk assessment for the wind instrumentalist.

#### University Medical Center and University of Music Freiburg

**RISK ASSESSMENT OF A CORONAVIRUS INFECTION IN THE FIELD OF MUSIC** (2020)

Claudia Spahn and Bernhard Richter

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=8473403794dcea857066368b82689667)

#### University of Iowa Carver College of Medicine

**Wind Instrument Aerosol in Covid Era - COVID-19 and horns, trumpets, trombones, euphoniums, tubas, recorders, flutes, oboes, clarinets, saxophones and bassoons: Wind Musicians’ Risk Assessment in the Time of COVID-19** (2020)

Adam T. Schwalje MD, DMA; Henry T. Hoffman MD

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=e9f78c7523f5e921ce403ff1c0b70335)

COVID-19 is a severe and dangerous disease. Its heart-wrenching infectivity and virulence hit home for many musicians, as we learned of the several choirs which were affected by superspreading events early in the pandemic. One was in Amsterdam, where 102 of 130 participants wound up with coronavirus infection; one in Washington state, where 52 of 60 participants were infected, and at least two others in Europe. Several choir members unfortunately died as a result. These were early hints that singing itself might be risky. The risks were strong enough that an alarm was raised by Dr. Lucinda Halstead and others in a National Association of Teachers of Singing webinar (NATS), leading many including the Metropolitan Opera to forego their upcoming seasons. Because of similarities to singing, there is concern that wind players might also be at additional risk, above the background risk, for spread of COVID-19. It is vitally important to be clear about the current uncertainties in COVID-19 risk assessment for the wind instrumentalist.

## C. Systematic Reviews

#### Alberta Health Services, COVID-19 Scientific Advisory Group

**Singing as a risk for transmission of SARS-CoV-2 virus** (2020)

Ania Kania-Richmond and Heather Sharpe

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=fff0bec1914d34100e7f35feb7a4309e)

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 SARSCoV-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.

## D. Institutional Publications

#### Brass Bands England

**BBE Statement on the COVID-19 Pandemic – effective from 4 July 2020** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=34ee12efa406b1212063300ff15a2faa)

Social distancing in rehearsals The risk of transmission of viral aerosols in brass instruments is currently not fully understood and the scientific literature is at best mixed over safe distances of operation. For this reason, to ensure your members’ safety we recommend you still aim to maintain 3m spacing while playing wherever possible. It has been estimated this spacing has a transmission risk approximately 100 times lower than spacings of 1m. Spacing is more important indoors and you should aim to increase ventilation to aid the removal of viral aerosols.

## E. Original Research

1. **Clusters of Coronavirus Disease in Communities, Japan, January-April 2020**  
   Furuse Y. Emerging infectious diseases 2020;26(9):No page numbers.

We analyzed 3,184 cases of coronavirus disease in Japan and identified 61 case-clusters in healthcare and other care facilities, restaurants and bars, workplaces, and music events. We also identified 22 probable primary case-patients for the clusters; most were 20-39 years of age and presymptomatic or asymptomatic at virus transmission.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=f848311614cbbab64b0faf1350be5f17)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=a9b4ff145be25b4b615f6346057f7295)

1. **COVID-19 and spontaneous singing to decrease loneliness, improve cohesion, and mental well-being: An Italian experience.**  
   Corvo Elisabetta Psychological trauma : theory, research, practice and policy 2020;:No page numbers.

Since March 2020, Italy has been in lockdown due to COVID-19, and individuals have missed all kinds of networking opportunities. Already in the 1st weeks of March, Italian cities' silence was broken by singing. The use of singing as a coping strategy as well as to improve the sense of cohesion is evident. Greater attention should be paid to the development of social cohesion and to social support in terms of social networks and the development of social capital. (PsycInfo Database Record (c) 2020 APA, all rights reserved).

1. **Fundamental protective mechanisms of face masks against droplet infections**  
   Kahler C.J. Journal of Aerosol ScienceJournal of Aerosol Science 2020;148:No page numbers.

Many governments have instructed the population to wear simple mouth-and-nose covers or surgical face masks to protect themselves from droplet infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in public. However, the basic protection mechanisms and benefits of these masks remain controversial. Therefore, the aim of this work is to show from a fluid physics point of view under which circumstances these masks can protect against droplet infection. First of all, we show that the masks protect people in the surrounding area quite well, since the flow resistance of the face masks effectively prevents the spread of exhaled air, e.g. when breathing, speaking, singing, coughing and sneezing. Secondly, we provide visual evidence that typical household materials used by the population to make masks do not provide highly efficient protection against respirable particles and droplets with a diameter of 0.3-2 mum as they pass through the materials largely unfiltered. According to our tests, only vacuum cleaner bags with fine dust filters show a comparable or even better filtering effect than commercial particle filtering FFP2/N95/KN95 half masks. Thirdly, we show that even simple mouth-and-nose covers made of good filter material cannot reliably protect against droplet infection in contaminated ambient air, since most of the air flows through gaps at the edge of the masks. Only a close-fitting, particle-filtering respirator offers good self-protection against droplet infection. Nevertheless, wearing simple homemade or surgical face masks in public is highly recommended if no particle filtrating respiratory mask is available. Firstly, because they protect against habitual contact of the face with the hands and thus serve as self-protection against contact infection. Secondly, because the flow resistance of the masks ensures that the air remains close to the head when breathing, speaking, singing, coughing and sneezing, thus protecting other people if they have sufficient distance from each other. However, if the distance rules cannot be observed and the risk of inhalation-based infection becomes high because many people in the vicinity are infectious and the air exchange rate is small, improved filtration efficiency masks are needed, to take full advantage of the three fundamental protective mechanisms these masks provide.<br/>Copyright &#xa9; 2020 The Author(s)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=89fd36665f3d38a4a8949ca541c8e555)

1. **High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice - Skagit County, Washington, March 2020.**  
   Hamner Lea MMWR. Morbidity and mortality weekly report 2020;69(19):606-610.

On March 17, 2020, a member of a Skagit County, Washington, choir informed Skagit County Public Health (SCPH) that several members of the 122-member choir had become ill. Three persons, two from Skagit County and one from another area, had test results positive for SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19). Another 25 persons had compatible symptoms. SCPH obtained the choir's member list and began an investigation on March 18. Among 61 persons who attended a March 10 choir practice at which one person was known to be symptomatic, 53 cases were identified, including 33 confirmed and 20 probable cases (secondary attack rates of 53.3% among confirmed cases and 86.7% among all cases). Three of the 53 persons who became ill were hospitalized (5.7%), and two died (3.7%). The 2.5-hour singing practice provided several opportunities for droplet and fomite transmission, including members sitting close to one another, sharing snacks, and stacking chairs at the end of the practice. The act of singing, itself, might have contributed to transmission through emission of aerosols, which is affected by loudness of vocalization (1). Certain persons, known as superemitters, who release more aerosol particles during speech than do their peers, might have contributed to this and previously reported COVID-19 superspreading events (2-5). These data demonstrate the high transmissibility of SARS-CoV-2 and the possibility of superemitters contributing to broad transmission in certain unique activities and circumstances. It is recommended that persons avoid face-to-face contact with others, not gather in groups, avoid crowded places, maintain physical distancing of at least 6 feet to reduce transmission, and wear cloth face coverings in public settings where other social distancing measures are difficult to maintain.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=7679df731bdc80677523b99fe586364e)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=58854025a306870e828ae388d61a62da)

1. **Psychopathological problems related to the COVID-19 pandemic and possible prevention with music therapy**  
   Mastnak W. Acta Paediatrica, International Journal of PaediatricsActa Paediatrica, International Journal of Paediatrics 2020;:No page numbers.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=60b5a4156acf5a3b035ab463ee719d5c)

1. **Safer Singing During the SARS-CoV-2 Pandemic: What We Know and What We Don't**  
   aunheim MR JOURNAL OF VOICE 2020;:Ahead of print.

ntroduction While the novel coronavirus outbreak has profoundly altered health care systems across the globe, it has also affected similar change and devastation on the social, educational and cultural communities upon which many rely, including communities of choral singers, solo performers, conductors, voice teachers and the professionals that collaborate with them. Even as citizens of the most heavily impacted countries took to their balconies to serenade first responders and health care workers, singers of most genres who typically perform in ensembles have been told to not carry on their beloved practice. This message, promoted by the lay media and by early reports of “super-spreading” of the virus at choral events in the United States and abroad,1 , 2 has been reinforced by expert and non-expert opinion regarding the transmissibility of SARS-CoV-2 through droplets and aerosols, the generation of respiratory particles when singing, and concern about the interpersonal interactions that routinely accompany vocal performance, both in groups and in one-on-one teaching situations. Unfortunately, there is a paucity of data about both how SARS-CoV-2 is transmitted by singing and how to bring communities of singers back together safely. The data available about disease spread through vocalization, most of which preceded the current pandemic, address primarily transmission of disease through droplets and aerosols and are specific neither to this virus nor to singing.3, 4, 5, 6 Specifically, there is a lack of data addressing how to congregate and sing safely in choral environments such as churches, concert halls and practice spaces, as well as stages, theatres and other venues. In addition, protective measures such as safest distancing between singers, wearing masks or other personal protective equipment (PPE), using larger rehearsal or performance spaces, reducing the number of singers inside a certain enclosed space, reducing the duration of rehearsals or performances, and using real time air and surface cleaning methods such as increased ventilation, UV-C light and HEPA filtration specific to a singing environment among other topics have not been studied well enough to provide evidence on which to base advice to the singing community.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=b398fc9c8fd3ca3adc9e0077384545d1)

1. **Visualizing Speech-Generated Oral Fluid Droplets with Laser Light Scattering**  
   Anfinrud Philip N Engl J Med 2020;382(21):2061-2063.

TO THE EDITOR: Video Digital Object Thumbnail Laser Light-Scattering Experiment Showing Speech-Generated Droplets. (00:42) Aerosols and droplets generated during speech have been implicated in the person-to-person transmission of viruses,1,2 and there is current interest in understanding the mechanisms responsible for the spread of Covid-19 by these means. The act of speaking generates oral fluid droplets that vary widely in size,1 and these droplets can harbor infectious virus particles. Whereas large droplets fall quickly to the ground, small droplets can dehydrate and linger as “droplet nuclei” in the air, where they behave like an aerosol and thereby expand the spatial extent of emitted infectious particles.2 We report the results of a laser light-scattering experiment in which speech-generated droplets and their trajectories were visualized....

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=7188e455803bc27940654950a99a6b3d)

1. **Aerosol emission and superemission during human speech increase with voice loudness**  
   Asadi Scientific Reports 2019;9:2348 .

Mechanistic hypotheses about airborne infectious disease transmission have traditionally emphasized the role of coughing and sneezing, which are dramatic expiratory events that yield both easily visible droplets and large quantities of particles too small to see by eye. Nonetheless, it has long been known that normal speech also yields large quantities of particles that are too small to see by eye, but are large enough to carry a variety of communicable respiratory pathogens. Here we show that the rate of particle emission during normal human speech is positively correlated with the loudness (amplitude) of vocalization, ranging from approximately 1 to 50 particles per second (0.06 to 3 particles per cm3) for low to high amplitudes, regardless of the language spoken (English, Spanish, Mandarin, or Arabic). Furthermore, a small fraction of individuals behaves as “speech superemitters,” consistently releasing an order of magnitude more particles than their peers. Our data demonstrate that the phenomenon of speech superemission cannot be fully explained either by the phonic structures or the amplitude of the speech. These results suggest that other unknown physiological factors, varying dramatically among individuals, could affect the probability of respiratory infectious disease transmission, and also help explain the existence of superspreaders who are disproportionately responsible for outbreaks of airborne infectious disease.

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=e021b3f598929a9f777ac7c8930833c9)

### Opening Internet Links

The links to internet sites in this document are 'live' and can be opened by holding down the CTRL key on your keyboard while clicking on the web address with your mouse

### Full text papers

Links are given to full text resources where available. For some of the papers, you will need an **NHS OpenAthens Account**. If you do not have an account you can [register online](https://openathens.nice.org.uk/).

You can then access the papers by simply entering your username and password. If you do not have easy access to the internet to gain access, please let us know and we can download the papers for you.

### Guidance on searching within online documents

Links are provided to the full text of each document. Relevant extracts have been copied and pasted into these results. Rather than browse through lengthy documents, you can search for specific words as follows:

**Portable Document Format / pdf / Adobe**  
Click on the Search button (illustrated with binoculars). This will open up a search window. Type in the term you need to find and links to all of the references to that term within the document will be displayed in the window. You can jump to each reference by clicking it.

**Word documents**  
Select Edit from the menu, the Find and type in your term in the search box which is presented. The search function will locate the first use of the term in the document. By pressing 'next' you will jump to further references.

## F. Search History

|  | **Source** | **Criteria** | **Results** |
| --- | --- | --- | --- |
| 1. | Medline | (covid OR coronavirus\* OR coronovirus\* OR "corono-virus\*" OR "2019nCoV" OR "2019-nCoV" OR "WN-CoV" OR "nCoV" OR "SARS-CoV-2" OR "HCoV-19").ti,ab | 13508 |
| 2. | Medline | CORONAVIRUS/ | 1905 |
| 3. | Medline | (1 OR 2) | 40970 |
| 4. | Medline | (sing OR singer\* OR singing).ti,ab | 5788 |
| 5. | Medline | (wind ADJ3 instrument\*).ti,ab | 304 |
| 6. | Medline | (woodwind ADJ3 instrument\*).ti,ab | 42 |
| 7. | Medline | (recorder\* OR flute\* OR oboe OR clarinet\* OR saxophone\* OR bassoon\*).ti,ab | 7397 |
| 8. | Medline | (brass ADJ3 instrument\*).ti,ab | 99 |
| 9. | Medline | (4 OR 5 OR 6 OR 7 OR 8) | 13476 |
| 11. | Medline | (music).ti,ab | 15851 |
| 14. | Medline | (9 OR 11) | 28606 |
| 15. | Medline | (3 AND 14) | 6 |
| 16. | EMBASE | (covid OR coronavirus\* OR coronovirus\* OR "corono-virus\*" OR "2019nCoV" OR "2019-nCoV" OR "WN-CoV" OR "nCoV" OR "SARS-CoV-2" OR "HCoV-19").ti,ab | 39805 |
| 17. | EMBASE | CORONAVIRUS/ | 6557 |
| 18. | EMBASE | (16 OR 17) | 42006 |
| 19. | EMBASE | (sing OR singer\* OR singing).ti,ab | 6966 |
| 20. | EMBASE | (wind ADJ3 instrument\*).ti,ab | 310 |
| 21. | EMBASE | (woodwind ADJ3 instrument\*).ti,ab | 45 |
| 22. | EMBASE | (recorder\* OR flute\* OR oboe OR clarinet\* OR saxophone\* OR bassoon\*).ti,ab | 10975 |
| 23. | EMBASE | (brass ADJ3 instrument\*).ti,ab | 111 |
| 24. | EMBASE | (19 OR 20 OR 21 OR 22 OR 23) | 18233 |
| 25. | EMBASE | (music).ti,ab | 19819 |
| 26. | EMBASE | (24 OR 25) | 37082 |
| 27. | EMBASE | (18 AND 26) | 8 |
| 28. | CINAHL | (covid OR coronavirus\* OR coronovirus\* OR "corono-virus\*" OR "2019nCoV" OR "2019-nCoV" OR "WN-CoV" OR "nCoV" OR "SARS-CoV-2" OR "HCoV-19").ti,ab | 4778 |
| 29. | CINAHL | CORONAVIRUS/ | 531 |
| 30. | CINAHL | (28 OR 29) | 4934 |
| 31. | CINAHL | (sing OR singer\* OR singing).ti,ab | 3529 |
| 32. | CINAHL | (wind ADJ3 instrument\*).ti,ab | 64 |
| 33. | CINAHL | (woodwind ADJ3 instrument\*).ti,ab | 22 |
| 34. | CINAHL | (recorder\* OR flute\* OR oboe OR clarinet\* OR saxophone\* OR bassoon\*).ti,ab | 1680 |
| 35. | CINAHL | (brass ADJ3 instrument\*).ti,ab | 46 |
| 36. | CINAHL | (31 OR 32 OR 33 OR 34 OR 35) | 5288 |
| 37. | CINAHL | (music).ti,ab | 11896 |
| 38. | CINAHL | (36 OR 37) | 16497 |
| 39. | CINAHL | (30 AND 38) | 4 |

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