



Hochschule  
**FÜR MUSIK**  
Freiburg



## **RISK ASSESSMENT OF A CORONAVIRUS INFECTION IN THE FIELD OF MUSIC**

**fourth update from 17.07.2020**

**Changes compared to the third update from 1.07.2020 in blue**

Prof. Dr. med. Dr. phil. Claudia Spahn<sup>1</sup> and Prof. Dr. med. Bernhard Richter<sup>1</sup>  
Heads of the Freiburg Institute for Musicians' Medicine (FIM), University Medical  
Center and University of Music Freiburg

With the collaboration of the following colleagues and departments at the University  
Medical Center Freiburg:

Dipl.-Biol. Armin Schuster, Technical Hospital Hygiene (Institute for Infection  
Prevention and Hospital Hygiene, Head: Prof. Dr. med. H. Grundmann)

Prof. Dr. med. Hartmut Hengel (Director of the Institute of Virology)

Prof. Dr. med. Hartmut Bürkle (Director of the Clinic for Anesthesiology and  
Intensive Care Medicine)

English translation was made by Dr. Scott Swope and Dr. Kirk Moss (see Translator's  
Notes at the end of this document, page 35)

---

<sup>1</sup> See Author's Information page 35

<b>Contents</b>	<b>Page</b>
<b>Introduction</b>	3
<b>1. Transmission Pathways of SARS-CoV-2</b>	8
<b>2. Specific Risk Aspects in the Field of Music</b>	11
2.1 Systemic Possibilities for Risk Reduction in the Field of Music	11
a.) Entrance Screening	
b.) Room / Air / Duration Parameters	
c.) Individual Protection Measures	
2.2 Vocal and Instrument-specific Risk Assessment	20
2.2.1 Vocal	
General Risk Assessment of Singing	
Forms of Singing	
Individual voice lessons	
Choir singing	
Singing in religious services	
2.2.2 Wind Instrument Playing	28
Risk Assessment Regarding Playing Wind Instruments	
Forms of Wind Instrument Playing	
Individual lessons for wind players	
Woodwind & brass ensembles	
2.2.3 Other Instruments	34
Keyboard, Bowed and Plucked String Instruments, Percussion	
Chamber Music Ensemble / Wind Ensemble / Band	
Orchestra / Concert Band / Big Band	
<b>3. Risk Management</b>	38
<b>Literature</b>	42
<b>Author's Information/ Translator's Notes</b>	45

## Introduction

Since the first risk assessment published on April 25, 2020, additional questions have been raised due to the dynamically changing situation of the corona pandemic. With the gradual loosening of the lockdown (in Germany) beginning May 6, 2020—which also varies from state to state—increasingly urgent questions are coming from the field of professional and amateur music as to how and when musical activities could resume again. These questions relate to congregational singing in religious services, as well as organized forms of singing and playing music in amateur settings [and in schools](#), as well as to the professional music making of orchestras, choirs, bands, and ensembles in theaters, concert halls, opera houses, and other venues.

The type of questions arising from various musical genres have something in common and are similar in scope. Especially relevant questions regarding singing and instrumental teaching at music colleges, music schools, and other educational institutions are particularly important.

[With the expansion of the number of people who are currently allowed to gather again](#), information about performance ensemble size in orchestras, concert bands and big bands becomes the focus of discussions. This expands the complexity of questions to be considered. Especially for professional musicians, there are questions of comparability with other work situations, for example: to what extent does the risk of infection when working in an open-plan office differ from that of a rehearsal workspace for an orchestra. The announced planned readmission of audiences, as permitted in individual states, also raises further questions. The fact that the audience has been readmitted in some federal states also announces further questions. In Baden-Württemberg, for example, events with up to 250 people will again be permitted from 1.07.2020, if the participants are allocated fixed seats for the entire duration of the event and the event follows a programme that has been determined in advance (CoronaVO of 23 June 2020). From 1.08.2020, it is planned to double the number of participants permitted in Baden-

Württemberg to 500. The very different regulations in the individual federal states, especially those concerning singing - and especially choral singing - also give rise to completely new questions. While the state of Berlin in its current Corona Ordinance (SARS-CoV-2 Infection Protection Ordinance of 23.06.2020), completely prohibits singing activities of more than one person in closed rooms, the state of Rhineland-Palatinate has almost simultaneously permitted choral singing in closed rooms under strict hygiene rules since 24.06.2020 (10. CoBeLVO). Also the inconsistent consideration of sporting and musical activities, which is apparent in the regulations of the states nationally and internationally, gives reason to question the evidence base of these decisions.

Nevertheless, intensive efforts are currently being made at the level of science and politics to achieve uniform measures and regulations.

Fundamentally, the national and state regulations in Germany regarding gatherings, contacts, minimum distancing, and mouth-nose protection, which are specified by government ministries and health authorities (as well as other jurisdictional authorities and the institution's statutory accident insurance), apply to all musicians. It is thus a great challenge to develop appropriate recommendations of action for the specific instances and great variety found in areas of professional and amateur music, indeed, even more so for classical and popular music. In this context, specialized assessments, such as the present ones, are intended to provide information and guidance on decisions that would otherwise be made only at the political and institutional level.

Further scientific studies and discussions among experts have emerged in the past few weeks. There are also current risk assessments for musicians and singers from various sources in Germany (including Charité—Mürbe et al. and Willich, et al.), DGfMM (Firle et al.), Kähler & Hain, and the Health Working Group and Prophylaxis of the German Orchestra Association (DOV) with commentary by the Association of German Operators and Company Doctors VDBW AG Stages and Orchestra (Böckelmann et al.).

As authors, we are striving to include scientific results in our assessment that are as comprehensive and as up to date as possible. The aim is to continually adapt the risk assessments already made so that they are in line with the latest scientific knowledge, and thus to facilitate consensus.

To this end, we regularly publish the latest scientific findings and risk-reducing measures in numbered and dated updates of our risk assessment. The latest version is always posted under the same link on the homepage of Freiburg University of Music.

In our risk assessment, we are including the results of a study of wind players and singers, which was initiated by the Bamberg Symphony Orchestra and took place on May 5, 2020, and in which the authors of FIM were involved. The company Tintschl BioEnergie- und Strömungstechnik AG was commissioned to do the technical measurements. All wind instruments common to the orchestra, as well as the recorder, saxophone, and singers (classical singing and popular singing styles), were included in the study. Both qualitative tests for flow visualization and quantitative measurements of air velocities at different distances were carried out. The presentation of the measurement data and resulting discussion will be published in a further update.

In those areas in which no scientific data is yet available, these comments will continue to represent informed professional assessments of the authors. The paper presented here is therefore still a snapshot in time, which in the future—taking the latest status of existing governmental regulations into account—will be reviewed and adapted in light of new scientific evidence.

In order to increase the quality and reliability of the risk assessment at hand, we established an interdisciplinary working group at the University Medical Center Freiburg with colleagues Head Prof. Dr. med. H. Grundmann, Institute for Infection Prevention and Hospital Hygiene; Prof. Dr. med. Hartmut Hengel, Director of the Institute of Virology; and Prof. Dr. med. Hartmut Bürkle, Director of the Clinic for

Anesthesiology and Intensive Care Medicine. The colleagues mentioned helped fashion and reviewed this paper from the perspective of their respective specialties.

Since the outbreak of the coronavirus pandemic, we have all gained an increased understanding of the epidemiologically important factors in the spread of SARS-CoV-2. From the start, the Robert Koch-Institute and politics in Germany have made it clear that the aim of the instituted protective measures is to slow and contain the spread of infection. The guiding principle of these measures is to reduce the risk of infection with SARS-CoV-2 as much as possible. In our view, a risk assessment focused on specific questions of music practice should therefore be based on the *added* risk that arises there from. This focus on existing general standards is important to us in that it enables political decision-makers to evolve appropriate recommendations for action in the field of music.

The risk assessment presented here pursues the concept of risk management with the aim of identifying specific risks in the field of music and at the same time offering risk-reducing measures. In this way risk management concepts and the related questions, adapted to meet specific musicians and musical situations, can be appropriately and flexibly integrated into the society as a whole.

In furthering a flexible risk adaptation, one could make a stronger differentiation in the future between infection risk and disease risk, and to take different precautionary measures depending on the susceptibility of the musicians (previous illnesses, age, etc.).

The local and time-dependent epidemiological situation (e.g., in a city or local community) could also be considered when devising strategies to prevent infections when making music together. For example, the collective risk of a choir rehearsal can probably be better assessed in the future using [a CORONA WARN-APP \(Corona warning app\)](#)—which has been online since 16.06.2020 in Germany. Comprehensive tests, which are carried out free of charge and independent of any particular event—as

has been possible in Bavaria since 1 July 2020—could also make an important contribution to this.

From the authors' point of view, an important goal is to develop tools for a differentiated risk adaptation in society as a whole and in the field of music making. The concept of risk management already started by the authors in the 2nd update is therefore differentiated and further developed in the respective updates.

Our risk assessment has now been translated into English, French, Spanish, Portuguese, Dutch and Japanese (<https://www.mh-freiburg.de/en/university/covid-19-corona/risk-assessment>).

# 1. Transmission Pathways of SARS-CoV-2

## *Basic Information*

The main avenue of transmission of viruses that cause respiratory infections generally takes place via **droplets** and **aerosols**. This occurs when exposure to coughing and sneezing leads to the inhalation of droplets by a person through the mucous membranes of the nose, mouth, and deep respiratory tract, and possibly through contact with the conjunctiva of the eye. In this context, droplets are to be understood as larger particles (diameter of more than 5 micrometers). In some cases, they can be so large that they are visible when a person coughs or sneezes and can be felt on the skin. An aerosol (an artificial word from ancient Greek *ἀήρ*, German *air* and Latin *solutio* “solution”) is a heterogeneous mixture of very small suspended particles in a gas (diameter of less than 5 micrometers) that are not visible without technical tools. A Finnish working group, centered around Ville Vuorinen from Aalto University in Helsinki, carried out a computer simulation of the spread of aerosols in a closed room/supermarket (Vuorinen et al. 2020). According to the simulation if an infected person sheds virus when coughing, the viruses can still be detected in the air after several minutes, even if the sick person has already left the room. Other people can then inhale the airborne viruses.

The viruses also land on surfaces from where they can be transmitted when others touch these contaminated surfaces with their hands and then touch their faces (before washing their hands); provided the virus particles still retain their ability to infect at this point (**contact transmission**).

The transmission pathways are shown schematically in Figure 1 below.

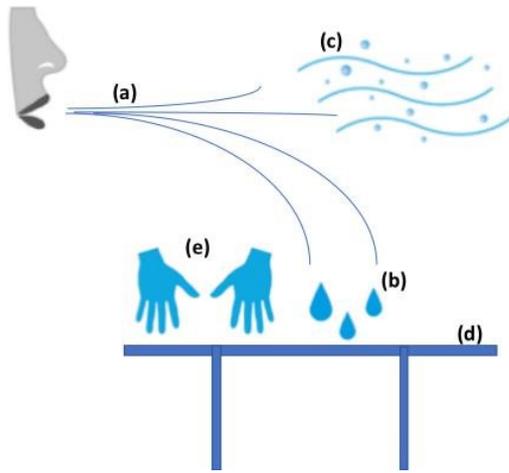


Fig. 1: Schematic representation of the possible transmission pathways. With exhaled air (a), droplets (b) and aerosols (c) are released into the environment. The droplets can land on surfaces, e.g., a table (d). From there they can be picked up by hands (e). If the hands then come into contact with the mouth, nose, or eye, a contact transmission (smear infection) can occur.

### *Specific Information about SARS-CoV-2*

According to current knowledge, the spread of the coronavirus (scientific name: SARS-CoV-2) as a trigger for the COVID-19 disease can take place via the route of droplet infection or via aerosols (Meselson et al. 2020).

According to data in three studies from the Robert Koch-Institute from April 17, 2020, aerosols containing coronavirus RNA were detected in air samples of the exhaled breath of patients or in the room air inside patient rooms (Leung et al. 2020; Chia et al. 2020; Santarpia et al. 2020).

The transmission path via aerosols has become increasingly significant in recent weeks (Morawska & Cao 2020; Miller et al. 2020; [Morawska & Milton 2020](#)).

Contact transmission of the virus is also possible. Transmission through contaminated surfaces cannot be ruled out, especially in the immediate vicinity of the infected person (ECDC 2020), since reproductive SARS-CoV-2 pathogens can be detected in the environment under certain circumstances (van Doremalen et al. 2020). To what extent an infection via the eyes is likely here cannot yet be conclusively determined (Zhou et al. 2020).

In addition to the air we breathe, saliva and respiratory secretions should also be mentioned as other relevant infectious materials. In direct patient care, it was found that

an above-average number of ear, nose, and throat doctors and anesthesiologists/intensive care physicians and nurses suffer from COVID19. This is because they carry out endoscopic examinations and interventions in the mouth and throat area and may therefore have had intensive contact with all of these three forms of transmission (German ENT Society 2020; Ruthberg et al. 2020).

## 2. Specific Risk Aspects in the Field of Music

### 2.1 Systemic Possibilities for Risk Reduction in the Field of Music

Before a vocal, instrumental, and situational specific risk assessment can take place that can be used in the field of music, general systemic methods of risk reduction should first of all be established. From our point of view, these play an especially decisive role in ensembles with a larger number of people (choir and singing in the community, orchestra, concert band, big band).

The following Figure 2 gives an overview of possible risk reduction measures. We view these three useful areas for risk reduction measures:

- a.) Entrance screening
- b.) Air & Ventilation/ Room & Space / Duration parameters
- c.) Individual protective measures

The areas of a.) and c.) are related to behavioral prevention; area b.) is related to environmental prevention.

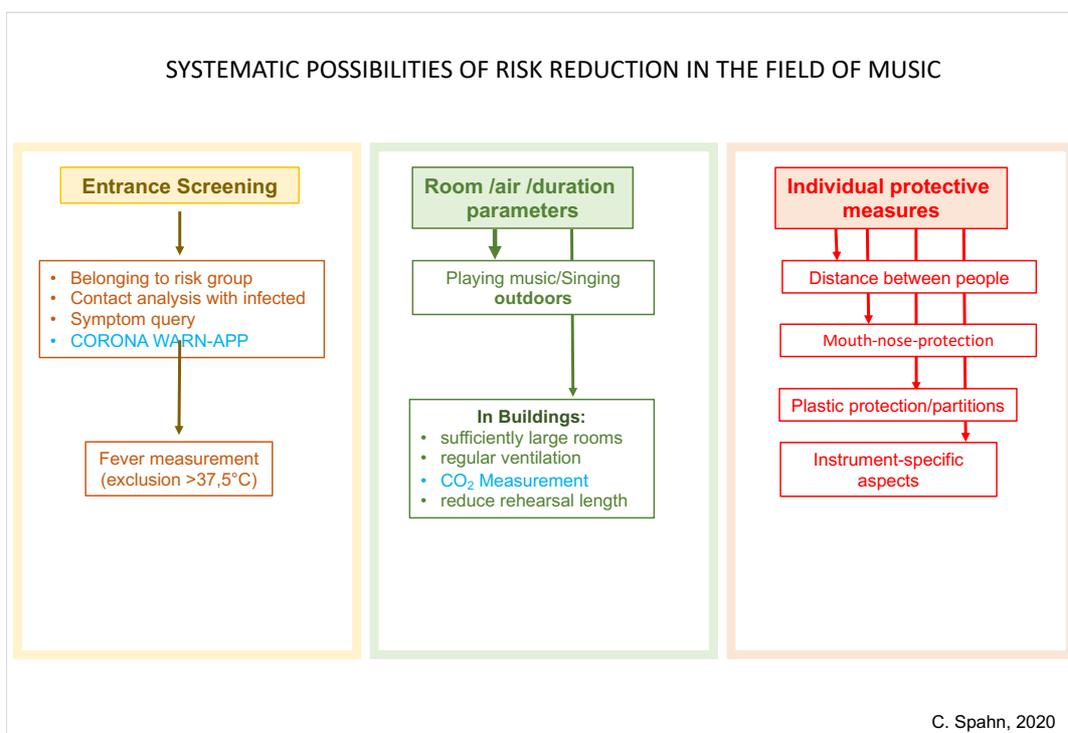


Fig. 2: Overview of systemic measures for risk reduction in the field of music

### ***a.) Entrance Screening***

An entrance screening can include a survey and a comprehensive assessment of several relevant characteristics for the disease:

- The assessment of carrier risk can be ascertained through a standardized survey (questionnaire or app<sup>2</sup>) of personal contact analysis of the previous 5–6 days and suspected COVID-19 symptoms. A standardised survey is also part of the hygiene concept in the elective treatment of outpatients since the gradual opening of hospitals from 4 May 2020, as is being carried out at the University Hospital in Freiburg. This standardized survey can serve to regulate eligibility for attendance at rehearsals / lessons / concerts and lead to better self-protection and the third-party protection in the future. [Since June, the CORONA WARN-APP \(Corona warning app\) has also been available in Germany, which can be used for risk assessment.](#)
- At-risk personnel can be identified utilizing the RKI list of pre-existing conditions (RKI list of risk groups for severe disease progression<sup>3</sup>). [The parameter age seems worth a closer look after the presentation of statistics in Germany since the beginning of March, which now show the figures over a period of four months. Statistical data on deaths from COVID-19 show that people in older age groups \(>70 years\) are significantly more affected than younger people \(Statista 2020\). Since the first death—which was reported on 9 March 2020—a total of 9059 people have died from COVID-19 in Germany up to 13 July 2020. Of these, there was one death in the first decade of life \(0-9 years\), two deaths in the second decade of life \(10-19 years\) and nine deaths in the third decade of life \(20–29 years\). The age median of the deaths was 82 years](#)

---

<sup>2</sup> Questionnaires and app could be based on the survey instruments of the University Hospital Freiburg, in use since May 4, 2020

<sup>3</sup> Older people (beginning at 50–60 years with an increasing risk of a severe progression), morbidly obese people, pre-existing conditions of cardiovascular disease, chronic lung disease, chronic liver disease, patients with diabetes mellitus, patients with cancer, patients with compromised immune systems

with a markedly right-skewed distribution curve. The data on two deaths in a choir in Skagit County, Washington (Hamner et al. 2020) also fit this pattern. Here, the median age of all choristers\* was 69 years, and the median age of the patients was 69 years, too.

- Musicians in all areas of music should pay strict attention to general illness symptoms such as fever plus respiratory complaints (dry cough, catarrh) or, in the case of more typical COVID-19 symptoms such as the acute loss of smell and taste, by avoiding any contact with other musicians until the SARS-CoV-2 PCR nasopharyngeal smear result has ruled out infection.

In the event of a confirmed infection, entry from another country, or contact with a person infected with the coronavirus, the most current quarantine rules must be observed. If symptoms occur, persons should definitely contact their family physician. In the case of music lessons for children and adolescents, legal guardians should also be given clear instructions to keep their child home at the first suspected sign of coronavirus or any mild symptoms. University students should also be made aware of this protocol. Of course, this applies to educators, who should not teach under these circumstances. Particularly strict precautions apply for older persons or persons at risk due to pre-existing conditions (see RKI risk list) when actively practicing and performing music.

- Another possible measure, which is relatively inexpensive and practical, is a system of temperature checks as an additional screening tool before making music with others. At the University Medical Center Freiburg, a majority of COVID-19 sufferers showed an elevated temperature in connection with acute respiratory complaints. The Robert Koch-Institute, on the other hand, no longer recommends using temperature measurement as a screening method for entry points, e.g. at airports, as only 42% of those infected in Germany had an elevated temperature ( $>37.5^{\circ}$  Celsius) (Epidemiological Bulletin RKI 20/2020). Also, asymptomatic, fever-free virus excretors cannot be detected by temperature measurement. Both a standardised survey and fever measurement could improve

the attention of musicians with regard to the risk aspects and increase compliance in the implementation of protective measures.

- For the professional music sector (operas, concerts, theatre) detailed hygiene concepts could be applied here, which would have to be developed and checked by company doctors depending on the institution (Böckelmann et al. 2020). These concepts could be based on existing concepts in professional sports, with which extensive experience has already been gained in recent weeks - since the partial resumption of play in national and international competitions in various contact sports. Regular corona tests (nasopharyngeal swabs) could also be established, as is regularly practised in professional sport—for example, in the German Bundesliga. Joint ventures between sports associations and music associations could also be a viable way forward in the future. [Corona tests, which can provide results regarding an infection with SARS-CoV-2 within hours, have great potential for hygiene concepts of ensembles. First application examples of regularly recurring tests as part of a hygiene concept are described by the Vienna Philharmonic Orchestra and the Thomanerchor Leipzig \(personal communication on 15.07.2020 by Prof. Sterz, Vienna and Prof. Fuchs, Leipzig\).](#)

### ***b.) Parameters of Room & Space / Air & Ventilation / Duration***

The epidemiological findings from the course of the SARS-CoV-2 pandemic already show that room and air conditions, as well as the length of exposure to gatherings of people, are likely to have a decisive influence on the risk of infection (Leung et al. 2020; Chia et al. 2020; Santarpia et al. 2020; Liu et al. 2020; Miller et al. 2020).

In order to be able to estimate how many people can stay in a certain room with a defined room volume and ventilation, two different scientists have developed very interesting calculation tools (Trukenmüller, 2020; Jimenez 2020). These are based on the previously known publications on the transmission of SARS-CoV-2 in enclosed spaces and the existing model assumptions, in particular those of Buonanno et al. 2020 a / b.

Hartmann & Kriegel have also recently presented a model calculation in which with regard to the risk assessment of virus-laden aerosols, the parameters air quality - determined by the CO<sub>2</sub> content - are included (Hartmann & Kriegel 2020).

### ***Singing and Playing Music Outdoors***

Infections are especially likely to occur in people who spend a long time in closed rooms. In a study by Qian et al. in January and February 2020, in a total of 7324 cases of infected people in China, the authors found that there was evidence in only one case of an infection being passed on outdoors (Qian et al. 2020). It can be assumed that aerosols dissipate faster outdoors, that deactivation of the pathogen is greatly accelerated (through UV, ozone, hydroxyl radicals, nitrogen oxides), and that the overall risk of infection is therefore much lower. If minimum distancing is observed, the risk of infection while singing and playing music outdoors can be considered to be very low.

Therefore, the first choice when making music with larger groups is the outdoor option. Especially in view of the fact that the coming weeks and months in which the gradual opening will take place are the summer months (in Germany), making music outdoors seems practical and even particularly attractive. There is a long cultural tradition here, just think of the ancient amphitheater. The term choir (ancient Greek χορός choros) originally referred to the dance floor of an amphitheater, in which people also sang.

Brass music also has a tradition of taking place outdoors. Outdoor concerts are the predominant setting for Pop and Rock music. Audiences need to observe the prevailing protocols for groups and distancing or creative solutions (e.g., “concert promenades,” i.e., “Wander Concerts”) need to be found.

### *Singing and Playing Music in Closed Spaces*

*Airing-Ventilation.* When singing and playing music takes place in closed rooms with natural ventilation, previous experience seems to show that regular and thorough ventilation seems to be an important factor in risk reduction. [The effectiveness of the ventilation can be checked by measuring the CO<sub>2</sub> content.](#) If the rooms are mechanically ventilated (ventilation and air conditioning systems, HVAC), a reduced risk of infection from aerosols can be assumed (Aerosols are removed by way of natural ventilation via the exchange of air in the range of approx. 0.5–2/h even with closed windows; for HVAC, e.g., in concert halls or performance halls, the air exchange rate is approx. 4–8/h; [from an air exchange rate of 6/h on, a sufficient removal of aerosols can be assumed](#)).

*Room size.* The size of the room, the number of people in a room, and the length of time they are in a closed room all seem to play an important role (Tellier 2006). A relatively large number of people who stayed in confined and poorly ventilated rooms for a long time seem to have contributed to the spread during the “well-known” outbreaks in Europe (e.g. Ischgl and Heinsberg). Pertinent to group music making, very large spaces such as church sanctuaries, concert halls, or city auditoriums (["cathedral situation"](#)) could also be increasingly utilized as rehearsal rooms.

*Rehearsal time.* In addition to the sufficient room size, short rehearsal periods (e.g., 15 minutes, see also Robert Koch-Institute, as of April 16, 2020, “Kontaktpersonennachverfolgung bei respiratorischen Erkrankungen durch das Coronavirus SARS-CoV-2”) with breaks during rehearsal for ventilation, presumably reduces risk.

In order to estimate the risk of infection depending on the above-mentioned parameters of ventilation, room size, number of people in a room and rehearsal duration, the Excel tables mentioned above [and the information at Hartmann & Kriegel](#) may be helpful in the future (Trukenmüller, 2020; Jimenez, 2020; [Hartmann & Kriegel 2020](#)).

### ***c.) Individual Protective Measures***

*Mouth-nose protection.* From our point of view, wearing a mouth-nose-protection (surgical face mask) represents an important way of reducing risk, particularly in the music field. It has been known for a long time that masks are suitable for infection protection in various respiratory diseases (van der Sande et al. 2008).

It is particularly important that the face masks be worn, even though they may be perceived as inconvenient or disruptive while singing or playing a string, plucked, or keyboard instrument. The medical differentiation between wearing filtering half-masks (N95) or wearing surgical face masks is whether the aim is to be protected from infection by droplets or aerosols from other people (own protection), or whether the aim is to reduce the spread of infectious material to other persons (protection of others). [When wearing a surgical face mask, both possible effects are combined.](#)

The material of the medical face masks, type II (according to DIN EN 14683: 2019-6), that are currently readily available surgical face masks, absorbs  $\geq 92\%$  of the particles  $\geq 3 \mu\text{m}$  in diameter. Thus, they represent a sensible measure for protection of others, but also offer relevant own protection (according to IuK measurements, they retain e.g. particles  $\geq 0.5 \mu\text{m}$  to approx. 80–90% and particles  $\geq 0.3 \mu\text{m}$  to approx. 70–80%). However, the correct mask fit also plays an important role here, as air particles can escape laterally past the masks, especially during forceful exhalation (Mittal et al. 2020). Current studies have shown that wearing such masks can effectively reduce the spread of droplets and aerosols (Leung et al. 2020).

Since the second update of 19.05.2020, further publications on the subject of corona and the wearing of face masks have appeared, which explain the wearing of masks based on the latest scientific results. They are briefly described below.

On the one hand, animal experiments have shown that the risk of infection can be significantly reduced by the application of masks (Chan et al. 2020).

On the other hand, a review found that in countries that consistently pursued the use of masks at the beginning of the pandemic—such as Taiwan, Japan, Hong Kong, Singapore and South Korea - significantly lower rates of illness and death were found than in regions where these measures were not initially recommended - such as New York (Prather et al. 2020).

This finding is consistent with the observations of Mitze’s working group, which assume a 40 percent reduction in infections by wearing masks in the Jena district (Mitze et al. 2020, English a/ German summary b). In the German-speaking area, the German Society for Pneumology (DGP) also published a positive statement on the topic of mask wearing at the end of May 2020 (Pfeiffer et al. 2020).

Furthermore, the effectiveness of the filtering effect of different mask types was investigated by Koanda’s working group (Koanda et al. 2020). As an important result, it was found that self-sewn masks also achieve a meaningful filtering effect - especially when they are made of different materials in multiple layers.

The working group around Stutt also emphasized the positive effect of mask wearing in a model (Stutt et al. 2020), as did the working group around Wang in its epidemiological study (Wang et al. 2020) and the extensive meta-analysis of the working group around Schünemann (Chu et al. 2020).

In a document (Interim Guidance) of 5.06.2020, the WHO now also recommends the wearing of masks as a component of infection protection also for the general population (WHO 2020).

*Distance protocol.* We continue to emphasize the importance of adhering to the distancing rules in protecting against droplet contamination, even in the music business. Since compliance with distancing protocols requires great attention—physical closeness and social connection are intuitive parts of music-making situations, and since singing and music-making do not take place from a rigid body position, but rather require a certain amount of freedom of movement—we believe that the distance between people should be 2 meters/6 ½ feet. An additional benefit can be simultaneously achieved by

applying the radial distancing rule of 2 meters to a larger number of people in a closed room. Thus, by applying this rule, only a few musicians can fit into small rooms. With larger ensembles, a larger room size becomes necessary if this rule is to be observed. As a result, a minimum radial distance of 2 meters/6 ½ feet can help to reduce not only the risk of droplet transmission, but also the risk of increased indoor aerosol accumulation. However, compliance with distancing rules does not negate the need for regular ventilation and/or shortening rehearsal times.

*Specific measures.* Further specific considerations for individual instruments fall within the area of individual protective measures below (e.g., spit protection and partitions between singers and accompanists).

## **2.2 Vocal and Instrument-specific Risk Assessment**

### **2.2.1 Vocal**

#### **General Risk Assessment pertinent to Singing**

As previously described, a distinction must be made in the transmission pathways of SARS-CoV-2 between the risk of infection from droplets (containing viruses) and the infection from aerosols (containing viruses). In addition, it is important to note the other transmission paths via hand/nose/mouth contact and, potentially, hand/eye contact.

*Droplets.* Due to their size and weight, droplets sink quickly to the ground and travel a distance of maximum 1 meter (39 inches). This is the basis for the distance rule of 1.5 meters (5') in everyday situations (shops, offices, etc.).

*Is there an increased risk of droplet infection when singing?* In the field of voice physiology it has long been maintained that no significant additional air movement occurs in front of a singer's mouth during phonation (sound production when singing) since sound waves travel physically without significant flow: the flame of a burning candle does not move in front of a singer's mouth, even if one sings loudly.

This observation was recently confirmed by measurements made of three singers with the Bamberg Symphony Orchestra. The artificial fog channeled directly in front of the singers' mouths was not visibly redirected by singing even at different pitches, different volumes or different vocal styles. By forceful articulation, e.g. with consonants (plosives, fricatives), slight turbulences in the fog was observed in the close proximity to the singer's mouth. However, when measuring the air speed with sensors set at a distance of 2 meters/6 ½ feet from the singer, no air movement could be detected. This distance of 2 meters/6 ½ feet can therefore be viewed as a protective distance against droplet infection even with forceful articulation.

These observations are consistent with other working groups that have recently developed different optical methods for visualizing the air propagation at playing a wind

instrument and singing (Kähler & Hain 2020 a/b; Becher et al. 2020 a/b; [Echternach & Kniesburges 2020](#); [Sterz, 2020](#); [ORF 2020](#), [Becher et al. 2020 a/b](#)).

*Aerosols.* Reproductive pathogens are incorporated into aerosols in the airways, e.g., chickenpox virus, influenza viruses, measles virus, mycobacterium tuberculosis, and obviously, SARS-CoV-2 as well.

It has been shown that aerosol formation increases with increasing speech volume (Asadi et al. 2019). [First scientific studies on aerosols during singing are currently available \(Mürbe et al. 2020\)](#). To date, there are no known scientific studies regarding aerosols while singing. When aerosols emerge from the mouth opening, it is to be expected that these will rise, due to their lower specific density (approx. 37° Celsius and >95% relative humidity), and then mix with the room air. Sedimentation of aerosols below a particle size of approximately 4 µm is, practically speaking, not a factor.

*Is there an increased danger from aerosols when singing?* Fundamentally, it must be assumed that singing can produce aerosols that can transmit viruses just as resting breathing or speaking can (Fabian et al. 2019). The measurement of aerosols, in general, are a challenge to quantitatively measure.

Currently, several working groups are measuring aerosols while singing.

On May 17, 2020, a report on a study with the Vienna Philharmonic Orchestra was published in ORF Kultur, in which the breathing of different wind players was shown in a photo-documentary by ao Univ. Prof. Dr. med. Fritz Sterz from the Medical University of Vienna (ORF 2020).

On 22.05.2020 the Bayerischer Rundfunk reported in a radio report on a study by Prof. Dr. Matthias Echternach, Univ.-HNO-Klinik München (LMU) and PD Dr. Stefan Kniesburges Univ.-HNO-Klinik Erlangen (BR-Klassik aktuell 22.05.2020).

[On 4.07. a detailed film report on this investigation was broadcast on the Bayerischer Rundfunk, in which the authors Echternach and Kniesburges explained their results. In broad agreement with our own measurements of air movement, the authors state that the aerosol clouds spread in the singing direction up to a distance of 1.5 m when singing.](#)

Laterally to the singers\* the preparation distance was significantly smaller. The authors' recommendations for a safe distance are therefore at least 2 m (better 2.5 m) to the front and 1.5 m to the sides.

On 27.05.2020, a protocol of an investigation and a photographic documentation of aerosol and condensation water emissions of choir members was published on the website of the Austrian Choir Association, which was also prepared by Prof. Dr. Fritz Sterz of the Medical University of Vienna (Sterz et al. 2020).

On June 3, 2020, the Rundfunk Berlin-Brandenburg broadcast a television report on a study by Prof. Dr. Dirk Mürbe from the Charité and Prof. Dr. Martin Kriegel, Hermann Rietschel Institute of the TU Berlin (rbb Praxis, June 3, 2020). [As of 3 July, the results of this working group have now been published as pre-print \(Mürbe et al. 2020; Hartmann et al. 2020; Hartmann & Kriegel 2020; Kriegel & Hartmann 2020\).](#)

On 26.06.2020 a Japanese working group consisting of members of the Tokyo Metropolitan Symphony Orchestra (conductor: Kazushi Ono) in cooperation with the aerosol researcher Professor Tomoaki Okuda (Keio University) and Dr. Hiroyuki Kunishima from the Department of Infectious Diseases of St. Marianna University published a report on aerosol measurements with wind instruments and singers (Ono et al. 2020).

[As mentioned above, the results of these studies have now in part been published scientifically.](#)

*Inhalation.* The extent to which deep inhalation while singing increases the risk of infection has not yet been scientifically investigated.

*Phlegm production.* Putting other factors in tone production aside, singing can produce a not inconsiderable amount of phlegm. For one, it is not uncommon to observe that extra phlegm is produced when warming up for playing or singing, which is then expelled from the respiratory system by coughing or clearing the throat. Likewise, prolonged instrumental playing can lead to increased formation of phlegm due to stress on the respiratory tract.

*Conclusion: General risk assessment with regard to the activity of singing.* Based on the interrelationships and results shown, we assume that singing does not increase the risk of droplet transmission if a radial distance of 2 meters/6 ½ feet is maintained. Based on the latest measurement results, it does not appear necessary to extend the distance to 3–5 meters/10–16 ½ feet, as we had initially formulated in the first risk assessment on April 25, 2020.

The extent to which aerosol formation and diffusion specifically changed by singing occurs as a result of the singing process cannot be fully assessed at present, as the emission rates fluctuate widely (cf. Morawska et al. 2009). However, the data collected so far suggest that singing can lead to significantly higher emission rates for aerosols in comparison to oral respiration and speaking; on average, an emission rate 30 times higher is currently stated (Mürbe et al. 2020).

The CO<sub>2</sub> content of the air is an important starting point for the risk assessment of an infection through aerosols. It can be used as a measure for the accumulation of SARS-CoV-2 viruses contained in aerosols (Hartmann & Kriegel 2020). Max Pettenkofer already established in the middle of the 19th century that gaseous carbon dioxide (CO<sub>2</sub>) is an important measure of air quality. He recognized that CO<sub>2</sub> is not only a measure of air quality but that other substances in the air are also proportional to the CO<sub>2</sub> content (Pettenkofer 1858). According to Pettenkofer, the Pettenkofer number of the CO<sub>2</sub> content was also determined at 1000 ppm, which is required to be observed indoors, especially in the context of schools - even independently of singing (Communication from the Federal Environment Agency 2008). Here, simple, relatively inexpensive measuring devices are available which also visually represent the air quality in the sense of a "traffic light". These enable the risk of infection from aerosols in enclosed spaces to be assessed and can control the ventilation required in naturally ventilated rooms.

It is also still unclear what influence deep inhalation during singing has on possible infection transmission. As a consequence of the existing knowledge, we believe that necessary protective measures need to be proposed. These are detailed below in their individual forms and settings, in which singing occurs.

## ***Forms of Singing***

### *Individual voice lessons*

With solo singing, a deep inhalation and exhalation occurs during sound production. To the best of our knowledge, the extent to which this increases the risk of infection has not yet been scientifically investigated. Even if the direct air flow is not stronger in singing phonation, as our latest measurements have confirmed, [it is to be assumed that when singing, viruses can be spread by aerosols](#). In solo singing, spitting particles, i.e., droplets, are expelled when consonants are formed. The short range of these droplets has been described above.

Direct transmission by droplets can also be reduced by installing plastic partitions. Noise protection screens already available in some institutions could be used as makeshift protective barriers.

[CO<sub>2</sub> measurements with adherence to the Pettenkofer number can be a valuable aid here to monitor the effect of ventilation concepts over time.](#)

In addition, it makes sense to us that pedagogues wear additional face and nose protection during individual lessons when students are singing. If protective masks are available to the non-medical sector, wearing an FFP-2 (respirator type) mask for personal protection could further reduce the risk of infection.

In our view, if the safety measures are strictly observed, (according to the latest measurements, in particular a distance spacing of 2 meters/6 ½ feet, see above) and if the required room prerequisites are present (sufficient room size, ventilation breaks every 15 minutes [or according to CO<sub>2</sub> level](#) and between individual students) the risks in individual lessons can be reduced.

However, it cannot be inferred from this updated risk assessment that teachers or students can be obliged to teach or take part in individual face-to-face lessons. In our

opinion, if the structural and organizational requirements are not met or the people involved belong to a risk group, then face-to-face teaching should not take place, but could be possible digitally.

### *Choir singing*

Choral singing generally follows the characteristics of the singing process described above. Since it must be presumed that each and every singer creates aerosols, it is to be expected that aerosols containing viruses will accumulate in a higher concentration in an enclosed space when a large number of people gather (Liu et al. 2020). The quality of room ventilation also plays an important role here (Li et al., 2020). The question of the duration, i.e., how long a choir rehearsal lasts, also plays a role in the expected concentration of aerosol particles in a room. Over longer periods of time, particle concentration can rise to higher values than in shorter periods.

There have been repeated reports of the spread of SARS-CoV-2 infections among several different choirs after choir rehearsals and religious services. A scientific publication reported on one such outbreak in a choir in the United States on May 12th (Skagit County, Washington) (Hamner et al. 2020). A high infection rate was reported by the choir to the health authorities on March 17, 2020. The choir rehearsal, which presumably led to the high infection rate, took place on March 10, 2020. Of the 61 choir members who took part in the rehearsal on March 10th, 53 fell ill, three had to be treated in hospital, and two died. The median age of the singers was 69 years (range = 31–83), the three hospitalized patients had two or more known medical conditions. Infection via aerosols is discussed in the publication as a likely source. However, other influencing factors are also critically examined. The distance between individual singers was small, 6–10 inches (about 15–25 cm) between the chairs. The entire rehearsal lasted approximately 2 ½ hours. There was a 15-minute snack break. In addition, the presumed index person, who is suspected to be the primary source of viral spread at the rehearsal on March 10th, had already been symptomatic on March 7th. That person had also participated in the March 3rd rehearsal.

In order to reduce the risk of infection from aerosols in the choral setting, *mouth and nose protection* can be worn, as already explained above.

In addition, singing in very *large rooms*, such as concert halls or church sanctuaries, appears to be most favorable. A regular *airing out* of the room approximately every 15 minutes, or the use of rooms with an HVAC system are important risk-reducing measures.

A control of air quality in closed rooms with natural ventilation using the CO<sub>2</sub> traffic light—as described above—can significantly optimise the ventilation concept. Since aerosols are emitted to a greater extent when singing, but also when speaking and increased breathing, e.g. when moving, this measure seems to be generally recommended, especially since it can be assumed that aerosols accumulate in a closed room when several people are present, even independently of singing and making music. Under control of such a CO<sub>2</sub> traffic light, singing in a group could be integrated and would no longer mean an uncontrollable additional risk. The use of CO<sub>2</sub> measurement is also reported in the field of dance/movement as part of the hygiene concepts of dance medicine (TaMed 2020).

It *still* appears that the most favorable way to minimize risk is to sing *outdoors* (see also Systemic Risk Reduction).

Furthermore, through better rehearsal scheduling, the *rehearsal periods* could be divided into short 15-minute sections—enabling *airing out* of the room—to help minimize risk.

To eliminate droplet transmission, choirs must observe the general *spacing rule* for social distancing, even in the choir breaks, where face masks should also be worn to protect against droplet transmission.

Above and beyond that, in our view, particular care must also be taken in break situations to ensure that there is no hand contact or contact with surfaces (e.g., by sharing music, etc.). Regular and thorough *hand washing* is very important. One should especially avoid touching the face and rubbing the eyes.

A further general risk reduction is the personal entrance screening (see above). Sneezing and coughing should be avoided, if possible, and caught in the crook of the elbow.

### *Singing in religious settings*

Congregational singing appears possible if the distancing rule of 2 meters/6 ½ feet is observed and face masks are worn, since it can be assumed that there is no greater risk of being infected by singing than by speaking. In addition, services usually take place in large to very large spaces.

Church rooms with a ceiling height of 10 metres and more usually have such large volumes of room air that they can be considered comparable to smaller rooms with a powerful ventilation system (air exchange rate 6/h) with regard to the risk of infection. In addition, many church rooms are equipped with modern ventilation systems. Where this is not the case, the air quality and the effectiveness of the ventilation can be checked directly on site using the CO<sub>2</sub> traffic light - as described above. The ventilation concept is to be optimised on the basis of the values collected on site.

## 2.2.2 *Wind Instrument Playing*

### **Risk Assessment Regarding Playing Wind Instruments**

With the exception of flute, experienced players of wind instruments do not let air escape at the contact point between the player's mouth and the mouthpiece (rim/cup, single and double reed). With some wind instruments, air escapes out of the keyholes for certain notes, but in general, wind instruments have a sound opening, e.g., in the form of a bell. The wind instruments will be considered individually because of their unique features.

As a commonality, apart from the flute-instruments, it can be stated that the sound is generated by vibrations of the lips of the mouth (brass instruments) or interrupted by a reed in the mouthpiece (reed instruments among the woodwind family). Comparable to singing, only small amounts of air flow out of the instrument's horn in wind instruments per unit of time. The latest measurements taken of the Bamberg Symphony Orchestra by Dipl. Ing. Schubert from the Tintschl company support these assumptions.

These observations and measurement results are also supported by the results of other working groups (Kähler & Hain 2020 a/b; Becher et al. 2020 a/b; Echternach & Kniesburges 2020; Sterz, 2020; ORF 2020; Becher et al. 2020 a/b; NFHS 2020).

Due to the previously described transmission pathways of SARS-CoV-2, a distinction must be made between the potential risk of infection from virus-containing droplets and virus-containing aerosols when blowing air. In addition to these are the important transmission pathways via hand contact and hand/eye contact.

*Droplets.* Due to their size and weight, droplets sink quickly to the ground and reach a maximum distance of 1 meter (3'3"). This is the basis for the distance rule of 1.5 meters (4'1") in everyday situations (shops, offices, etc.).

*Is there an increased risk of droplet infection when playing a wind instrument?* Since no air escapes at the contact point between the player and his mouthpiece in those who control their instruments, no droplets are released directly into the environment from the musician's mouth when playing brass instruments, woodwind instruments with a single reed (clarinet and saxophone), and double reeds (oboe, bassoon). This is different with flute instruments (flute, recorder). Especially with the flute, air is blown directly from the mouth of the player into the environment when blowing on the mouthpiece and droplets can be released. The measurements of the Bamberg Symphony Orchestra show, that with regard to the air speed parameter, no air movement could be detected at the sensors, which were placed 2 meters/6 ½ feet from the mouthpiece. Therefore, transmission by droplet infection is very unlikely at this distance. With the recorder, the lips surround the beak of the instrument, so that no droplets can get into the surroundings. On the other hand, droplets could form when the air flow is broken up at the labium of the head piece. In measurements taken with the Bamberg Symphony Orchestra, when the recorder was played air movements in the area of the labium were no longer measurable at a distance of 1.5 (4'1") meters. Therefore, transmission by droplet infection is very unlikely at this distance.

*Condensation.* Condensation is created when warm, moist, air inside the instrument—whose inner walls are markedly colder—condenses as drops of water. During this process, any aerosols contained in the exhaled air are greatly reduced (air purification principle [*Luftwäscher-Prinzip*]). If the breath is from a virus carrier, the question arises whether and to what extent this condensation, which Brass players need to release at the water key during breaks, contains viruses and is therefore potentially infectious. Measurements regarding the viral load in condensed water are still pending.

*Aerosols.* When aerosols escape from the mouth, they rise due to the low specific weight of the exhaled air. They spread out in space, with sedimentation no longer playing any practical role. A reduction can only occur as a result of dilution through the volume of air in the respective space and through the natural exchange of air.

*Is there an increased risk of aerosols when playing wind instruments?*

Aerosols do not escape into the room air directly from the mouth when playing wind instruments, except for the flute. They get into the environment via the body of the instrument and through open keys and/or the bell. One needs to differentiate here between the possible exit points among different wind instruments. In brass instruments, air exits through the bell. With woodwind instruments, only at the lowest note of the respective instrument are all side holes closed, so that only in this case the air escapes through the bell. Exceptions to this are the oboe and the English horn, in which air escapes through the last open side hole even when the instrument is at its lowest note. In addition, air that escapes through the first open side hole is subject to change depending on the pitch played in woodwind instruments.

Even when playing the flute and recorder, aerosol formation occurs exclusively in the airways. For the flute, the air flow can be compared to the flow of an exhalation. The air flow is diverted in accordance with the Coanda effect. With the recorder, the lips enclose the mouthpiece of the flute and the air flow is broken up at the labium of the headpiece.

It is a physical assumption, that inside every wind instrument it comes to surface contact with aerosol particles, which stick to the inner surfaces, i.e., that the instruments basically reduce the particle concentration of the given aerosol. The effect increases the longer the airway of the instrument, the smaller the diameter, and the more curved it is. The effect governs all particle sizes, but the effect is more pronounced for larger particles than for smaller particles, e.g., viruses. As described above, the question arises as to what extent the instrument also acts as a filter for aerosols (due to condensation of air humidity and due to surface contact). Measurements are still pending.

As long as no clear results are available, some authors (cf. Kähler & Hain; Willich et al.) recommend using some sort of transparent protective material or tightly woven silk cloths (aka drop protection) placed in front of the bell of the brass family instruments. Until further clarification of the question, this could help reduce potentially escaping

aerosols. A covering over the bell of woodwind instruments seems less effective for reasons already mentioned.

To what extent inhaling deeply when playing wind instruments increases the risk of infection has not yet been scientifically investigated.

On the recipient side, the question arises to what extent virus loaded aerosols are absorbed in greater amounts due to the deep and often rapid inhalation when playing wind instruments, and to what extent higher concentrations of viruses thereby invade the respiratory system. To date, no scientific studies have been carried out on this topic.

For wind players, phlegm production can also occur as a byproduct of sound production. For example, it is not uncommon to observe additional phlegm being produced during inhalation, which is then removed from the respiratory system by coughing or clearing the throat. Likewise, prolonged wind playing can lead to increased phlegm formation due to overloading the respiratory tract.

*Conclusion: General risk assessment of wind instruments.*

As far as we know, there are still no measurements of the viral concentration in the blown-out air of wind players. However, it is known that playing wind instruments requires an intensive exchange of air in the lungs and airways with, at times, high air pressures. The extent to which the viral load is reduced by the air's path through the instrument is currently unclear. Based on the latest measurement results, it does not appear necessary to extend the distance to 3–5 meters/10–16 ½ feet, as we had initially formulated in the first risk assessment on April 25, 2020. 2 meters/6 ½ feet seems sufficient as a minimum distance, because no additional movement of indoor air during playing was detected at this distance during the tests. Therefore, the risk of droplet infection, if the distancing protocol is being observed, can be classified as very low.

In addition, there is the formation of condensation from the exhaled air in the instrument, which can be regarded as another potentially virus-spreading material. We recommend

avoiding the draining of condensation onto the floor and recommend instead disposing of it in a collection container or absorbent blotting paper. Furthermore, wind players should not blow through the instruments to clean them. Wind instruments should, if possible, be cleaned in separate rooms away from the teaching or rehearsal setting. In the event of contact with condensation or with the interior of the instrument (e.g., horn), great care must be taken to ensure a thorough hand hygiene protocol is followed (at least 30 seconds of hand cleaning, i.e., very thorough hand washing with soap or, if necessary, the use of a hand sanitizer).

## **Forms of Wind Instrument Playing**

### *Individual lessons with wind players*

In our opinion, the risk seems basically comparable to that of singers in individual lessons (see above). [CO<sub>2</sub> measurements with adherence to the Pettenkofer number can be a valuable aid here to monitor the effect of ventilation concepts over time.](#) It also makes sense to us that educators and pupils wear mouth-nose protection in individual lessons, when they are not playing. We emphasize the correct handling of the masks based on the current hygiene rules. If protective masks are available to the non-medical sector, wearing an FFP-2 (respirator type) mask for personal protection could further reduce the risk of infection.

### *Wind ensembles*

Wind ensembles can have different numbers of players depending on their instrumentation. The number of players must always correspond to the currently applicable regulations on group sizes. Even with smaller ensembles, a minimum distance of 2 meters/6 ½ feet should be maintained according to the latest data, since at this distance no additional room air movement could be detected when playing. Rehearsal rooms should be as large as possible and should be thoroughly and regularly aired out every 15 minutes.

Since compliance with the distancing rule is a very important measure, see section 2 c.), making music in large rooms—in addition to concert halls, church sanctuaries should also be considered in this case—can further reduce the risk. In the summer season, we see an important opportunity to play outdoors. There is a great tradition of playing outdoors in the field of wind music.

It can be assumed that aerosols dissipate faster outdoors, that the deactivation process of the pathogens is greatly accelerated (UV, ozone, hydroxyl radicals, nitrogen oxides), and the cumulative effect thereof is a much lower risk of infection. If the minimum distancing rule for wind ensembles is observed, then the risk can be deemed very low.

### 2.2.3 Other Instruments

#### **Keyboard, Bowed and Plucked String Instruments, Percussion**

From our point of view, there is no increased risk to other instrumentalists *through music making* when compared to other social situations with regard to the question of droplet infection or increased aerosol formation, provided that the applicable rules are strictly observed. The known risks apply. If several musicians are gathered in one room, the risk of a possible infection via aerosols has to be considered. In our view, the measures listed above (see Paragraph 2 b.) should therefore apply; in particular, ventilating (after 15 minutes of rehearsal/lesson *shock ventilation* [*Stoßlüftung*], [CO<sub>2</sub> measurements](#)), having sufficient room size and observing distancing. Thorough hand cleaning is of particular importance.

#### *Keyboard instruments*

With pianists, the risk of contact transfer plays a role if different pianists play the same instrument in succession. Before playing begins, all players must wash their hands for at least 30 seconds (i.e., very thorough hand washing with soap or, if necessary, use a hand sanitizer). In addition, from our point of view, the keys themselves should be disinfected with cleaning cloths before and after being played.

In our opinion, during collaborative/accompanied rehearsals care should be taken to ensure that there is a distance of 2 meters/6 ½ feet between pianist and fellow musicians, including during the coaching/rehearsals of wind players or singers, as it is not uncommon for spontaneous movements to occur when making music, such as turning towards the accompanist. According to our measurements, there is no danger of droplets being transmitted through the air from a wind instrument and a singer's mouth at this distance.

However, a possible infection from aerosols in the room cannot be ruled out. In the sense of the risk reduction measures described above, we see the wearing of face masks in the

context of mutual protection of third parties and self-protection of the players as an important option for the accompanist and the instrumentalists/singers with whom they make music. For wind players, the risk reduction measures described above (wearing face masks) are problematic.

#### *String bowed, plucked, and percussion instruments*

The transfer or sharing of instruments should be avoided, if at all possible. As with pianists, the risk of contact transmission can be reduced by washing hands and avoiding touching the face, mouth, nose, and eyes.

### **Chamber Music Ensemble / Wind Ensemble**

Even for smaller ensemble configurations of chamber music or wind groups, the options for risk reduction through the *entrance screening*, the optimization of the parameters of *room-space / air-ventilation / duration*, as well as the *individual protective measures* detailed in Section 2 above should be observed. Here too, it is very important to observe the distancing protocols so as to protect against droplet contamination. For complying with the distance protocols requires great attention, and because physical closeness and social connection are an intuitive part of music-making situations, and since music is accompanied by movements around the body axis in space, we feel a distance of 2 meters/6 ½ feet between people should be observed. In addition, when several people play music in a closed room, the risk-reducing protective factors for infection by aerosols apply. These are: rooms as large as possible (enforced by a radial distance of 2 meters/6 ½ feet around each musician), regular room airing (after 15 minutes of rehearsal/instruction *shock ventilation* [*Stoßlüftung*] in closed rooms with natural ventilation, [CO<sub>2</sub> measurements](#)) and a reduction in the total rehearsal time.

In addition, musicians who do not play a wind instrument in chamber music ensembles and wind chamber groups should wear mouth-nose protection (face masks), as described several times above, in order to reduce the risk of an aerosol-borne infection. Above and beyond that particular care must also be taken to ensure that there is no hand contact or

touching of surfaces (e.g., by sharing music, etc.) during breaks. Regular and thorough hand washing is very important and especially avoid touching the face and rubbing the eyes. Sneezing and coughing should be avoided as much as possible and caught in the crook of the elbow.

### **Orchestra / Concert Band / Big Band**

In large groupings of musicians, such as orchestra, concert band, or big band, the measures described above for risk reduction are to be applied in accordance with the respective ensemble's situation. When the risks from droplet transfer and/or aerosols are summarized, the risk-reducing measures must be combined in such a way that the greatest possible risk minimization can be achieved. With regard to the transmission of droplets between the individual musicians, according to the data from the Bamberg Symphony Orchestra and other working groups, it can be assumed that at a distance of 2 meters/6 ½ feet (radial) between the musicians—including the wind instrumentalists and the flute—no droplet transmission is to be expected.

Currently, there is no scientific data regarding the spreading of aerosols in closed rooms during rehearsals and concerts. As long as this is the case, we believe that the greatest possible risk reduction should be carried out by using a combination of measures. This combination should be applied to orchestra or big band—as already described for chamber ensemble and choir—including regular room airing (see Section 2 above). Regular airing of the room every 15 minutes—[CO<sub>2</sub> measurements with adherence to the Pettenkofer number can be a valuable aid here to monitor the effect of ventilation concepts over time](#)—or using rooms with an HVAC system are important measures for risk reduction. In terms of risk minimization, it seems most favorable if musical groups can play outdoors (see also Systemic Risk Reduction). In addition, a face mask should be worn for own protection and protection of others. For wind instruments, as long as the filter effect of the instruments has not been proven, appropriate cloth protection can be attached to the bells. The question of the length of time, i.e., how long a rehearsal or

concert lasts, also plays a role for the expected particle concentration of aerosol in a room: during longer time periods the particle concentration can increase to higher values than in shorter time periods. This should be considered when planning rehearsals or concert productions. Sneezing and coughing should be avoided, as much as possible, and caught in the crook of the elbow.

Especially with larger numbers of people, situations outside of orchestral/band music activity plays an important role for a possible infection. It is particularly important to ensure that there is no hand contact or contact via surfaces (e.g., by sharing music, etc.) during breaks. Regular and thorough hand washing is very important, and especially avoid touching the face and rubbing the eyes.

The entrance screening mentioned under the measures above could represent an effective additional step if used consistently.

### 3. Risk Management

For newly emerging risks, the risk management procedure has been established in quality management—for example in industry—for years. ISO standards have been developed specifically for this purpose (ISO 31000:2018).

Effective risk management usually requires a precise risk analysis with an associated likelihood of occurrence and knowledge of the effectiveness of certain risk-reducing measures. At the moment, however, we do not yet know much about the transmission of SARS-CoV-2, so that risk management currently means an equation with many unknowns. These unknowns leave room for different goal perspectives (disease rate vs. preservation of the music culture) and different personal attitudes (risk-willing or risk-averse) to lead to different recommendations for action. Individually, everyone must have the right to decide for themselves what level of personal risk they are willing to carry.

As scientists, we want to help convert as many of these unknown variables of the equation into known variables as possible. On the basis of the latest research results and recommendations of the working groups in Freiburg, Munich and Berlin, which are intensively involved in the topic, it is possible to formulate statements on risk levels and the extent of the risk of infection depending on the risk-reducing measures, as shown in Figure 3. In our estimation, when levels 1 & 2 are reached, the risk is reduced in such a way that music can be played while strictly observing the risk-reducing measures. If only level 3 can be achieved, music performance is not recommended. The practice of music is forbidden at level 4.

<b>Level 1</b>	<ul style="list-style-type: none"> <li>• Individuals having recurring negative test-results (see Sports, Wiener Philharmonic, Thomaner)</li> <li>• No Risk reducing measures necessary</li> </ul>	Very low Risk
<b>Level 2</b>	<ul style="list-style-type: none"> <li>• Observance of Minimum Distance (radial 2m/6<sup>1/2</sup> feet, or 1,5m lateral and 2m in front, staggered arrangement)</li> <li>• Outdoors</li> <li>• Closed spaces <ul style="list-style-type: none"> <li>– Very large („Cathedral-Situation“)</li> <li>– High air exchange rate (HAVAC (6/h)) or sufficient intermittent ventilation (CO<sub>2</sub>-traffic light)</li> <li>– Wearing surgical masks while singing</li> <li>– Specific Measures in Brass-/Wind Instruments (Shields, condensation water)</li> </ul> </li> </ul>	Remarkable reduction of Risk
<b>Level 3</b>	<ul style="list-style-type: none"> <li>• Abnormalities during entrance screening</li> <li>• No observance of distances (radial 2m, or 1,5m lateral and 2m in front),</li> <li>• Too many people in a room</li> <li>• Insufficient ventilation</li> </ul>	High Risk
<b>Level 4</b>	<ul style="list-style-type: none"> <li>• Absence of Risk awareness</li> <li>• Absence of Risk reducing measures</li> </ul>	Ultra-High risk

Spahn/Richter 2020: Risiko Management Corona in the field of music

Fig. 3: Four levels with assessment of the infection risk depending on the risk-reducing measures (based on the risk matrix according to Nohl 2019)

In practice, from our point of view, an optimal risk management would currently look something like each institution developing its own risk management protocols for its own specific musical setting. It is to be expected that the higher and more effective the number of risk-reducing measures, the greater the reduction of infection risk. This action should be guided by the advice of company doctors, health departments, etc.

As long as we do not have a sufficiently scientifically verified understanding, we must err on the side of over- rather than underestimating the possible risks. In this way, the overall risk of infection can be reduced as much as possible by combining risk-reducing measures. However, it must be clearly pointed out that according to the ALARP principle (As Low as Reasonably Practicable) there will be residual risk that is currently not quantifiable.

## Literature

- Asadi S, Wexler AS, Cappa CD, Barreda S, Bouvier NM, Ristenpart D. Aerosol emission and superemission during human speech increase with voice loudness. *Sci Rep*. 2019 Feb 20;9(1):2348. doi: 10.1038/s41598-019-38808-z.
- Becher L, Gena AW, Völker C. (a) Risk assessment of the spread of breathing air from wind instruments and singers during the COVID-19 pandemic. 1. Update as of 17.07.2020. [https://www.uni-weimar.de/fileadmin/user/fak/bauing/professuren\\_institute/Bauphysik/00\\_Aktuelles/1\\_Update\\_-\\_Risk\\_assessment\\_of\\_the\\_spread\\_of\\_breathing\\_air\\_from\\_wind\\_instruments\\_and\\_singers\\_during\\_the\\_COVID-19\\_pandemic.pdf](https://www.uni-weimar.de/fileadmin/user/fak/bauing/professuren_institute/Bauphysik/00_Aktuelles/1_Update_-_Risk_assessment_of_the_spread_of_breathing_air_from_wind_instruments_and_singers_during_the_COVID-19_pandemic.pdf)
- Becher L, Gena AW, Völker C. (b) Video <https://vimeo.com/431505952>
- Böckelmann I, Böttcher S, Fendel M, Hartjen A, Neuber M, Höfting I, Richter A, Schlaich C, Wanke E. DOV Stellungnahme. Kommentar zum durch den Arbeitskreis Gesundheit und Prophylaxe der Deutschen Orchestervereinigung (DOV) vorgelegten Maßnahmenvorschlag vom 30.4.2020 – Verband Deutscher Betriebs- und Werksärzte VDBW Arbeitsgruppe Bühnen und Orchester. <https://www.dov.org/projekte-kampagnen/musikergesundheit/corona-krise>
- br-klassik aktuell. 22.05.2020 Miriam Stumpfe. Neue Studie mit dem BR-Chor untersucht Übertragungswege. <https://www.br-klassik.de/aktuell/news-kritik/corona-pandemie-studie-chor-br-ansteckung-uebertragung-singen-saenger-100.html>
- Buonanno G, Stabile L, Morawska L. (a) Estimation of airborne viral emission: Quanta emission rate of SARS-CoV-2 for infection risk assessment. *Environment International* 141, August 2020. <https://doi.org/10.1016/j.envint.2020.105794>
- Buonanno G, Morawska L, Stabile L. (b) Quantitative assessment of the risk of airborne transmission of SARS-CoV-2 infection: prospective and retrospective applications. medRxiv Preprint. doi: <https://doi.org/10.1101/2020.06.01.20118984>
- Chan J F-W, Zhang A J, Yuan S, Poon V K-M, Chan C C-S, Lee A C-Y, Chan W-M, Fan Z, Tsoi H-W, Wen L, Liang R, Cao J, Chen Y, Tang K, Luo C, Cai J-P, Kok K-H, Chu H, Chan K-H, Sridhar S, Chen Z, Chen H, To K K-W, Kwok-Yung Yuen K-Y. Simulation of the clinical and pathological manifestations of Coronavirus Disease 2019 (COVID-19) in golden Syrian hamster model: implications for disease pathogenesis and transmissibility *Clinical Infectious Diseases*, ciaa325, <https://doi.org/10.1093/cid/ciaa325>
- Chia PY, Coleman KK, Tan YK, Ong SWX, Gum M, Lau SK, et al. Detection of Air and Surface Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Hospital Rooms of Infected Patients. medRxiv. 2020. doi: <https://doi.org/10.1101/2020.03.29.20046557>
- Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ. 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. *The Lancet* 2020 Jun 27;395(10242):1973-1987. doi: 10.1016/S0140-6736(20)31142-9. Epub 2020 Jun 1.
- Deutsche HNO-Gesellschaft. SARS-CoV-2: HNO-Ärzte besonders gefährdet. [https://cdn.hno.org/media/presse/PM\\_DGHNO\\_Covid-19.pdf](https://cdn.hno.org/media/presse/PM_DGHNO_Covid-19.pdf). (letzter Zugriff am 17.05.2020)
- Echternach M, Kniesburges S. *Aerosol-Studie mit dem Chor des BR – Erste Ergebnisse liegen vor*. <https://www.br.de/presse/inhalt/pressemitteilungen/aerosol-studie-chor-100.html>
- European Centre for Disease Prevention and Control (ECDC). Factsheet for health professionals on Coronaviruses European Centre for Disease Prevention and Control; 2020 [Available from: <https://www.ecdc.europa.eu/en/factsheet-health-professionals-coronaviruses>]. (letzter Zugriff am 17.05.2020)
- Fabian P, McDevitt JJ, Houseman EA, Milton DK. Airborne influenza virus detection with four aerosol samplers using molecular and infectivity assays: considerations for a new infectious virus aerosol sampler. *Indoor Air*. 2009 Oct;19(5):433-41. doi: 10.1111/j.1600-0668.2009.00609.x.
- Firle C, Jabusch HC, Grell A, Fernholz I, Schmidt A, Steinmetz A. Musizieren während der SARS-CoV-2-Pandemie – Empfehlungen der Deutschen Gesellschaft für Musikphysiologie und Musikermedizin (DGfMM)

zum Infektionsschutz beim Musizieren.

[https://dgfmm.org/fileadmin/DGfMM\\_Musizieren\\_waehrend\\_der\\_SARS\\_Cov2\\_Pandemie\\_14.05.2020.pdf](https://dgfmm.org/fileadmin/DGfMM_Musizieren_waehrend_der_SARS_Cov2_Pandemie_14.05.2020.pdf)

Hamner L, Dubbel P, Capron I, Ross A, Jordan A, Lee J, Lynn J, Ball A, Narwal S, Russell S, Patrick D, Leibrand H. High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington, March 2020. *Morbidity and Mortality Weekly Report*.

<https://www.cdc.gov/mmwr/volumes/69/wr/mm6919e6.htm>

Hartmann A, Mürbe D, Kriegel M, Lange J, Fleischer M. Risikobewertung von Probenräumen für Chöre hinsichtlich virenbeladenen Aerosolen. DOI: <http://dx.doi.org/10.14279/depositonce-10372>

Hartmann A, Kriegel M. Risikobewertung von virenbeladenen Aerosolen anhand der CO<sub>2</sub>-Konzentration. DOI: <http://dx.doi.org/10.14279/depositonce-10361>

ISO 31000:2018. Risk management — Guidelines. <https://www.iso.org/standard/65694.html>

Jimenez JL. Estimator of COVID-19 Airborne Transmission. <https://tinyurl.com/covid-estimator>

Kähler CJ, Hain R. (a) Musizieren während der Pandemie – was rät die Wissenschaft? – Über Infektionsrisiken beim Chorsingen und Musizieren mit Blasinstrumenten. Institut für Strömungsmechanik und Aerodynamik. <https://www.unibw.de/home/news-rund-um-corona/musizieren-waehrend-der-pandemie-was-raet-die-wissenschaft>

Kähler CJ, Hain R. (b) Singing in choirs and making music with wind instruments – Is that safe during the SARS-CoV-2 pandemic? <https://www.youtube.com/watch?v=BYo3wIWUDDM&feature=youtu.be>

Konda A, Prakash A, Moss GA, Schmoltdt M, Grant GD, Guha S. Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks. *ACS Nano* 2020 14 (5), 6339-6347. DOI: 10.1021/acsnano.0c03252

Kriegel M, Hartmann A. Risikobewertung von Innenräumen zu virenbeladenen Aerosolen. DOI: <http://dx.doi.org/10.14279/depositonce-10343.2>

Leung NH, Chu DK, Shiu EY, Chan K-H, McDevitt JJ, Hau BJ, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nature medicine*. 2020:1-5. <https://doi.org/10.1038/s41591-020-0843-2>

Li Y, Qian H, Hang J, Chen X, Hong L, et al. (2020). Aerosol transmission of SARS-CoV-2. Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant: <https://www.medrxiv.org/content/10.1101/2020.04.16.20067728v1>

Liu Y, Ning Z, Chen Y, Guo M, Liu Y, Gali NK, et al. Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals. *Nature*. 2020:1-6. <https://doi.org/10.1038/s41586-020-2271-3>

Liu Y, Ning Z, Chen Y, Guo M, Liu Y, Gali NK, Sun L, Duan Y, Cai J, Westerdahl D, Liu X, Ho K, Kan H, Fu Q, Lan K. Aerodynamic Characteristics and RNA Concentration of SARS-CoV-2 Aerosol in Wuhan Hospitals during COVID-19 Outbreak. *bioRxiv* 2020.03.08.982637; doi: <https://doi.org/10.1101/2020.03.08.982637>

Meselson M. Droplets and Aerosols in the Transmission of SARS-CoV-2 *New England Journal of Medicine*, 2020 Apr 15. doi: 10.1056/NEJMc2009324.

Miller SJ, Nazaroff WW, Jimenez JL, Boerstra A, Buonanno G, Dance SJ, Kurnitski J, Marr LC, Morawska L, Noakes C. Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading Event. Submitted to *Indoor Air* 15 June 2020. medRxiv preprint doi: <https://doi.org/10.1101/2020.06.15.20132027>. this version posted June 18, 2020.

Mittal R, Ni R, Seo J-H. The flow physics of COVID-19. *Journal of fluid Mechanics* Vol. 894, 10 July 2020.

Mitteilungen der Ad-hoc-Arbeitsgruppe Innenraumrichtwerte der Innenraumlufthygiene-Kommission des Umweltbundesamtes und der Obersten Landesgesundheitsbehörden. *Gesundheitliche Bewertung von Kohlendioxid in der Innenraumluft Bundesgesundheitsbl. – Gesundheitsforsch. - Gesundheitsschutz* 2008. 51:1358–1369. DOI 10.1007/s00103-008-0707-2

Mitze T, Kosfeld R, Rode J, Wälde K. Face Masks Considerably Reduce COVID-19 Cases in Germany: A Synthetic Control Method Approach. June 2020. IZA DP No. 13319: <https://www.iza.org/publications/dp/13319/face-masks-considerably-reduce-covid-19-cases-in-germany-a-synthetic-control-method-approach>

Mitze T, Kosfeld R, Rode J, Wälde K. Maskenpflicht und ihre Wirkung auf die Corona-Pandemie: Was die Welt von Jena lernen kann. [https://download.uni-mainz.de/presse/03\\_wiwi\\_corona\\_masken\\_paper\\_zusammenfassung.pdf](https://download.uni-mainz.de/presse/03_wiwi_corona_masken_paper_zusammenfassung.pdf)

Morawska L, Johnson GR, Ristovski ZD, Hargreaves M, Mengersen K, Corbett S, Chao CYH, Katoshevski LD. Size distribution and sites of origin of droplets expelled from the human respiratory tract during expiratory activities. *J Aerosol Science* Volume 40, Issue 3, 2009, Pages 256-269. <https://doi.org/10.1016/j.jaerosci.2008.11.002>

Morawska L, Cao J. Airborne transmission of SARS-CoV-2: The world should face the reality. *Environment International* Volume 139, June 2020, 105730. <https://doi.org/10.1016/j.envint.2020.105730>

Morawska L, Milton DK. It is Time to Address Airborne Transmission of COVID-19. *Clinical Infectious Diseases*, ciaa939, <https://doi.org/10.1093/cid/ciaa939>

Mürbe, D. Bischoff, P, Fleischer, M., Gastmeier, P. Beurteilung der Ansteckungsgefahr mit SARS-CoV-2-Viren beim Singen. Charité Berlin, 04.05.2020 Das Dokument ist zum Download verfügbar unter: <https://audiologie-phoniatrie.charite.de>. (letzter Zugriff am 17.05.2020)

Mürbe D., Fleischer M, Lange J, Rotheudt H, Kriegel M. Erhöhung der Aerosolbildung beim professionellen Singen DOI: <http://dx.doi.org/10.14279/depositonce-10374>

NFHS. Performing Arts Aerosol Study – Round one preliminary results Clarinet, Flute, Horn, Soprano Singer, Trumpet. <https://www.nfhs.org/media/4029952/preliminary-testing-report-7-13-20.pdf>

Nohl J. Risikomatrix <https://www.dguv.de/medien/ifa/de/pra/container/pdf/risikomatrix-nohl.pdf>

Ono K, Okuda T, Kunishima H. Reshaping the concert stage. 26 June 2020. <http://maestroarts.com/articles/reshaping-the-concert-stage>

ORF Kultur vom 17.05.2020 Philharmoniker zeigen geringe Infektionsgefahr auf. <https://wien.orf.at/stories/3049099/>

Pettenkofer (1858) *Besprechung Allgemeiner auf die Ventilation bezüglichlicher Fragen über den Luftwechsel in Wohngebäuden*. J.G. Cotta.sche Buchhandlung, München

Pfeifer M, Ewig S, Voshaar T, Randerath E, T. Bauer T, Geiseler J, Dellweg D, Westhoff M, Windisch W, Schönhofer B, Kluge S, Lepper PM. Positionspapier zur praktischen Umsetzung der apparativen Differenzialtherapie der akuten respiratorischen Insuffizienz bei COVID-19. *Pneumologie* 2020; 74: 1–21. DOI <https://doi.org/10.1055/a-1157-9976>

Prather KA, Wang CC, Schooley RT. Reducing transmission of SARS-CoV-2. *Science* 27 May 2020: eabc6197 DOI: 10.1126/science.abc6197

QIAN H, Te MIAO T, LIU L, ZHENG X, LUO D, and Li Y. Indoor transmission of SARS-CoV-2 doi: <https://doi.org/10.1101/2020.04.04.20053058>. medRxiv preprint

rbb Praxis. 03.06.2020 Carola Welt/Dr. Katrin Krieft. Corona: Wie groß ist das Übertragungsrisiko beim Singen? [https://www.rbb-online.de/rbbpraxis/archiv/20200603\\_2015/sars-cov-corona-singen-aerosole-infektion-covid-chor-musik-luft-.html](https://www.rbb-online.de/rbbpraxis/archiv/20200603_2015/sars-cov-corona-singen-aerosole-infektion-covid-chor-musik-luft-.html)

RKI Risikoliste. [https://www.rki.de/DE/Content/InfAZ/N/Neuartiges\\_Coronavirus/Steckbrief.html#doc13776792bodyText3](https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Steckbrief.html#doc13776792bodyText3)

Robert Koch-Institut SARS-CoV-2 Steckbrief zur Coronavirus-Krankheit-2019 (COVID-19). [https://www.rki.de/DE/Content/InfAZ/N/Neuartiges\\_Coronavirus/Steckbrief.html](https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Steckbrief.html) (letzter Zugriff am 17.05.2020)

Ruthberg JS, Quereshy HA, Jella TK, Kocharyan A, D’Anza B, Maronian N, Otteson TD. Geospatial analysis of COVID-19 and otolaryngologists above age 60. *Am J Otolaryngol*. 2020 Apr 30:102514. doi: 10.1016/j.amjoto.2020.102514. [Epub ahead of print]

Santarpia JL, Rivera DN, Herrera V, Morwitzer MJ, Creager H, Santarpia GW, et al. Transmission Potential of SARS-CoV-2 in Viral Shedding Observed at the University of Nebraska Medical Center. medRxiv. 2020.

SARS-CoV-2-Infektionsschutzverordnung, Berlin vom 23.06.2020. <https://www.berlin.de/corona/massnahmen/verordnung/>

Statista. <https://de.statista.com/statistik/daten/studie/1104173/umfrage/todesfaelle-aufgrund-des-coronavirus-in-deutschland-nach-geschlecht/>

Sterz F, Herkner H, Bixa H. Protokoll einer Untersuchung und fotografische Dokumentation von Aerosol- und Kondenswasseremission bei Chor Mitgliedern. 27.05.2020.

[https://www.chorverband.at/images/AerosoleFotos/Untersuchung\\_MedUni\\_Wien\\_Sterz\\_Aerosolchor.pdf](https://www.chorverband.at/images/AerosoleFotos/Untersuchung_MedUni_Wien_Sterz_Aerosolchor.pdf)

Stutt ROJH, Retkute R, Bradley M, Gilligan CA, Colvin J. A modelling framework to assess the likely effectiveness of facemasks in combination with 'lock-down' in managing the COVID-19 pandemic. *Proc. R. Soc. A* 2020, 476: 20200376. <http://dx.doi.org/10.1098/rspa.2020.0376>

TaMed. Wiederaufnahme und Durchführung eines regelmäßigen Trainings- und Probenbetriebes im Bereich des professionellen Bühnentanzes an Stadt-, Staats- und Landestheatern im Rahmen der SARS-CoV-2-Pandemie – Prinzipien, Überlegungen und Empfehlungen.

[https://tamed.eu/files/Aktuelles/ta.med\\_Uberlegungen\\_und\\_Empfehlungen\\_Wiederaufnahme\\_von\\_Training\\_und\\_Proben\\_V\\_2\\_Stand\\_08.07.20\\_EV.pdf](https://tamed.eu/files/Aktuelles/ta.med_Uberlegungen_und_Empfehlungen_Wiederaufnahme_von_Training_und_Proben_V_2_Stand_08.07.20_EV.pdf)

Tellier R. Review of aerosol transmission of influenza A virus. *Emerg Infect Dis.* 2006 Nov;12(11):1657-62.

Trukenmüller A. Risikoanalyse der Übertragung von SARS-CoV-2 durch Aerosole.

<https://www.magentacloud.de/share/e7esxr9ywc>

van der Sande M, Teunis P, Sabel R. 2008 Professional and home-made face masks reduce exposure to respiratory infections among the general population. *PLoS ONE* 3, e2618. (doi:10.1371/journal.pone.0002618)

van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *The New England journal of medicine.* 2020.

Verordnung der Landesregierung über infektionsschützende Maßnahmen gegen die Ausbreitung des Virus SARS-CoV-2 (Corona-Verordnung – CoronaVO) vom 23. Juni 2020. [https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Coronainfos/200623\\_Corona-Verordnung.pdf](https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/Coronainfos/200623_Corona-Verordnung.pdf)

Vuorinen et al. 2020 (a). Researchers modelling the spread of the coronavirus emphasise the importance of avoiding busy indoor spaces. <https://www.aalto.fi/en/news/researchers-modelling-the-spread-of-the-coronavirus-emphasise-the-importance-of-avoiding-busy>. (letzter Zugriff am 17.05.2020).

Vuorinen V, Aarnio MA, Alava M, Alopaeus V, Atanasova N, Auvinen M, Balasubramanian N, Bordbar H, Erästö P, Grande R, Hayward N, Hellsten A, Hostikka S, Hokkanen J, Kaario O, Karvinen A, Kivistö I, Korhonen M, Kosonen R, Kuusela J, Lestinen S, Laurila E, Nieminen HJ, Peltonen P, Pokki J, Puisto A, Råback P, Salmenjoki H, T. Sironen T., M. Österberg M. (b) Modelling aerosol transport and virus exposure with numerical simulations in relation to SARS-CoV-2 transmission by inhalation indoors. Preprint submitted to *Safety Science*. arXiv:2005.12612v1 [physics.flu-dyn] 26 May 2020

Wang Y, Tian H, Zhang L, et al. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Global Health* 2020;5:e002794. doi:10.1136/bmjgh-2020-002794

Willich SN, Berghöfer A, Wiese-Posselt MK, Gastmeier P, Stellungnahme zum Spielbetrieb der Orchester während der COVID-19 Pandemie.

[https://epidemiologie.charite.de/fileadmin/user\\_upload/microsites/m\\_cc01/epidemiologie/downloads/Stellungnahme\\_Spielbetrieb\\_Orchester.pdf](https://epidemiologie.charite.de/fileadmin/user_upload/microsites/m_cc01/epidemiologie/downloads/Stellungnahme_Spielbetrieb_Orchester.pdf)

World Health Organization. (2020). Advice on the use of masks in the context of COVID-19: interim guidance, 5 June 2020. World Health Organization. <https://apps.who.int/iris/handle/10665/332293>. License: CC BY-NC-SA 3.0 IGO

Yan J, Grantham M, Pantelic J, Bueno de Mequita PJ, Albert B, Liu F, Ehrman S, Milton DK, EMIT Consortium. Infectious virus in exhaled breath of symptomatic seasonal influenza cases from a college community. *Proc Natl Acad Sci U S A.* 2018 Jan 30;115(5):1081-1086. doi: 10.1073/pnas.1716561115.

Zehnte Corona-Bekämpfungsverordnung Rheinland-Pfalz vom 24.06.2020.

<https://corona.rlp.de/de/service/rechtsgrundlagen/>

Zhou Y, Zeng Y, Tong Y, Chen C. Ophthalmologic evidence against the interpersonal transmission of 2019 novel coronavirus through conjunctiva. MedRxiv. 2020.

## Author's Information

The authors, *Claudia Spahn* and *Bernhard Richter*, are two medical doctors who also hold educated musician backgrounds. They are both Professors of Musicians' Medicine and direct the Freiburg Institute for Musicians' Medicine (FIM), a joint institution of the Freiburg University of Music and the Albert-Ludwig-University of Freiburg (Germany), represented by the Medical Faculty. For the purpose of health care, there is cooperation with the University Medical Center Freiburg. Claudia Spahn specializes in psychotherapeutic medicine and Bernhard Richter is an ENT and phoniatic/pediatric audiologist. Both have received university recognition for outstanding teaching. They collaborated with three additional colleagues at their university; each are medical directors of divisions, respectively for the Institute for Infection Prevention and Hospital Hygiene, Institute of Virology, and Department of Anesthesiology and Critical Care.

## Translator's Notes

*Kirk D. Moss*, Ph.D. is Professor and Chair, Department of Music & Theatre at University of Northwestern – St. Paul and former National President, American String Teacher's Association

My primary interest in the work of our colleagues at the university in Freiburg, Germany, is their May 19, 2020, university risk assessment of a coronavirus infection in the field of music. With the aid of multiple online translation tools and the assistance of *Susanna Klein*, a native German speaker from Stuttgart, Germany—and an artist-teacher/ASTA member/Associate Professor of Violin at Virginia Commonwealth University—we offer this English translation. I am grateful for Professor Klein's role in helping to make the German sentence structure/syntax clearer and more reader friendly for us, as well as in helping check for accuracy. That said, neither of us translates for a living, so please be kind. We did our best.

Throughout this pandemic, music educators have encouraged one another with expressions of, “*You* are not alone.” My motive for this translation shares that sentiment. I am comforted to know that music educators worldwide wrestle with similar problems and work to find solutions in order to one day make music with students face-to-face again safely. *We* are not alone.

*Dr. Scott S. Swope*, D.M.A.

Retired Opera singer and Voice teacher residing in Portland, Oregon, USA, Member of NATS, BDG & EVTA  
Former Visiting Asst. Prof. of Voice, UNLV, Aug. 2002 - June 2003  
Former Treasurer – German Voice Teachers Assn, Former V.Pres. - European Voice Teachers Assn

Through my many old friends and contacts in the voice teacher's community, both in Europe and USA, I have been witnessing and sharing the difficulties and challenges that the Corona Virus pandemic has visited upon us all. As we all cope with suddenly teaching online, getting up to speed with unfamiliar digital tools, and trying to learn as singers what is safe to do and not, Drs. Richter and Spahn offer musicians professional, thoughtful and long needed practical advice on how to navigate the pandemic as with minimal risk.

When I read their 1<sup>st</sup> Risk Assessment in German from April 25 of this year, I immediately felt this vital information needed to be made available to a wider audience. What better way than to translate it into English! Although not a professional translator, my long career in Germany and Europe allowed me a more nuanced viewpoint from which to make an English translation than Google Translate alone could offer. Dr. Richters and Spahn have graciously allowed me to translate both their first (April 25) and second (May 6) Risk Assessments into English.

This translation of their Risk Assessment Update from May 19<sup>th</sup> is an “open-source” endeavor. In the main, it is a combined work of Dr. Moss, myself and Google Translate. The mistakes are ours, as are the interpretations necessary for a translation. Please send any corrections or suggestions for improvement to Drs Richter and Spahn. My thanks to *Prof. Marilyn Schmiede*, Pres. of BDG, for her eagle eyes in redacting the previous translations. We all hope that this translation will help you find answers to your many questions about being a musician in the time of Corona Virus.