Statement on Orchestra Performance and Protection During the COVID-19 Pandemic
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We appreciate the expert advice of musicians of the following orchestras:

Berliner Philharmoniker
Deutsches Symphonie-Orchester Berlin (DSO)
Konzerthausorchester Berlin
Orchester der Deutschen Oper Berlin
Orchester der Komischen Oper Berlin
Rundfunk-Sinfonieorchester Berlin (RSB)
Staatskapelle Berlin

Note from the authors:

The statement refers to orchestra playing and the safety of the musicians and is intended to enable playing during the COVID-19 pandemic. When implementing our recommendations, further epidemiological developments as well as new research results may have to be taken into account.

Summary

The present statement updates our statement of May 7, 2020 and is based on current scientific knowledge or assessments and the experience of musicians and instrument experts. In order to avoid risks of COVID-19 infection, we recommend the following measures during the performance of concert and opera orchestras.

General protective measures:

- Symptoms alertness: A daily self-check with regard to the following COVID-19-typical symptoms: cough, fever, sniffles, sore throat, shortness of breath, headaches and aching limbs, gastrointestinal complaints, feeling of weakness, odour/taste disorders. If one or more of these symptoms occur, the musician should stay at home, contact a doctor and have as soon as possible a test for SARS-CoV-2 performed.
- High-risk individuals: Persons who have an increased risk of a severe course of COVID-19 infection may be offered exemption from orchestra participation.
- Distancing: Musicians and other employees should generally keep a physical distance of at least 1.5 m. Entering and leaving the rehearsal and concert areas should take place in an appropriate order maintaining a distance of 1.5 m, and crowds in narrow stage entrances should be avoided. Wear mouth and nose mask, when distance cannot be kept
- Attentiveness of hand hygiene and cough etiquette, hand disinfection at least when entering and leaving the workplace
- Surfaces in the concert hall or practice rooms including chairs and music stands must be cleaned after every orchestra rehearsal/concert.
- Air conditioning/ventilation: Operation of air conditioning systems with appropriate DIN standard, in recirculation mode use of a HEPA filter (High Efficiency Particulate Air Filter), alternatively regular ventilation.

Orchestra formation and instrument recommendations:

- String players distance of 1 m between chairs.
- Wind and brass players chair distance of 1.5 m, liquid removal and instrument cleaning with disposable cloths or cloths (to be cleaned). According to current estimates, a plexiglas protection against the brass instruments seems no longer necessary and can be omitted.
- Percussionists with chair distance 1.5 m, avoid sharing instruments and accessories.
- Harps and keyboard instruments, chair distance 1.5 m.
- Conductor Distance to orchestra musicians 2 m for rehearsals and 1.5 m for concerts.

Background

The spread of the coronavirus SARS-CoV-2 since December 2019 has reached the dimensions of a global pandemic. Measures to contain the infection have led to severe restrictions on public life and individual freedom of movement in many countries. Cultural institutions have been particularly hard hit by these restrictions. Due to the largely unclear risk situation for musicians and the audience, most rehearsal and concert activities of orchestras were rapidly shut down.

Infection control strategies have already led to substantial decline in the incidence of COVID-19 in many countries, so that successive easing of restrictions is being discussed and implemented in the areas of industry, commerce, schools and universities, and public life[1]. However, it is likely to take some time before possible vaccines and antiviral drugs are developed and available, so protocols for a life as normal as possible with adequate COVID-19 prevention for each public setting must be developed.

The resumption of professional activity is not only relevant from an economic point of view. Job activity is particularly important and stabilizing from the perspective of social medicine. Occupational activity is an important positive determinant of health and life expectancy. The arts and culture are also of indispensable value to the population. On the individual level, art has a positive effect on health and development, music in particular has healing effects[2]. At the population level, art and culture have an identity-building effect, serving well-being, education, and social cohesion[3]. A resumption of the business of art and culture should therefore occur expeditiously in parallel with the reopening of industry, trade, and educational institutions.

Based on current scientific knowledge and assessment, as well as on the experience of musicians (from several participating orchestras listed below) and instrument experts, we have developed recommendations on general hygiene and behavioral measures, on orchestra seating and on instrument-specific aspects that will enable the resumption of orchestra playing. The special recommendations focus in particular on the musician groups of woodwind and brass instruments, because in these groups aerosol production and droplet formation are associated with playing activity and a potentially increased risk of infection compared to normal social contacts should be considered.

Since the publication of our first statement on the playing of orchestras during the COVID-19 pandemic on May 7, 2020, the epidemiological situation regarding new cases (incidence) and number of sick people in the population (prevalence) has stabilized. Even though a slight increase in new infections has been registered in recent weeks, the epidemiological burden in Germany with 500-1,500 new infections reported daily (corresponding to approx. 1 infection per 100,000 inhabitants) can be considered low to moderate. For example, no new infections at all have been reported in the last 7 days for more than 100 countries/urban districts [4]. Relevant outbreaks of SARS-CoV-2 infections have occurred only sporadically in Germany since May 2020.

Rehearsals and concerts of professional orchestras have been resumed for several weeks in varying degrees depending on the federal state.

Based on the low epidemiological burden in Germany, new scientific findings or assessments, and the experience of musicians and instrument experts, we are updating the previous recommendations (dated May 7, 2020) on general hygiene and behavioral measures, on orchestra formation and on instrument-specific aspects, which will allow orchestral playing in Germany to be largely normalized. The update focuses in particular on the distances between musicians in the various instrument groups. When implementing our recommendations, further epidemiological developments as well as new research results may have to be taken into account.
Regulations and recommendations that affect the audience will be made separately.

Potential risks in orchestra playing

Individuals who show typical clinical signs of COVID-19 disease transmit the majority of SARS-CoV-2 infections. Transmission of SARS-Cov-2 from one person to another also occurs through infected subjects who do not yet show any symptoms of the disease or remain symptom-free, as well as through patients with minimal symptoms initially[5] [6]. Thus, there is a relevant risk of transmission of the virus in groups of people who appear to be in good health and capable of work. For this reason, the hygiene and clearance rules listed here must be observed on and off the stage. Moreover, every orchestra member and other employees have to stay at home when the slightest signs of illness occur. It is imperative that they be tested as quickly as possible for SARS-CoV-2. Furthermore, a musician or employee who is in domestic quarantine due to contact with a COVID-19 case must not be allowed to come to work[7]. These infection

control measures are more effective than regular screening of all musicians and orchestra members.

In general contact with people, the main transmission route of the virus is droplet infection and transmission by speaking, coughing, or sneezing. Another route of transmission that could be relevant in certain work environments in healthy individuals is transmission via aerosol-producing processes [8] [9]. According to current knowledge, it is unclear whether aerosol transmission plays a significant role in normal social interactions of individuals[10]. Entry points for the virus are the mucous membranes (mouth, nose, and the conjunctiva), onto which viruses enter via droplets, aerosol or through contact with contaminated surfaces.

The SARS-CoV-2 is capable of surviving in aerosols as well as on surfaces for a certain period of time. This so-called tenacity is up to 3 hours in aerosols and up to 72 hours on surfaces depending on the material[11]. Especially on stainless steel and plastic surfaces, viruses can probably survive between 48 and 72 hours, but on paper and porous materials they can only survive for much shorter periods [11]. Even if these data were determined in special laboratory tests - i.e. not in everyday practice - surfaces or working materials contaminated with SARS-CoV-2 must be considered a relevant risk of infection for a limited period of time.

Technical aspects

Orchestra musicians are typically seated in several parallel rows. Movements are limited and take place exclusively while seated or standing in place. Breathing frequency can be higher than at rest, depending on the passages to be played, usually breathing through both nose and mouth. Musicians do not sit facing one another with minimal speaking in rehearsal situations. String, keyboard, harp, and percussion instrumentalists will therefore have significantly lower risk of saliva droplet or aerosol generation than normal social contact with conversation.

Players of woodwind and brass instruments will produce aerosols, condensation water depending on the outside temperature, as well as droplet formation from saliva during playing. At present, only general statements regarding aerosol, droplet and liquid condensation production can be made, as details regarding aerosol and droplet risks developed by playing woodwind and brass instruments has not been well defined. Additional investigation is required to define the amount of each produced, as well is

their velocity, direction and spread for each individual instrument. These fluids are potentially infectious in a SARS-CoV-2 positive musician, even if currently asymptomatic. The specific risk characteristics must be defined for each wind and brass instrument, and measures developed that effectively reduce such potential hazard.

The reed instruments including oboe, clarinet, bassoon family (made of wood) and saxophones (made of brass) require but a very small amount of air. Breath flows through the reed into the instrument, passing out through the open holes in a volume far below that used for normal speaking. A study from Bamberg demonstrated that especially deep and long-lasting tones can lead to flow movements in the range of 1 meter[12]. Those made of wood produce little condensation, dripping only occasionally from the bell of oboes and clarinets and removed with a swab after playing. When used in a cool environment, the temperature and impervious nature of the saxophone metallic body will produce more condensation, drained from a water key.

In contrast, tone production in the flute family produces a significant forward-directed airstream with aerosol formation. The majority of breath flows directly from the lips across the embouchure hole. The air velocity if high, and further increased when playing notes low in the instrument register. The air is deflected downward by contact with the curved mouthpiece, or embouchure but still represents a greater risk of infection than any other wind instrument. Only a small part of the breathing air escapes from the open holes in the instrument's body. Modern flutes are primarily made from brass and more precious metals. Condensation water may form as in the saxophone, and will drip from the end of the instrument. The entire instrument is cleaned with a swab after playing.

The french horn, trumpet, trombone, and tuba are lip tone instruments in which a thin air stream is periodically divided by the lips and thus produces the sound. The amount of air used in playing is small, but the amount of moving air coming through the bell is variable. Velocity increases in instruments with smaller bells, and when playing lower, louder or sharply accented notes[13]. The amount of condensation forming from moist breath in the brass tubes depends upon on ambient temperature. Frequent drainage is required via one or more water keys. At intervals, removing and blowing through both the mouthpiece and draining the instrument by removing tuning slides is required. Condensation will therefore inevitably produce a potential liquid and aerosol hazard in an infected instrumentalist.

In the orchestra, several percussion and timpani players sit or stand at their instruments while playing. However, they must often move between several instruments during a performance, resulting in routine encounters in a confined space as well as exchange timpani mallets and other pieces of equipment between the musicians.

Insight from engineering studies

The preliminary results of visualization studies at the Bamberg Symphony Orchestra[12] show that the transverse flutes have air that flows only to the front and bottom, i.e. in the main direction of the blowing stream up to about 1 m. There is no airflow towards the side, neither at the mouth end nor at the open end of the flute tube, neither for high nor low notes. Results are also available for trumpets where no significant airflow could be measured in front of the bell. Semi-quantitative visualization experiments on the airflow of brass instruments were conducted by the University of Music and Performing Arts Vienna. The trumpet's airflow could be shown to be significantly less as compared to speaking or coughing [14]. These results are in line with experiments at Bundeswehr University Munich [12] and early findings on aeroacoustic experiments in wind and brass instruments [15 16].

Testing for SARS-CoV-2 infection and infection control measures

Regular serial testing of all symptom-free orchestra members for COVID-19 infection prior to the start of playing would seem of limited value due to possible false negative and false positive test results in the test procedures. However, as soon as a musician or another employee has signs of COVID-19 disease, testing for SARS-CoV-2 should be performed as quickly as possible. These persons have to stay at home until a SARS-CoV-2 infection can be safely ruled out and no signs of illness are present anymore. It would be helpful to have a medical certificate. This must be considered depending on the organization of the public health service. Furthermore, a musician or employee who is in domestic quarantine due to contact with a COVID-19 case is not allowed to come to work. Once an orchestra member or staff member has tested positively, direct contact persons in the working environment must be identified. Usually a 14-day quarantine applies to the direct contact persons depending upon local public health regulations. If COVID-19 cases occur in an orchestra, it is the

responsibility of the public health service (“örtliches Gesundheitsamt”) to take further infection control measures. Here, a screening of all musicians and employees of the orchestra could be considered.
Furthermore, a testing of all ensemble members after the end of a vacation period or e.g. after returning from a tour can be considered, because during longer flight trips or visits to risk areas contact with SARS-CoV-2 infected persons might have existed.

Recommendations

Depending on the specific working conditions (premises, technical equipment, ensemble size, works to be rehearsed), we recommend that the orchestras carry out a risk analysis and develop an appropriate hygiene, behavior, and protocol based on the SARS-CoV-2 occupational safety standard of the Federal Ministry of Labor and Social Affairs [17] taking into account and integrating the following recommendations.

General protective measures

- Symptoms alertness: Only those musicians who feel healthy and able to perform should resume professional activity in the orchestra. A daily self-check with regard to the following COVID-19-typical symptoms is therefore required before entering the work building (e.g. with appropriate notice): cough, fever, sniffles, sore throat, shortness of breath, headaches and aching limbs, gastrointestinal complaints, feeling of weakness, odour/taste disorders. If one or more of these symptoms occur, the musician should stay at home, contact a doctor and have as soon as possible a test for SARS-CoV-2 performed. Players should measure their temperature daily and refrain from coming to work with any measurable fever.
- High-risk individuals: Persons who have an increased risk of a severe course of COVID-19 infection include those with severe obesity, age greater than 70, coronary heart disease, significant hypertension (requiring 2 or more medications), chronic lung disease (e.g. COPD, asthma), chronic liver disease, diabetes mellitus or a weakened immune system as a result of illness or medication. These musicians should be offered exemption from orchestra participation.
- Distancing: Musicians and other employees should generally keep a physical distance of at least 1.5 m. Entering and leaving the rehearsal and concert areas

should take place in an appropriate order maintaining a distance of 1.5 m, and crowds in narrow stage entrances should be avoided.

- Hands should be washed thoroughly with soap or hand sanitizer immediately upon entering the workplace (at least 30 seconds). Hands should be washed thoroughly with soap or disinfected with a provided hand disinfectant immediately after entering the workplace (at least 30 seconds). Hands should be washed thoroughly (or disinfected if necessary) immediately after any coughing or sneezing that has not been absorbed into a handkerchief or sleeve [18].
- When coughing and sneezing, musicians should try to prevent saliva or nasal secretions to spray into the environment. Covering the mouth and nose with a tissue to be disposed of, or in the crook of the arm are recommended measures [18].
- Mouth and nose mask: In closed rooms outside the concert hall, e.g. changing rooms, sanitary rooms, hallways, etc., a mask should be worn. Ensure that the mask fits properly, securely covering both mouth and nose. When used correctly (only touching at the fastening ends, firm contact at the sides and on the nose), it can be assumed that they protect others, as the distribution of droplets is effectively prevented. Soaked masks must be replaced and properly disposed of. A mask is not necessary on the stage, as the musicians do not speak or move from their seats during the performance.
- Cleaning: Surfaces in the concert hall or practice room including chairs and music stands must be cleaned after every orchestra rehearsal/concert with disinfectant [19]. The professional cleaning of the instruments and, if necessary, disinfectant cleaning is the responsibility of the musicians.
- Air conditioning/ventilation: Systems for air conditioning and ventilation of the rooms and stages may continue to be operated as long as they comply with the applicable regulations. If no ventilation system can be used, window ventilation should be provided regularly.

Special Recommendations

- In the group of musicians with wind and brass instruments, specific hygiene measures should be adhered to with regard to the following aspects:
  - Efforts to reduce ballistic saliva output and airflow from some instruments should be routine. A thin fabric or paper shield placed before the opening of

some wind instruments will effectively block flying droplets and reduce the velocity of aerosols. These measures would be particularly important in small diameter brass instruments (trumpet) and members of the flute family, but also for other winds requiring occasional forceful breathing while playing, such as the oboe section.

- Dripping condensation or saliva in the instruments should be handled carefully. The usual method of allowing condensate to drip or be expelled onto the floor represents an infection hazard. Instead, collection in disposable tissues or cloths is recommended, to be disposed of after each rehearsal or concert. If possible, swabs used to clean brass and woodwind instruments should also be washed with water at a temperature of at least 70°C (or thrown away, if disposable) after playing. Alternatively, a 60°C wash program can be used, in which the water temperature of 60°C is kept long enough. This means that no fast-washing or economy programs may be used. For sensitive materials, even lower temperatures with disinfectant detergent are also sufficient [20].
- Attempts to expel condensation water from instruments by forceful blowing is to be prohibited.
- Hands should be washed or disinfected after contact with the liquid when cleaning the instrument. Cleaning the instruments is the responsibility of the musicians.
- To avoid potential contamination of the neighbor's workplace, musicians with wind instruments should keep a distance of 1.5 m from each other.
- According to current estimates, a plexiglass protection from the brass players seems no longer necessary and can be omitted.
- After a rehearsal/concert, music stands and other work surfaces in the vicinity of the wind players should be cleaned, including the protective screen mentioned above.

- For string players a distance of 1 m between chairs is recommended in accordance with the recommendations of the World Health Organization[21].
- For percussion players a chair distance of 1.5 m should be maintained. In addition, the instrument playing should be prepared in terms of organization and personnel in such a way that the instruments can be operated as stationary as possible. The exchange of mallets or instrument parts should be avoided.
- Harps and keyboard instruments should be placed 1.5 m apart.

- Sharing instruments should be avoided. However, if an exchange is necessary, the instrument should not have been used for 72 hours to ensure that the instrument is no longer potentially contaminated.
- During rehearsals, the conductor usually talks to orchestra musicians positioned directly opposite to him/her, so a distance of 2 m during rehearsal and 1.5 m during concert should be kept from the orchestra musicians.
- Orchestra support personnel should use personal protective equipment including facemasks and gloves, particularly when touching potentially virus-contaminated surfaces in their area of responsibility. It is crucial that employees wash their hands thoroughly after touching potentially virus-contaminated surfaces and objects or they carry out hand disinfection.

In conclusion, the present recommendations are based on the most recent scientific results from fluidic investigations and include the expert knowledge of the musicians and instrument specialists. The actual implementation of the recommendations should take into consideration the current epidemiological development.

Health monitoring

In order to closely examine the effectiveness of the protective measures, it would be reasonable to monitor cold and respiratory diseases as well as flu-like infections and possible COVID-19 symptoms over the winter half year 2020/21 in the orchestras that resume regular rehearsal and concert activities.

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