S3-Guideline
Measures for the prevention and control of SARS-CoV-2 transmission in schools | Living Guideline

Short Version

AWMF-Reg.Nr. 027-076
Version 1.2, March 2022

Note: This version does not contain any content changes to version 1.1, it has only been edited.

Remarks on the short version

This short version provides an overview of the consensus-based recommendations of the living S3-Guideline on measures for the prevention and control of SARS-CoV-2 transmission in schools. The long version of the guideline and the appendix are also available on the AWMF website.

The short version was translated into English by the coordination team at the Ludwig-Maximilians-Universitaet (LMU), Munich.
Lead societies
German Society for Epidemiology, DGEpi
German Society for Public Health, DGPH
German Society of Pediatrics and Adolescent Medicine, DGKJ
German Society for Pediatric Infectious Diseases, DGPI

Participation of other AWMF societies
German Society for Social Pediatrics and Adolescent Medicine, DGSPJ
German Society of Childhood and Adolescent Psychiatry and Psychotherapy, DGKJP
German Academy of Ethics in Medicine, AEM
Society of Hygiene, Environmental and Public Health Sciences, GHUP
German Society for Social Medicine and Prevention, DGSMPP
German Society for Hospital Hygiene, DGKH
German Society for Virology, GfV
German Society for Occupational, Social and Environmental Medicine, DGAUM

Participation of other societies and organisations
Robert Koch Institute, RKI
Federal Association of Physicians of German Public Health Departments, BVÖGD
Professional Association of Physicians in Child and Adolescent Medicine, BVKJ
State Health Department Baden-Wuerttemberg
Health Authority Frankfurt am Main
Health Authority Neukölln
Standing Conference of Students, BSK
Children and Youth Advisory Committee of the German Childrens’ Fund, DKHW
Child Protection Agency, DKS
Association for Education, VBE
General Association of Head Teachers Germany, ASD
Main Personnel Council for State Teachers at Comprehensive Schools, Rhineland- Palatinate

Association for Special Education, vds
Federal Council of Parents
State Parent Council of Lower Saxony
State Parent Council of Saxony
Public Education Authority Cottbus
German Educational Research Association, DGfE

Observers
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Standing Conference of the Ministers of Education and Cultural Affairs, KMK
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Preamble

The SARS-CoV-2 pandemic represents a major challenge for schools. Despite uncertainties about the effectiveness of measures to contain the pandemic, far-reaching decisions had and have to be made in schools - as in all areas of society. The aim of this guideline is to provide scientifically sound and agreed recommendations for action to all those involved.

The guideline recommends an adaptable and applicable set of measures to reduce the risk of infection and to enable a safe, regulated and continuous school operation in pandemic times. The topic of school closures is not covered by this guideline.

These recommendations were developed by a representative group of experts from scientific societies, persons involved in school activities and decision-makers using a structured approach. They are based on the studies on the effectiveness of measures to control and prevent the transmission of SARS-CoV-2 in schools published before December 9, 2020. In addition, non-systematic searches were carried out when revising the recommendations.

The authors and contributors involved in this guideline urgently recommend to scientifically monitor the implementation of these measures in order to capture both their effectiveness as well as their unintended consequences in all areas. A continuous evaluation not only supports the steady improvement of the evidence base, but also enables course corrections.

The recommendations were published as short version 1.0 on February 7, 2021. This updated short version 1.1 corresponds to long version 1.1. All basic infection prevention principles remain unchanged. When referring to recommendations of the Robert Koch Institute (RKI), e.g. on isolation and quarantine, the current RKI recommendations apply (see www.rki.de).

The contributors to this guideline strongly recommend that the implementation of the measures be accompanied scientifically in order to record both their effectiveness and undesirable consequences in all areas. Continuous evaluation not only helps to constantly improve the evidence base, but also enables course corrections.

Remarks

Standard set of measures: A set of measures is needed for the prevention and control of SARS-CoV-2 transmission in schools: measures must be implemented in a coordinated manner in order to be effective. The starting point is a standard set of measures, which is based on the generic rules (distance, hygiene, masks, ventilation) generally applicable in the population and which specifically provides for distancing, hygiene, the wearing of an appropriate mask, and ventilation. Other measures could be testing strategies in schools, but these have not yet been considered in this guideline.

Changes/mutations in the pathogen: The recommendations also apply to the spread of mutations of the SARS-CoV-2 virus, which are more contagious and potentially cause a more severe disease. If the dynamics of the infection process change due to new virus variants, the recommended measures should be checked and, where necessary, adjusted. The implementation details also depend on the levels of community transmissions (based on the interaction of several indicators), but also on changes due to increasing immunisation or vaccination rates of the population.

Regional/local adaptation: Regional and local circumstances must always be considered when designing specific measures. Relevant are both the regional or local levels of infection (e.g. vaccination rates, spread of new variants, age-specific incidences and hospitalisation rates and/or testing strategies) as well as resources and preconditions for the implementation of the measures (e.g. structural conditions).
Overview of recommendations
Changes compared to short version 1.0 and 1.1

Recommendations 4, 5, 6, 7 and 9 have been updated in version 1.1. The changes are explained and documented in detail in the respective recommendations. The editorial changes in version 1.2 concern recommendations 4 and 9: the formally not accepted recommendations can now be visually distinguished from the formally accepted ones. These changes were developed within the steering group (DGKJ, DGPI, DGPH, DGEpi, GHUP).

<table>
<thead>
<tr>
<th>Topic</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preamble</td>
<td>Addition of text and update</td>
</tr>
<tr>
<td>4 Measures for music classes in schools</td>
<td>Supplementary recommendation 4.3 on music classes in the event of high infection levels</td>
</tr>
<tr>
<td>5 Measures for physical education classes in schools</td>
<td>Supplementary recommendation 5.3 on physical education in the event of very high infection levels</td>
</tr>
<tr>
<td>6 Dealing with suspected cases among students without known risk contact</td>
<td>Amendment of recommendation 6.3 with specification of symptoms for suspected cases</td>
</tr>
<tr>
<td>7 Dealing with contact persons in schools</td>
<td>Amendment of recommendation 7.2 and deletion of recommendations 7.3 and 7.4 in line with the amended contact person definition of the Robert Koch Institute.</td>
</tr>
<tr>
<td>9 Air purification and reduction of aerosol concentration in classrooms</td>
<td>Omission of the recommendation and statements of dissent</td>
</tr>
</tbody>
</table>

1 Reducing the number of students in face-to-face teaching and/or cohorting

1.1 Evidence-based recommendation

The number of students taught face-to-face should be reduced and/or students should be cohortied, depending on levels of community transmission.

<table>
<thead>
<tr>
<th>Grade of recommendation</th>
<th>Strong recommendation A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of consensus</td>
<td>Consensus (88 %); Yes 22, No 3, Abstain 1</td>
</tr>
<tr>
<td>Literature</td>
<td>Krishnaratne et al. (2021)</td>
</tr>
</tbody>
</table>

1.2 Consensus-based recommendation

With moderate levels of community transmission, cohorting of classes/years ought to be implemented.

With very high levels of community transmission, all measures should be implemented.

<table>
<thead>
<tr>
<th>Infection level</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohorting of classes/years</td>
<td>optional</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Halving of classes with alternating attendance</td>
<td>rather no</td>
<td>optional</td>
<td>+ one of the measures</td>
<td>yes</td>
</tr>
<tr>
<td>Phased opening of schools according to year</td>
<td>rather no</td>
<td>optional</td>
<td></td>
<td>yes</td>
</tr>
</tbody>
</table>

| Strength of consensus | Consensus (92 %); Yes 23, No 2, Abstain 1 |

1.3 Consensus-based recommendation

Implementation should be based on the age of the students, with priority for secondary schools, followed by elementary schools.

| Strength of consensus | Consensus (88 %); Yes 22, No 3, Abstain 1 |
Glossary

- **Face-to-face teaching**: Teaching where students and teachers are together on site. Used here as a standard form of teaching.
- **School closures**: Distance learning for all years except for emergency care.
- **Cohorting**: Dividing larger groups (e.g. years, classes, teachers) into smaller groups; restriction to contacts within a defined group, contacts between groups are largely avoided.
- **Alternating attendance**: Alternation between face-to-face and distance teaching (e.g. daily or weekly alternation). As a result, only a part of the classes or years are present in school.
- **Phased opening according to year**: Years 1-4 or 1-6 (primary school) receive face-to-face teaching (with a standard set of measures), higher years receive distance teaching.
- **Distance learning**: Alternative to face-to-face teaching to reduce the contacts, partly implemented as online teaching.
- **Hybrid teaching**: A term that is sometimes used vaguely; usually defined as simultaneous face-to-face and distance teaching, where one part of the class is on site and another participates from home.

Evidence base

- The evidence on the effectiveness of the measures with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. Findings are based to a large extent on modelling studies characterized by a low to very low quality of evidence [2-26]. Particularly meaningful individual studies from the Cochrane Rapid Review were used to assess the potential effectiveness of specific measures [4, 10, 11, 14]. The certainty of the evidence is low to very low for all effects considered.
- Health consequences beyond COVID-19 were not systematically assessed and are based on indirect evidence, individual studies, and/or expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

**Benefits**
- Potential for a high contribution to infection prevention with high and very high infection rates.
- Maintaining face-to-face teaching for as many students as possible, especially for socially and economically disadvantaged students and students with disabilities or special needs

**Harms**
- Potential negative effects on mental health and social well-being (students, teachers, parents, guardians), on health equity, and on educational opportunities and learning outcomes.
- Probably increased need for supervision and possible associated limitations on the employment of parents and guardians.

**Overall assessment**
- A reduction in the number of students in face-to-face teaching and/or cohorting has positive and negative consequences for those directly affected and for the society as a whole. Overall, in the opinion of experts, the positive effects predominate.
2 Wearing of face masks by students, teachers and other school personnel

2.1 Evidence-based recommendation

Appropriate wearing of face masks by students, teachers, and other school personnel should be implemented in schools.

- **Quality of evidence**: Low ⬜⬜⬜⬜
- **Grade of recommendation**: Strong recommendation A
- **Strength of consensus**: Strong consensus (100 %); Yes 24, No 0, Abstain 1
- **Literature**: Chu et al. (2020), Krishnaratne et al. (2021), Li et al. (2020)

2.2 Evidence-based recommendation

With high infection levels, surgical masks should be used.

- **Quality of evidence**: Low ⬜⬜⬜⬜
- **Grade of recommendation**: Strong recommendation A
- **Strength of consensus**: Consensus (86 %); Yes 18, No 3, Abstain 4
- **Literature**: Chu et al. (2020); Krishnaratne et al. (2021); Li et al. (2020)

2.3 Consensus-based recommendation

Respirators (FFP2) may be considered for students, teachers, and other school personnel at particular risk for severe COVID-19 disease.

- **Strength of consensus**: Consensus (76 %); Yes 19, No 6, Abstain 3

2.4 Consensus-based recommendation

Temporary and local exceptions for measures may be considered for elementary school students in the case of moderate regional and supra-regional infection levels in the population and in schools.

Breaks from wearing masks ought to be spent outside the school building (i.e. outdoors) in compliance with standard hygiene rules.

- **Strength of consensus**: Consensus (85 %); Yes 22, No 4, Abstain 1

Glossary

- **General term**: face mask.
- **Cloth mask, community mask**: textile barrier, usually made of one or more layers of cotton, fixed with straps on the ears or on the back of the head; not subject to any regulation; offers a relatively effective external protection of the immediate environment, since droplets, but not exhaled aerosols, are intercepted; poor protection of the person wearing the mask
- **Surgical mask**: defined medical device (CE-labelling); limited protection of the person wearing the mask, as aerosols can penetrate from the side; protection of the immediate environment, as droplets are intercepted
- **FFP2 (=N95, KN95) masks, respirator**: product with CE label; protection against particles (at least 94%). Protection of the person wearing the mask and the environment, as aerosols are filtrated. Masks with an exhalation valve do not offer any protection for others and are therefore unsuitable in the context of the COVID-19 pandemic.
Evidence base

- The evidence on the effectiveness of the measures with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. The findings are based to a large extent on modelling studies characterized by a low to very low quality of evidence [5, 7, 9-11, 29-31]. The certainty of the evidence is low to very low.
- Indirect evidence on the transmission of SARS-CoV-2 when using masks in the general population shows low trustworthiness.
- Health consequences beyond COVID-19 were not systematically assessed and are based on indirect evidence, individual studies, and/or expert consensus [27, 32].
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

**Benefits**
- Mask-wearing is associated with a reduction in SARS-CoV-2 transmission. Mask-wearing - as part of a set of measures in schools - is associated with a reduced rate of infection.
- FFP2 masks are associated with higher efficacy in the healthcare sector than surgical masks.
- Surgical masks and FFP2 masks are associated with higher efficacy than community/cloth masks.

**Harms**
- There are few health side effects associated with wearing masks. There is little evidence of potential harm from wearing a mask (e.g., skin irritation).
- High consumption of resources (production, disposal of surgical masks and FFP2 masks).
- FFP2 masks: currently no availability of FFP2 masks specially made for children; higher acquisition costs: compliance with occupational safety regulations for teachers and school staff is required, which can affect the organisation of the lessons. Probably increased need for supervision and possible associated limitations on the employment of parents and guardians.

**Overall assessment**
- According to the experts, the benefits of wearing masks by students, teachers and school staff predominate. In combination with other measures, wearing masks reduces the risk of infection in schools. According to experts, the potential additional protection provided by an FFP2 mask for people with an increased risk of a severe clinical course of COVID-19 disease outweighs possible harms.
3 Measures on school routes

### 3.1 Evidence-based recommendation

Infection control measures (wearing of face masks, reduction in the number of people) should be implemented on school routes in public transportation and on school buses.

<table>
<thead>
<tr>
<th>Quality of evidence</th>
<th>Quality of evidence: Very low ⭕️🚫🚫🚫</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of recommendation</td>
<td>Strong recommendation A</td>
</tr>
<tr>
<td>Strength of consensus</td>
<td>Strong consensus (100%); Yes 27, No 0, Abstain 0</td>
</tr>
<tr>
<td>Literature</td>
<td>Chu et al. (2020); Krishnaratne et al. (2021)</td>
</tr>
</tbody>
</table>

### 3.2 Consensus-based recommendation

Surgical masks should be used on school routes in public transport and on school buses in the case of high or very high infection levels.

| Strength of consensus | Consensus (96%); Yes 24, No 1, Abstain 2 |

**Glossary**

- **Staggered start of lessons**: If there are several schools in the vicinity, coordination between the schools can be a measure to reduce the number of people on the way to school at the same time.
- **Alternating attendance**: Alternation between face-to-face and distance teaching (e.g. daily or weekly alternation). As a result, only a part of the classes or years are present in school.
- **Cohorting**: Dividing larger groups (e.g. years, classes, teachers) into smaller groups; restriction to contacts within a defined group, contacts between groups are largely avoided.
- **Cloth mask, community mask**: textile barrier, usually made of one or more layers of cotton, fixed with straps on the ears or on the back of the head; not subject to any regulation; offers a relatively effective external protection of the immediate environment, since droplets, but not exhaled aerosols, are intercepted; poor protection of the person wearing the mask.
- **Surgical mask**: defined medical device (CE-labelling); limited protection of the person wearing the mask, as aerosols can penetrate from the side; protection of the immediate environment, as droplets are intercepted.
- **Public transport**: local public transport; here the term always includes school buses or other means of transport, regardless of the operator, if they provide transport for students or school staff on the way to school. Private services provided by parents, for example, are excluded.

**Evidence base**

- The evidence on the effectiveness of the measures with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. The findings are based to a large extent on modelling studies characterized by a low to very low quality of evidence [5, 7, 9-11, 29-31]. The certainty of the evidence is low to very low for all effects considered.
- Indirect evidence of SARS-CoV-2 transmission during mask use in the general population has low certainty [27, 32].
- Health consequences beyond COVID-19 were not systematically assessed and are based on indirect evidence, individual studies, and/or expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.
Weighing up benefits and harms of the measure

<table>
<thead>
<tr>
<th>Benefits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Probably a great contribution to infection control.</td>
<td></td>
</tr>
<tr>
<td>• Further arguments in favour of the measures depend on the design</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Probably negative ecological consequences from the use of disposable masks and/or the increased use of means of transport (especially when switching to private cars).</td>
<td></td>
</tr>
<tr>
<td>• Probably various negative consequences due to the absence of classes in the case of alternating attendance or phased opening.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Infection control measures on school routes (wearing masks, reducing the number of people) have positive and negative consequences for those directly affected and for society. Overall, according to the experts, the positive effects predominate.</td>
</tr>
<tr>
<td>• In case of measures with stronger negative effects (e.g. wearing of surgical masks) further measures should be taken to address these (e.g. accessible and free masks).</td>
</tr>
</tbody>
</table>

4 Measures for music classes in schools

4.1 Consensus-based recommendation

Music classes in schools ought to – subject to certain conditions – also take place under pandemic conditions.

Strength of consensus: Strong consensus (100 %); Yes 26, No 0, Abstain 2

4.2 Consensus-based recommendation

Indoors, music classes should be conducted without aerosol-generating activities (e.g., singing, wind instruments), and should be in compliance with the standard measures, like teaching on other subjects.

Strength of consensus: Strong consensus (96 %); Yes 26, No 1, Abstain 0

4.3 Consensus-based recommendation

Music classes with aerosol-generating activities should not be conducted in case of high infection levels.

Strength of consensus: Consensus (92 %); Yes 24, No 2, Abstain 1

Explanations on recommendation 4.3 (new compared to short version 1.0)

Recommendation 4.4 (initially 4.4) was consented in an online vote in July 2021 and newly included in the guideline. Comments criticised that this new recommendation overlaps with the previous recommendations and may therefore be superfluous. An even stricter approach may be appropriate in the case of very high levels of infection.

Recommendation put to the vote, no consensus reached by a narrow margin

Music classes with aerosol-generating activities (e.g., singing, wind instruments) should be conducted outdoors in compliance with the distancing rules (at least 2 meters in all directions) or indoors as individual lessons with an appropriate hygiene concept

Voting result: No consensus, majority approval (75 %); Yes 18, No 6, Abstain 3
Note
The wording used above (initially 4.3) received only 75% of the votes (no consensus, majority approval) and is therefore not a formally adopted recommendation. The main controversial points were whether this recommendation should always (= should) or only if possible (= ought to) be implemented, as well as whether indoor music classes with aerosol-generating activities were only possible as individual lessons or - with sufficiently large and well-ventilated rooms and with an appropriate hygiene concept - also possible in groups.

Amendment in version 1.2: To make it clear that the original recommendation 4.3 is not a formally adopted recommendation, in version 1.2 recommendations that did not achieve consensus are graphically distinguished from formally adopted recommendations.

Glossary

- **Aerosol generating activities in music classes**: e.g., singing, playing wind instruments.

Evidence base

- The evidence on the effectiveness of the measures with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. No studies were identified that focused on the transmission of SARS-CoV-2 with regard to musical activities in school.
- However, there is indirect evidence - outside of school and mostly relating to adults - that shows an increased risk of transmission of SARS-CoV-2 through singing and wind instruments, including larger outbreaks in choirs [33, 34]. In addition, there are experimental studies on aerosol development when speaking and singing [35]. However, this indirect evidence was not systematically assessed. All assessments of the effects on health are therefore based on expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

**Benefits**

- Probably relevant contribution to infection control.
- Maintaining music classes for as many students as possible.

**Harms**

- Potential negative effects on educational opportunities and educational success, primarily affecting individual groups of students, especially students taking advanced music courses or being part of a singing or wind class.

**Overall assessment**

- According to the experts, the positive effects of the measures for music classes in schools predominate.
5 Measures for physical education classes in schools

5.1 Consensus-based recommendation

Physical education classes in schools ought to – subject to certain conditions – also take place under pandemic conditions.

Physical education classes ought to be conducted outdoors.

Physical education classes should be conducted in small and unaltered groups but without wearing face masks.

Strength of consensus	Strong consensus (100 %); Yes 27, No 0, Abstain 0

5.2 Consensus-based recommendation

Indoor physical education classes should only be carried out considering the general rules on distancing, hygiene, and ventilation.

Strength of consensus	Consensus (95 %); Yes 21, No 1, Abstain 2

5.3 Consensus-based recommendation

Indoor physical education classes should not be carried out in case of very high levels of infection.

Strength of consensus	Consensus (88 %); Yes 23, No 3, Abstain 1

Explanations on recommendation 5.3 (new compared to short version 1.0)

Recommendation 5.3 was consented in an online vote in July 2021 and newly included in the guideline. In a comment to this recommendation, it was suggested that physical education should not take place indoors even when the levels of infection are only high. Another suggestion was that physical education should only take place in rotation with half the class size. One comment critically questioned whether this supplementary recommendation makes sense in presence of recommendation 1.2 (reduction of the number of students at very high levels of infection) and the high added value of sport.

Evidence base

- The evidence on the effectiveness of the measures with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. However, no studies were identified that focused on the transmission of SARS-CoV-2 with regard to physical activities in school.
- However, indirect evidence on the effectiveness of social distancing in the general population on SARS-CoV-2 transmission and on the risk of transmission being outdoors was taken into account [27, 36]. Further assessments of the effects on health are based on individual studies and expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

Benefits

- Probably relevant contribution to infection control.
- Maintaining physical education for as many students as possible with positive health effects.
Harms

- Potential negative effects on educational opportunities and educational success, primarily affecting individual groups of students, especially students taking advanced sports courses, being part of a sports class or at schools with a focus on sports.

Overall assessment

- According to the experts, the positive effects of the measures for physical education classes in schools predominate.

6 Dealing with suspected cases among students without known risk contact

6.1 Consensus-based recommendation

In the case of students who are not known to have had any risk of exposure and who have at least one of the following symptoms, an increased risk of being infected with SARS-CoV-2 should be assumed (as long as no other explanation is available according to a medical judgement):

- fever > 38.0 °C, poor general condition
- dry cough (more than occasional and not explained by an underlying disease)
- pronounced gastrointestinal symptoms (persistent significant abdominal pain with or without diarrhea and vomiting)
- smell and/or taste disorders (hyposmia, anosmia, hypogeusia, ageusia)

Strength of consensus

| Strength of consensus | Consensus (100%); Yes 28, No 0, Abstain 1 |

6.2 Consensus-based recommendation

Students with symptoms that indicate an increased risk of SARS-CoV-2 infection should not take part in face-to-face classes until 48 hours after the symptoms have subsided.

Strength of consensus

| Strength of consensus | Consensus (96%); Yes 25, No 1, Abstain 2 |

6.3 Consensus-based recommendation

Students with mild symptoms of an acute respiratory infection (e.g. cough, sore throat) should only return to face-to-face classes after being symptom-free for 48 hours.

Students with rhinorrhea (runny nose) or blocked nasal breathing (without fever), occasional coughing, sore throat or clearing of the throat that, according to the assessment of a parent or guardian, do not indicate the onset of an acute respiratory infection ought to continue to attend regular face-to-face classes.

Strength of consensus

| Strength of consensus | Consensus (85%); Yes 22, No 4, Abstain 1 |

Explanations on recommendation 6.3 (changes compared to short version 1.0)

The revised recommendation 6.3 was consented in an online vote in July 2021. It was supplemented by the specification of milder symptoms of illness (cough, sore throat). One comment suggested that the conditions under which individuals can participate in face-to-face teaching should be defined more strictly. Another suggestion was to replace the term “respiratory infections” with “infections” to account for other symptoms as well. A third suggestion was to recommend rapid tests as supplementary measure.
**Glossary**

- **Suspected cases**: Students with symptoms that indicate a potential SARS-CoV-2 infection are considered suspected cases, in particular:
  - elevated temperature, fever (≥ 38.0 °C)
  - respiratory symptoms (cough, sore throat, runny nose)
  - poor general condition (tiredness, exhaustion)
  - gastrointestinal symptoms (diarrhea, nausea and/or vomiting)
  - smell and/or taste disorders

**Evidence base**

- A systematic review was used to assess the informative value of individual symptoms in terms of sensitivity. Since many primary studies were carried out on hospitalized children, the informative value is limited [37].
- The assessment of the basic frequency of symptoms unrelated to SARS-CoV-2 for febrile and non-febrile acute respiratory infections is based on figures from the RKI’s weekly GrippeWeb survey [38].
- Health consequences beyond COVID-19 were not systematically assessed and are based on indirect evidence, primarily from three systematic reviews on the effects of quarantine on children and adolescents [39-41] and/or expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

**Weighing up benefits and harms of the measure**

**Benefits**
- Prevention of infection and secondary quarantine cases.

**Harms**
- Consequences of (self-)isolation for students and the associated absence from school, interruption of social contacts and social participation.
- Consequences for parents and guardians due to increased need for care and supervision of the students in (self-)isolation, in particular social and financial consequences due to reduced availability to work.
- Consequences for society and economy through the frequent and unpredictable absence of employees.

**Overall assessment**
- While the individual in (self-)isolation is always harmfully affected by the measure, there is only a benefit from the measure if the student is actually infected with SARS-CoV-2.
- The benefit of (self-)isolation outweighs the harm in the case of symptoms such as fever > 38.0 °C, which have a lower basic frequency in the population and are associated with an increased risk of SARS-CoV-2 infection.
- The possible harm of (self-)isolation outweighs the benefit in the case of frequent symptoms that have a high basic frequency in the population and that are in most cases are not associated with a SARS-CoV-2 infection (e.g. rhinorrhea).
7 Dealing with contact persons in schools

7.1 Evidence-based recommendation

Quarantine of close contact persons (according to RKI definition) prevents – depending on the duration – the further spread of SARS-CoV-2.

| Quality of evidence | Very low ⭕⭕⭕
|---------------------|------------------
| Grade of recommendation | Recommendation B
| Strength of consensus | Strong consensus (100 %); Yes 28, No 0, Abstain 0
| Literature | Krishnaratne et al. (2021), Fong and Iarocci et al. (2020), Imran et al. (2020), Panda et al. (2020), Nussbaumer-Streit et al. (2020)

7.2 Consensus-based recommendation

Students and teachers who are considered a close contact person (i.e. exposure to a confirmed case inside or outside of the school setting) should conduct themselves according to the assessments of the respective responsible health authority in accordance with the applicable RKI recommendation.

| Strength of consensus | Strong consensus (96 %); Yes 25, No 1, Abstain 1

General note on recommendation 7:

The aim of the guideline is to recommend appropriate set of measures to reduce the risk of infection in the school setting in order to enable the safest and most continuous face-to-face teaching possible (school closures are only appropriate if other interventions are not sufficiently effective). Adherence to the recommended infection prevention measures and a differentiated approach to assessing the risk of infection help to limit the number of persons for whom quarantine is ordered. If a case of infection occurs in the school, decisions on how to deal with contact persons should be made by the responsible health authority after assessing the situation and the risk of infection in accordance with the current RKI recommendations. As a decision-making aid for health authorities, the RKI provides a checklist (in German). In principle, it should be noted that the RKI continuously adapts recommendations and, if necessary, definitions to the course of the pandemic and in the light of new scientific findings.

Explanation on recommendation 7 (changes compared to short version 1.0)

Recommendation 7 was fundamentally revised due to changes in the definition of contact persons by the Robert Koch Institute (RKI). The omission of contact persons of category I and II led to a deletion of the recommendations 7.3 and 7.4 of the short version 1.0, which was consented in an online vote in July 2021:

- Deletion 7.3: strong consensus (96%); votes in favour 24, votes against 1, abstentions 2
- Deletion 7.4: consensus (93%); votes in favour 25, votes against 2, abstentions 0

A revised version of recommendation 7.2 was consented in the same online vote in July 2021:

- Amendment 7.2: Consensus (77%); votes in favour 20, votes against 6, abstentions 1

At a subsequent guideline meeting in July 2021, however, the amended wording was critically questioned by the RKI. Together with the leading paediatric societies (DGKJ, DGPI), recommendation 7.2 was revised. This version was consented in an online vote in September 2021:

- Amendment 7.2: strong consensus (96%); votes in favour 25, votes against 1, abstentions 1.

1 Retrieved 10/2021: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Hilfestellung_GA_Schulen
Glossary

- **Close contact persons**: According to the Robert Koch Institute (RKI), this is a person who has been exposed to an increased risk of infection through contact with a case. Decisive criteria are distance to the case and duration of exposure, wearing a mask and staying in rooms with potentially infectious aerosols. The previous classification into category 1 and 2 contact persons no longer applies. At least one of the following conditions must apply (as of 15th September 2021, the current recommendations apply):
  - Close contact (<1.5 meters distance) with index case, for >10 minutes without adequate protection,
  - Conversation (<1.5 meters distance) with case without adequate protection, regardless of duration of conversation or direct contact with respiratory secretions,
  - Stay in the same room with a case and potentially high concentration of infectious aerosols for >10 minutes, regardless of distance and adequate protection,
  - Assessment in contact situations that are difficult to survey (e.g., school classes, shared school lunches) is at the discretion of the health authority.

- **Case**: Person with confirmed SARS-CoV-2 infection who is a potential source of infection in contacts.

- **Adequate protection**: Defined as continuous and correct wearing of a mouth-nose protection or FFP2 mask by case and contact person.

Evidence base

- The evidence on the effectiveness of the measure with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review on infection control measures in schools and a further Cochrane Rapid Review on quarantine measures [1, 42, 43]. The findings are largely based on modelling studies with quality deficiencies or observational studies with limited transferability to the school context and to the definition of risk contacts according to the RKI. The certainty of the evidence is very low for all effects considered.

- Health consequences beyond COVID-19 were not systematically assessed and are based on indirect evidence, primarily from three systematic reviews on the effects of quarantine on children and adolescents [39-41] and/or expert consensus.

- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e., no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

**Benefits**

- Prevention of infections and secondary cases of quarantine, which as a result do not occur among students, teachers, in the household and in the community.

**Harms**

- Consequences of the quarantine for students and their associated absence from school, interruption of social contacts and social participation.

- Consequences for parents and guardians due to the increased need for care and supervision of the students in quarantine, in particular social and financial consequences due to reduced availability to work.

- Consequences for society and economy through the frequent and unpredictable absence of employees.

**Overall assessment**

- While the individual in quarantine is always harmfully affected by the measure, there is only a benefit from the measure if the person is actually infected with SARS-CoV-2 after a risk exposure.

- Therefore, the assessment of the probability of an infection depending on the kind of contact is critical.
8 Ventilation and reduction of the aerosol concentration in classrooms

8.1 Evidence-based recommendation

Regular and adequate ventilation should be ensured. Correct ventilation is conducted by means of cross-ventilation with the windows wide open every 20 minutes for 3-5 minutes, in summer every 10-20 minutes, and after each lesson for the entire break. The operation of a suitable ventilation or HVAC system to be regarded as equivalent.

<table>
<thead>
<tr>
<th>Quality of evidence</th>
<th>Very low ⋁⨀⨀⨀</th>
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</thead>
<tbody>
<tr>
<td>Grade of recommendation</td>
<td>Strong recommendation A</td>
</tr>
<tr>
<td>Strength of consensus</td>
<td>Consensus (93 %); Yes 26, No 1, Abstain 0</td>
</tr>
<tr>
<td>Literature</td>
<td>Krishnaratne et al. (2021)</td>
</tr>
</tbody>
</table>

8.2 Consensus-based recommendation

Rooms without the possibility for ventilation through windows and without suitable ventilation or HVAC system should not be used for teaching.

| Strength of consensus | Strong consensus (100 %); Yes 26, No 0, Abstain 1 |

Glossary

- **Aerosol**: heterogeneous, often relatively stable mixture of fine, potentially infectious suspended particles, which enables the transmission of pathogens via exhaled and inhaled air.
- **Ventilation system**: ventilator-assisted system that exchanges stale air for fresh air from outside.
- **Cross-ventilation**: According to DIN EN 12792: 2004-01, cross ventilation is defined as free ventilation through opposing windows or doors as a result of the differential pressure that is created by wind pressure on the outside of the building and where thermal lift in the building is of lesser importance. Colloquially, cross ventilation is also called draught.
- **HVAC systems**: Heating, Ventilation and Air Conditioning systems are ventilator-assisted systems that provide at least one of the functions of filtering, heating, cooling, humidifying, or dehumidifying. A suitable combination of these functions makes it possible to ensure the desired air conditions in terms of purity, temperature and humidity in rooms. A distinction must be made between whether the systems circulate part of the air (recirculation mode) or only supply fresh air from outside after appropriate pre-treatment.
- **Suitable ventilation system**: Ventilation systems and HVAC systems should feed fresh air into rooms from the outside, regardless of user influences, and convey the stale air out of the rooms to the outside. Often systems with a high proportion of circulating air are used. This poses a risk for the spreading of infectious aerosols, therefore additional measures are taken to remove these particles using HEPA filters of class H13 and H14. There are no studies on the optimal selection of filter classes for ventilation systems. The operation of circulating air systems without appropriate filtering is to be classified as unsuitable [44].
- **Spatial conditions**: Classroom sizes of approx. 60-75 m² with 20-30 students. Spatial conditions can differ considerably, including with regard to the size and occupancy of the room, the presence of a ventilation or HVAC system, the type of system, size and arrangement of the windows, the type of window opening, the arrangement of seats to the windows, number and location of possible sources of infection and weather conditions.

Evidence base

- The evidence on the effectiveness of the measure with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. The findings are based to a large extent on modelling studies characterized by a low to very low quality of evidence [5, 16] as well as one quasi-experimental study [45]. The certainty of the evidence is very low for all effects observed.
- Indirect evidence on the effectiveness of ventilation was derived from individual studies and statements [46-48].
- The health consequences of the ventilation measures beyond COVID-19 were not systematically examined and are based on individual studies and/or expert consensus.
• Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

| Weighing up benefits and harms of the measure |
| Benefits |
| • In combination with other measures, a likely contribution to the reduction of SARS-CoV-2 infections, the reproduction number, and the number of hospitalized COVID-19 patients. |
| • Inexpensive measure. |
| Harms |
| • The measure may be accepted differently in various groups. |
| Overall assessment |
| • In the opinion of the experts, the benefit of the measure outweighs the potential damage. In the present studies, ventilation is always considered together with other measures (distancing, masks, hand hygiene). Ventilation is therefore recommended as part of a standard set of measures. |

9 Air purification and reduction of aerosol concentration in classrooms

About the discussion and the voting process:
In an online vote in July 2021, a revised version of recommendation 9.1 from short version 1.0 was approved by a majority, but a consensus could not be reached:

- Amendment 9.1: majority approval (74%); votes in favour 16, votes against 7, abstentions 4

The recommendation was discussed afterwards in detail at the guideline meeting in July 2021. Three divergent positions emerged, which were mainly based on the different assessment of the evidence and the levels of recommendation. As a result, it was decided to prepare two other proposals as an alternative to the existing recommendation.

The following three proposals were put to vote in the online vote in September 2021:

Proposal 1 (unchanged / prepared by the Society of Hygiene, Environmental and Public Health Sciences, GHUP)

Recommendation put to vote, no consensus reached

The use of mobile air purifiers in schools may be considered as a supplementary measure to ventilation to reduce aerosols, if sufficient ventilation is guaranteed in principle and the assessment is carried out by experts.

Voting result

| No consensus, majority approval (54 %); Yes 14, No 12, Abstain 1 |

Proposal 2 (prepared by the German Society for Hospital Hygiene)

Recommendation put to vote, no consensus reached

No recommendation for or against the use of mobile air purifiers can be given due to lack of studies. There are no results available that show a reduction in infection.

Voting result

| No majority approval (38%); Yes 9, No 15, Abstain 3 |

Dissent by the German Society for Hospital Hygiene

Rational: Classrooms with good ventilation (Category I according to the German Federal Environment Agency (UBA)) do not require any additional measures to reduce aerosol levels. Rooms with insufficient ventilation (category III according to UBA) are not suitable for teaching. Other rooms with insufficient ventilation (Category II according to UBA) should be assessed with regard to a sustainable improvement of ventilation.
These rooms could reach an improved ventilation-level (Category I) through suitable structural-technical measures (e.g. by installing extractor fans or by improving the possibility to open windows). Category II rooms, which cannot be improved, should be classified as Category III rooms and thus not be used for teaching or only be used under even more stringent hygiene protection measures.

A possible additional benefit in the sense of a reduction of infection transmission is considered very unlikely due to the overall very low risk of transmission within schools between students. Epidemiological data from follow-up studies of infected students have identified only very few secondary cases of infection. To date, there have been no relevant numbers of clusters or outbreaks within schools, and when an outbreak has occurred, the number of secondary cases has been rather small and the location of the infection has usually remained unclear. However, it is not only the lack of evidence of a reduction in infections that argues against the use of air purifiers, but also possible risks have not yet been investigated. These include a false sense of security and consequently a neglect of generic hygiene measures, noise pollution, dysfunction, airflow effects (draughts) and drift effects due to horizontal virus-containing airflows towards the device, which could lead to increased exposure of students sitting in the airflow close to the device. The UBA refers to recent studies that show that the effect of aerosol reduction of air purifiers is quantitatively not better than those of wearing masks.

**Overall assessment of the measure by the German Hospital Federation:** The harm may possibly outweigh the benefit. The benefit in terms of infection reduction has not been proven in any study. The actual problem is insufficient ventilation in schools. As long as a room cannot be ventilated sufficiently, the whole measure has no added benefit. It is not possible to give a recommendation due to the unclear evidence.

**Assessment of the quality of the evidence by the German Hospital Federation:** No statement can be made on the quality of the evidence, as there is no evidence on directly clinically relevant outcomes. Only an additional benefit with regard to the prevention of SARS-CoV-2 infections compared to the measures of masks wearing and ventilation would be evaluated as a positive outcome of studies.

**Proposal 3** (prepared by the parent’s association of Lower Saxony)

<table>
<thead>
<tr>
<th>Recommendation put to vote, no consensus reached</th>
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<tbody>
<tr>
<td>Mobile air purifiers in schools should be used as a supplementary measure to ventilation to reduce aerosols, if sufficient ventilation is guaranteed in principle and an assessment is carried out by experts.</td>
</tr>
</tbody>
</table>

| Voting result | No majority approval (27%); Yes 7, No 19, Abstain 1 |

**Dissent by the Parent Council of Lower Saxony**

**Rational:** The wording “should be considered” is the minimum statement that should be made, as aerosol reduction is shown in modelling studies. Also, a reduction in the number of infections has not been proven for the measure “ventilation”.

It is assumed that other measures such as mask wearing and ventilation will continue to be implemented. The generic rules (distance, hygiene, masks, ventilation) aim to minimise the direct risk of infection. Mobile air purifiers minimise the indirect risk of infection, and are therefore a valuable addition.

**Assessment of the quality of the evidence by the Parent Council of Lower Saxony:** The additional benefit is regarded as probable, as modelling studies show an aerosol reduction. Adverse effects due to noise emission are estimated to be low, at least with high-quality devices. In addition, increased noise pollution can also occur while windows are opened to facilitate ventilation. The economic strains on schools and school authorities caused by the purchase of mobile air purifiers will be relieved by state subsidies. These subsidies increase the equality of opportunity for infection control at schools in both, structurally strong and weak regions.

Note: due to a transcription error, proposal 2 was not correctly presented at the beginning of the voting phase (“should be considered” instead of “should be used”). After consultation with Dr. Nothacker, AWMF, the voting period was extended to provide the representatives with the opportunity to review and/or correct the proposal.

**Amendment in version 1.2:** To clearly show that none of these proposals has been consented, they were made visually distinguishable from those that were formally consented.

**GLOSSARY**

- **Mobile air purifiers:** Mobile air purifiers are all devices in which the air in a room is passed through a mobile cleaning device that is free-standing in the room. The following processes are mainly used:
  - Purification of the air using a high-performance particulate filter
  - Purification using other filter techniques (e.g. activated carbon filters, electrostatic filters)
  - Treatment of the air through the use of UV-C technology
Treatment of the air using ozone, plasma or ionization
Combination of several procedures
(Adopted definition from the Federal Environment Agency (UBA, 16/11/2020))

Experts: Persons who have special knowledge in the fields of ventilation technology and indoor air hygiene; these may be, for example, ventilation engineers or indoor air quality technician.

Evidence base

- The evidence on the effectiveness of the measure with regard to SARS-CoV-2 transmission was systematically assessed by a Cochrane Rapid Review [1]. The findings on the effectiveness of air purifiers are based on a modelling study containing an experimental component but with quality deficiencies [49]. The certainty of this evidence is very low.
- Indirect evidence on the effectiveness of air purifiers was derived from individual studies and statements [46, 50, 51].
- The health consequences of the ventilation measures beyond COVID-19 were not systematically examined and are based on individual studies and/or expert consensus.
- Evidence on other criteria (acceptance, health equity, social and ecological consequences, financial and economic consequences, feasibility) was not examined, i.e. no systematic search and assessment of scientific studies was conducted. All assessments of these criteria are based on expert consensus. The restriction of fundamental rights through the measure was considered, also with regard to the proportionality of the measure. A legal examination has not been conducted.

Weighing up benefits and harms of the measure

Benefits
- A positive effect on infection control seems possible
- A reduction of aerosols could be proven in individual studies

Harms
- High costs for acquisition, maintenance, servicing and disposal.
- Feasibility issues, especially with regard to professional installation and maintenance.
- Impairment of teaching quality and educational success as well as health due to noise.
- Ecological: very resource-intensive.

Overall assessment

- The measure "mobile air purification as a supplement to ventilation" produces positive and negative health effects, which are offset by far-reaching negative effects in the area of the other decision criteria, in particular with regard to financial and ecological consequences as well as feasibility. Overall, in the opinion of the experts, neither the positive nor the negative effects predominate, so that the implementation of the measure can be considered. There is no evidence in terms of SARS-CoV-2 infections prevented, the number of replications and the number of hospitalised patients. There is weak evidence on the effectiveness of HEPA filters in reducing airborne aerosol particles.
- The use of air purifiers is limited to particular situations and is not recommended as a general measure. One such example would be a classroom with roof lights in which the threshold for CO2 is not exceeded due to ventilation, but only part of the air is effectively exchanged due to unfavourable airflow. An air purifier may be useful depending on the infection situation and in consultation with an expert (e.g. ventilation engineer).
- Standardised quality criteria for air purifiers have been defined by the VDI recently. However, there is no certainty about the required purification performance for the prevention of SARS-CoV-2 infections. Therefore, the current view is that any aerosol reduction should be aimed for. Therefore, the current view is that any reduction in aerosol concentration should be aimed for. However, the effectiveness of the filtration or virus inactivation performance must be assessed for each device.
- As noise emissions significantly influences the acceptance of the measure, it must be considered alongside purchasing, operations and maintenance costs and a special focus be put on low noise emissions of that apparatus.
B GUIDELINE REPORT

1 Background

Due to the COVID-19 pandemic, a variety of measures are being implemented in schools directly affecting students, teachers and other school staff, as well as parents and families. So far, these measures have been initiated and implemented without a systematic review of the evidence.

The topic of schools was formally prioritised in discussions with national and international decision-makers in the field of public health (including the World Health Organization (WHO); and the German Public Health Stakeholder Advisory Panel of the COVID-19 Evidence Ecosystem (CEOsys) project).

There is a need to consolidate and assess the growing evidence about controlling and preventing SARS-CoV-2 transmission in schools. Of particular importance is the collection, screening, aggregation, and evaluation of evidence on the effectiveness of measures that are implemented and evaluated in schools. Health-related side effects of these measures (e.g. psychosocial stress on students and parents) as well as consequences for the society as a whole (e.g. in the areas of education, social affairs and participation in employment of parents and guardians) deserve special consideration.

This overall review of the evidence is the basis for a living guideline, i.e. a guideline that is updated in regular intervals based on a current review and evaluation of the evidence. This first version of the guideline applies to primary and secondary schools. Other school types and activities (e.g. school-based afternoon child care) are to be included in future updates.

In addition, evidence-based findings regarding effective communication and implementation of control and prevention measures in schools are important.

2 Scope and target audience

The guideline is aimed at ministries and authorities, school administrators, teachers and other employees in schools, as well as students, parents and guardians.

3 Further documents on this guideline

This document is a short version of the recommendations on measures for the prevention and control of SARS-CoV-2 transmission in schools. The German long version of the guideline is available on the AWMF website. The appendix to the short version lists the search strategy and declarations of interests and how conflicts of interest were dealt with.

4 Composition of the guideline group: stakeholder participation

A representative guideline group was formed to develop the recommendations.

For this purpose, stakeholders and institutions that are affected by measures to prevent and control SARS-CoV-2 transmission in schools or are involved in their implementation were identified in November 2020. Representatives of these stakeholder groups and institutions were invited to assist in the guideline development and contribute their expertise.

Groups involved were

- Students
- Employees in the school sector (teachers, school principals, special educators)
- Parents
- Decision-makers in school authorities
- Public health stakeholders (including health authorities, RKI)
- Scientific societies (various medical societies, educational societies)

In addition, other institutions were invited to accompany the guideline creation process as observers without voting rights (Ministries of Education, Ministries of Health, World Health Organization, Conference of the Ministers of Education).

When selecting the invitees, attention was paid to a balanced representation of different federal states (east - west - north - south) and municipalities (rural - urban), as well as a balanced gender distribution. Furthermore, a balance was sought between stakeholders from education and health sectors as well as between affected interest groups and official institutions.

Due to the short development time and the diverse workloads in the context of the pandemic, some invited stakeholders and institutions were unable to contribute.

In addition to representatives of 12 scientific societies, representatives of 19 stakeholder groups were members of the guideline group with voting rights.
<table>
<thead>
<tr>
<th>Scientific coordination and methods team</th>
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<tbody>
<tr>
<td>Prof. Dr. Eva Rehfuess</td>
</tr>
<tr>
<td>Dr. Lisa Pfadenhauer</td>
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<tr>
<td>Brigitte Strahwald</td>
</tr>
<tr>
<td>Dr. Kerstin Sell</td>
</tr>
<tr>
<td>Dr. Jan Stratil</td>
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<tr>
<td>Suzie Kratzer</td>
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<tr>
<td>Julia Rabe</td>
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<tr>
<td>Katharina Wabnitz</td>
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<tr>
<td>Petra Schönweger</td>
</tr>
<tr>
<td><strong>Ludwig-Maximilians-Universität München, LMU</strong></td>
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<td><strong>University of Munich</strong></td>
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<th>Methodological guideline advice</th>
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<tbody>
<tr>
<td>Dr. Monika Nothacker</td>
</tr>
<tr>
<td><strong>Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften, AWMF</strong></td>
</tr>
<tr>
<td><strong>Association of the Scientific Medical Societies in Germany</strong></td>
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<table>
<thead>
<tr>
<th>Representatives of societies and organisations (Elected representatives with voting rights M)</th>
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<tbody>
<tr>
<td>Prof. Dr. Eva Grill</td>
</tr>
<tr>
<td>Prof. Dr. Dietrich Rothenbacher (M)</td>
</tr>
<tr>
<td>Prof. Dr. Hajo Zeeb</td>
</tr>
<tr>
<td>Dr. Berit Lange</td>
</tr>
<tr>
<td><strong>Deutsche Gesellschaft für Epidemiologie, DGEpi</strong></td>
</tr>
<tr>
<td><strong>German Society for Epidemiology e.V.</strong></td>
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</tbody>
</table>

| Prof. Dr. Freia De Bock (M)                 |
| Karin Geffert (M until 06/2021)             |
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| **German Society for Public Health e.V.**   |

| Prof. Dr. Ingeborg Krägeloh-Mann (M)       |
| Prof. Dr. Reinhard Berner                  |
| **Deutsche Gesellschaft für Kinder- und Jugendmedizin, DGKJ** |
| **German Society of Pediatrics and Adolescent Medicine** |

| Prof. Dr. Johannes Hübner (M)               |
| Prof. Dr. Arne Simon                        |
| **Deutsche Gesellschaft für pädiatrische Infektiologie, DGPI** |
| **German Society for Pediatric Infectious Diseases** |

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| Dr. Ulrike Horacek (M 07/2021- 09/2021)     |
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| **German Society for Social Pediatrics and Adolescent Medicine** |

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| Prof. Dr. Jörg Timm                        |
| **Deutsche Gesellschaft für Virologie, GV** |
| **German Society for Virology**            |

| Prof. Dr. Georg Marckmann (M)              |
| **Akademie für Ethik in der Medizin, AEM** |
| **German Academy of Ethics in Medicine**   |

| Prof. Dr. Andreas Seidler (M)              |
| Prof. Dr. Christian Apfelbacher            |
| **Deutsche Gesellschaft für Sozialmedizin und Prävention, DGSMP** |
| **German Society for Social Medicine and Prevention** |

| Prof. Dr. Caroline Herr                    |
| Dr. Stefanie Heinze                       |
| Dr. Julia Hurraß (M)                      |
| Susann Böhm                               |
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| **Society of Hygiene, Environmental and Public Health Sciences** |

| Prof. Dr. med. Michael Kölch (M)           |
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| **German Society of Childhood and Adolescent Psychiatry and Psychotherapy** |

| Prof. Dr. Stephan Letzel (M)               |
| **Deutsche Gesellschaft für Arbeits- und Umweltmedizin, DGAUM** |
| **German Society for Occupational, Social and Environmental Medicine** |

| Dr. Peter Walger (M)                       |
| **Deutsche Gesellschaft für Krankenhaushygiene, DGKH** |
| **German Society of Hospital Hygiene**     |

| Dario Schramm (M)                          |
| **Bundesschülerkonferenz, BSK**            |
| **Standing Conference of Students**        |

<p>| Yola-Marie Fanroth (M)                     |
| <strong>Kinder- und Jugendbeirat des Deutschen Kinderhilfswerks, DKHW</strong> |
| <strong>Children and Youth Advisory Committee of the German Childrens’ Fund</strong> |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
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<tbody>
<tr>
<td>Prof. Dr. Sabine Andresen (M)</td>
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<td>Health Authority Frankfurt am Main (since 06/2021)</td>
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<tr>
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<td>Landesgesundheitsamt Baden-Württemberg</td>
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<td>German Educational Research Association</td>
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</table>

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** only active as advisor
5 Information on guideline development

Prioritisation of topics and key questions
To determine the scope of this guideline, the members of the guideline group were initially asked which questions should be prioritised with regard to measures for the prevention and control of SARS-CoV-2 transmission in schools and which criteria are relevant for decision-making. An online survey was carried out for this purpose. Participants’ answers were evaluated by means of qualitative content analysis.

The results were presented to the guideline group at the constituent guideline meeting. Topics that are already addressed by other ongoing or scheduled guideline projects (e.g. test strategies) were excluded.

The following topics were put to vote:

1. Wearing of masks by students and teachers
2. Ventilation, air purification and reduction of aerosol concentration in classrooms
3. Attendance regulations for students and teachers showing symptoms of a cold
4. Quarantine regulations for students and teachers
5. Cohorting and/or grouping of school classes or students in and outside of school
6. Measures for infection control on school routes
7. Measures for infection control during physical education and music classes
8. Measures for infection control in the leisure time and in the extracurricular time of students and teachers

The final prioritisation took place by means of an orientation vote during the constituent guideline meeting. Questions 1-7 were accepted, question 8 was excluded.

From the questions accepted, key scientific questions were then developed according to the PICO scheme (population – intervention/measure – comparison – outcome/endpoint) in order to systematically identify the relevant evidence in each case. In the course of developing the guideline, two of the key questions were further differentiated, so that recommendations on a total of nine key questions were developed:

1. Reducing the number of students in face-to-face teaching and/or cohorting
2. Wearing face masks by students, teachers and other school personnel
3. Measures on school routes
4. Measures for music classes in schools
5. Measures for physical education classes in schools
6. Dealing with suspected cases among students without known risk contact
7. Dealing with contact persons in schools
8. Ventilation and reduction of the aerosol concentration in classrooms
9. Air purification and reduction of the aerosol concentration in classrooms

Systematic research and selection of evidence
A detailed description of the literature search will be presented in the long version guideline report. The procedure for the systematic search for direct and indirect evidence is briefly described below.

Direct evidence for the key questions of the guideline was collected by a Cochrane Rapid Review on the effectiveness of measures implemented to reduce the transmission of SARS-CoV-2 in schools [1]. The term “direct” describes that these studies relate directly to schools.

This systematic review included studies that quantified the effectiveness of measures in schools. Experimental, quasi-experimental and observational epidemiological studies as well as mathematical modelling studies were considered relevant. Students, teachers and other school staff were included as populations.

All measures aimed at preventing and controlling the transmission of SARS-CoV-2 in schools were considered, namely organisational, structural, surveillance and response measures. Effects on the transmission process, health in general, the use of the health system and other societal, economic and social consequences were analysed.

The following databases were searched, using a search strategy (see Appendix) developed by an information specialist:

- Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) (1946 - 8 December, 2020)
- Ovid Embase (1974- 7 December, 2020)
- Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library (1996 – December, 2020)
- Educational Resources Information Center (ERIC) through the Institute of Education Science at the US Department of Education (1965 – September, 2020)

Furthermore, the reference lists of all included studies, relevant reviews and guidelines were searched, as were all studies citing these reviews or guidelines. In order to find additional relevant reports that were not published in scientific journals, searches were carried out in Google Scholar.

Information from the included studies was extracted in a standardised manner. Various instruments were used to assess the risk of bias and the quality of the included studies: Cochrane Risk of Bias Tool for randomised controlled studies, ROBINS-I for quasi-experimental studies and an assessment tool for modelling studies, which appraises (i) model structure, (ii) input data, (iii) dimensions of uncertainty, (iv) transparency, and (v) validation. Due to the large variations between studies, no meta-analysis (i.e. quantitative-statistical evaluation) was carried out; the results were summarised narratively and in tables, divided into evidence from modelling studies and evidence from quasi-experimental studies.

Overall, we included 38 unique studies in the analysis, of which were 33 modelling studies, three observational studies, one quasi-experimental study and one experimental study with modelling components. The studies focused on different countries: United States of America (15), United Kingdom (3), Canada (4), Germany (3), France (2), China (2), Denmark (1), Israel (1), Netherlands (1), Switzerland (1), Chile (1), Sweden (1). There was one study which conducted a simulation study in classrooms in four European countries (Kaiser 2020).

Indirect evidence: Due to the often limited or missing evidence for measures in schools, indirect evidence was also sought systematically. The term "indirect" describes that these studies do not refer directly to schools but to other populations (e.g. general population) or other places of implementation (e.g. workplace).

The search for indirect evidence involved the following steps:

- Expansion of the key PICO questions: in particular replacement of the population “students/teachers” with the general population and expansion to also include non-school settings
- Search for relevant systematic reviews on the extended key PICO questions in the Cochrane Special collection on COVID-19, in the WHO COVID-19 database and in PubMed
- Review of the reference lists of all relevant publications, guidelines and literature in Google Scholar

During the revision of individual recommendations, a non-systematic literature search was carried out. More recent studies were included by the guideline group as part of the editing process.

Critical appraisal of the evidence

A critical appraisal of the direct evidence - not the indirect evidence - was carried out using GRADE [52]. This assessment is carried out for each question and each effect examined across all studies and leads to an assessment of the certainty of the entire evidence on each question. The certainty of the evidence is rated as follows:

<table>
<thead>
<tr>
<th>Certainty of the evidence</th>
<th>Definition</th>
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<tbody>
<tr>
<td>High</td>
<td>We are very confident that the real effect is close to the effect estimator.</td>
</tr>
<tr>
<td>Moderate</td>
<td>We have moderate confidence in the effect estimator: the real effect is likely close to the effect estimator, but there is a possibility that it is significantly different.</td>
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<tr>
<td>Low</td>
<td>Our confidence in the effect estimator is limited: the real effect can be significantly different from the effect estimator.</td>
</tr>
<tr>
<td>Very low</td>
<td>We have very little confidence in the effect estimator: the real effect is likely to be significantly different from the effect estimator.</td>
</tr>
</tbody>
</table>

Development of the recommendations using the WHO-INTEGRATE framework

Measures to improve public health are often complex: In addition to the intended effects on health and potential side effects, they often provoke direct or indirect far-reaching social, economic or ecological consequences.

While clinical recommendations primarily compare the health benefit with the possible health damage of a measure, a large number of criteria must be considered and weighed against each other when developing public health recommendations. These include: human rights, acceptance, effects on health equity and non-discrimination, social and ecological consequences, financial and economic effects and feasibility.

The WHO-INTEGRATE framework provides a structure for systematically considering and assessing these criteria in the guideline process [53]. In the context of this guideline, the framework was translated, adapted to the German context and used as a basis for the creation of recommendations.
The criteria for this guideline were implemented in the digital guideline development tool GRADEpro in the sense of an Evidence-to-Decision (EtD) framework. An introduction to this tool was given by Prof. Dr. Holger Schünemann (GRADE working group).

The scientific coordination and methods team created topic-specific bundles of evidence to be worked on for each question. Smaller teams, consisting of representatives of the contributing societies, the LMU scientific coordination and methods team and colleagues from the GHUP were created. Work on the recommendations and the assessment against the WHO-INTEGRATE framework was carried out in these smaller teams.

**Structured consensus development**

**Short version 1.0**

The structured consensus development was conducted in accordance with the consensus conferences on January 28 and 29, 2021 following the procedure of the National Institute of Health (NIH) with neutral moderation by Dr. Monika Nothacker (AWMF):

- Presentation of the recommendations, the evidence base and the assessment of the decision criteria by the preparatory team
- Opportunity for questions, clarification of content, inclusion of suggested changes
- If necessary, prioritisation of proposals, trial voting
- If a sufficient consensus is not reached, renewed discussion and coordination of proposed changes

The consensus conferences were held virtually and votes cast electronically. The following topics were discussed at the conference on January 28, 2021:

- Preamble
- Recommendation 1: Reducing the number of students in face-to-face teaching and/or cohorting
- Recommendation 2: Wearing face masks by students, teachers and other school personnel
- Recommendation 3: Measures on school routes
- Recommendation 4: Measures for music classes in schools
- Recommendation 5: Measures for physical education classes in schools

The following topics were discussed at the conference on January 29, 2021:

- Preamble
- Recommendation 6: Dealing with suspected cases among students without known risk contact
- Recommendation 7: Dealing with contact persons in schools
- Recommendation 8: Ventilation and reduction of the aerosol concentration in classrooms
- Recommendation 9: Air purification and reduction of the aerosol concentration in classrooms

Consensus or strong consensus was reached for all recommendations besides the initial recommendation 4.3 (Music classes with aerosol-generating activities), where with an approval of 75% only a majority agreement was achieved. This wording is labelled as “Recommendation put to vote, no consensus reached by a narrow margin”.

On February 3, 2021, an amendment was submitted to the recommendations on how to deal with suspected cases of students without known risk contact. Two recommendations were summarised and reformulated. The vote was sent in written form to the scientific coordination team. The amended proposal was adopted with a strong consensus.

**Short and long version 1.1 and 1.2**

During the preparation of the long version, it became apparent that several recommendations needed to be updated due to the dynamics of the pandemic. Therefore, two online votes (through LamaPoll) were conducted:

1. First online vote between July 16 and July 26, 2021, on the following topics:
   - Preamble
   - Recommendation 4: Measures for music classes
   - Recommendation 5: Measures for physical education classes
   - Recommendation 6: Dealing with suspected cases among students without known risk contact
   - Recommendation 7: Dealing with contact persons
   - Recommendation 9: Air purification and reduction of the aerosol concentration in classrooms

2. Evaluation with comments and quantitative results listed

3. Presentation of the results at the meeting of the guideline group on July 28, 2021: The amended wording of recommendation 7.2 on dealing with contact persons was critically questioned by the RKI. The main concern was that the chosen wording could require further changes at very short notice. Recommendation 7.2 was then revised together with the leading paediatric societies (DGKJ, DGPI).
Recommendation 9.1 on air purification and reduction of aerosol concentrations in classrooms was discussed at length during the meeting. Three diverging points of view emerged, which were mainly based on a different assessment of the evidence and the levels of recommendation. As a result, it was decided to prepare two other proposals for recommendation 9 as an alternative to the existing recommendation.

4. Second online vote between September 11 and September 22, 2021: The revised recommendation 7.2 was accepted with a strong consensus. Of the three proposals for recommendation 9.1, only the previous proposal by the GHUP has reached a majority approval.

Overall, consensus or strong consensus was achieved for all but two recommendations in the guideline; only for the initial recommendation 4.3 consensus was narrowly missed (75% agreement) and for recommendation 9.1 majority agreement was only narrowly achieved. Proposals were submitted for recommendation 9.1, which are listed in the recommendation above. As no consensus was reached for both 4.3 and 9.1, no recommendation can be made in either case.

Amendment in version 1.2: The DGKJ and DGPI suggested to emphasize the importance of vaccination rates and the spread of virus variants. This proposal was approved by the members of the steering group on July 13, 2022 and has been implemented in version 1.2.

### Grading of recommendations and classification of the strength of consensus

<table>
<thead>
<tr>
<th>Quality of the evidence</th>
<th>Classification: Very low – Low – Moderate – High</th>
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<tbody>
<tr>
<td>Grade of recommendation</td>
<td>Strong recommendation (grade of recommendation A) Syntax: should / should not</td>
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<tr>
<td></td>
<td>Recommendation (grade of recommendation B) Syntax: ought to / ought not to</td>
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<tr>
<td></td>
<td>Open recommendation (grade of recommendation 0) Syntax: may be considered / no specific recommendation</td>
</tr>
<tr>
<td>Strength of consensus</td>
<td>Agreement of &gt; 95% of the participants Syntax: Strong consensus</td>
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<tr>
<td></td>
<td>Agreement of &gt; 75-95% of the participants Syntax: Consensus</td>
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<td></td>
<td>Agreement of &gt; 50-75% of the participants Syntax: Majority agreement</td>
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<tr>
<td></td>
<td>Agreement of &lt; 50% of the participants Syntax: No consensus</td>
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</table>

### 6 Editorial independence

#### 6.1 Funding

The creation of this guideline was initiated in the COVID-19 Evidence Ecosystem (CEOsys) project, which is funded by the Federal Ministry of Education and Research (BMBF) as part of the National Research Network of University Medicine on COVID-19 (NUM).

The Cochrane Rapid Review and the moderation by Dr. Monika Nothacker was funded by the CEOsys project. The work of the scientific coordination and the methods team of the LMU Munich was partly financed by funds from the Chair for Public Health and Health Services Research at the LMU Munich, and partly on a voluntary basis. Further methodological advice from the AWMF (Dr. Monika Nothacker) was also carried out on a voluntary basis. The representatives of the societies and organisations were only involved on a voluntary basis, for which we would like to express our sincere gratitude.

#### 6.2 Declaration of interests and handling of conflicts of interests

All parties involved submitted a declaration of interest (see Appendix). The interests were evaluated by one representative each from the AWMF, the DGEpi, the DGPI, the Standing Conference of Students (Bundesschülerkonferenz) and the scientific coordination and methods team of the LMU Munich. The following issues were discussed or defined as conflicts of interest:
**Direct interests**

- **Financial relationships with industry/businesses**
  Consulting/lecturer fees; research funding from companies that manufacture ventilation systems and/or face masks; local transport companies or computer/laptop manufacturers or the ownership of shares in such companies were classified as conflicts of interest. No relationships of this kind were found in the guideline group or the scientific coordination and methods team. The detected financial relationships with industry were limited to the pharmaceutical industry without a direct reference to COVID-19.

- **Financing/Research funding by Ministries of Education/Standing Conference of the Ministers of Education/Ministry of Education and Research/Public educational institutions**
  The scientific coordination and methods team and some members of the guideline group receive (research) funding from the above-mentioned institutions. It was discussed whether this would impair independence. In general, public research funding is considered to be more independent than industrial research funding. In addition, the direction of the interests of the research funders was assessed as partly different, and partly not immediately known. In view of the protective factors: systematic research and assessment of evidence, criteria-based decision-making, structured consensus development of the representative guideline group, no conflict of interest was declared.

**Indirect interests**

It was discussed whether parenting a school-age child was a conflict of interest. On the one hand, several members of the guideline group (in addition to the parents’ representatives) stated that they had school-age children; on the other hand, several members of the guideline group (in addition to the teacher representatives) stated that they had teachers as close relatives or had close personal relationships with teachers to maintain. For this reason and due to the protective factor of a multi-perspective group composition, the assignment of a conflict of interest was waived. As a result, no conflict of interest was found for any member of the guideline group. An assessment of these conflicts as low, moderate and high was therefore omitted. The evaluation criteria and results were presented at the beginning of the guideline group meeting and agreed with the entire group.
7 Endorsement

This first short version of the guideline is supported by the boards of the following participating societies and organisations:

- German Society for Epidemiology, DGEpi
- German Society for Public Health, DGPH
- German Society of Pediatrics and Adolescent Medicine, DGKJ
- German Society for Pediatric Infectious Diseases, DGPI
- German Society for Social Pediatrics and Adolescent Medicine, DGSPJ
- German Society of Childhood and Adolescent Psychiatry and Psychotherapy, DGKJP
- German Academy of Ethics in Medicine, AEM
- Society of Hygiene, Environmental and Public Health Sciences, GHUP
- German Society for Social Medicine and Prevention, DGSMP
- German Association for Hospital Hygiene, DGKH
- German Society for Virology, GfV
- German Society for Occupational, Social and Environmental Medicine, DGAUM
- Robert Koch Institute, RKI
- Federal Association of Physicians of German Public Health Departments, BVÖGD
- Professional Association of Physicians in Child and Adolescent Medicine, BVKJ
- State Health Authority Baden-Wuerttemberg
- Health Authority Frankfurt am Main
- Children and Youth Advisory Committee of the German Childrens’ Fund, DKH
- German Child Protection Agency, DKSB
- Association for Education, VBE
- General Association of Head Teachers Germany, ASD
- Main Personnel Council for State Teachers at Comprehensive Schools, Rhineland-Palatinate
- Association for Special Education, vds
- Parents’ Association of Lower Saxony
- German Educational Research Association, DGfE
- Public Education Authority Cottbus
- German Social Accident Insurance, DGUV

This guideline is a living guideline. The first version of the guideline was adopted and published in February 2021 as short version 1. The short version 1.1 was adopted in November 2021 and published after editorial changes in February 2022 as short version 1.2. The recommendations contained in this version appear in the long version 1.2. Further updates are planned.

If you have any questions about the guideline, the validity or the update procedure, please contact the scientific coordination and methods team (rehfuess@ibe.med.uni-muenchen.de).
References


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**31.5.2022: validity of the guideline has been extended to 30.9.2022 after content review by the guideline office**