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S3-Leitlinie
Maßnahmen zur Prävention und Kontrolle der SARS-CoV-2-Übertragung in Schulen | Lebende Leitlinie

Evidenzgrundlage

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Schlüsselfrage: Kohortierung

Tabelle 1: Übersicht über inkludierte Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
Alvarez 2020	Modelling	1. Measures to reduce contacts - phased reopening of schools	1. School population (unspecified)	Not specified	Progressive opening of schools (from May 11 until June 5) until reaching to 25%, 50%, 75%, and 100% of the school activity compared to 0% of school activity.	1. Transmission - number of schools with at least one infected person on the premises	1. General population	Not specified
Aspinall 2020	Modelling	1. Measures to reduce contacts - phased reopening of schools	1. Students 2. Teachers	1. Student age groups: age not specified; but children in grade 1-6 (ages 5-11) 2. Teachers of primary school 3. Staff of primary school	Five scenarios: Scenario I: June 1st, 2020 school return for selected year groups, real world rate of attendance from June 5th Scenario II: June 1st school-return for selected year groups, full attendance Scenario IIIa: September: return of all primary school children, prevalence of June 5th Scenario IIIb: -"-, adult prevalence 4x of that in June Scenario IIIc: -"-, adult prevalence 0,25x of that in June	1.Transmission - number or proportion of infections; attack rate of cases observed or predicted with and without the intervention	1. School population (unspecified) 2. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
Baxter 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening	1. Students 2. Teachers 3. School staff	1. Student age group: Cohort 1: Nursery, Reception, Year One: ages 0-6; cohort 2: Years 2-6: ages 6-11; 2. Teachers: in cohort 3: classroom teachers and teaching assistants - adults 3. Staff: in cohort 4: adults	Five Scenarios: (a) schools closed schedule: all students receive online instruction (b) alternating school day for younger children schedule: only children 10 years old or younger return to in-person instruction while following an alternating school day schedule (c) alternating school day schedule: half of the students receive in-person instruction on Mondays and Wednesdays and the other half on Tuesdays and Thursdays (d) younger children only schedule: only children 10 years old or younger return to in-person instruction (e) regular schedule: all students return to in-person instruction." Each scenario evaluated	1. Transmission - number or proportion of infections	1. Students 2. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					for different timepoints of school reopening.			
Bershteyn 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing; modification of activities 3. Surveillance and response measures - daily symptom screening, active testing, reactive school closures, quarantine 4. Structural/environmental - enhanced ventilation	1. Students 2. Teachers	Not specified	Four scenarios: > Distance learning: providing an option of all-remote instruction > choice of class scheduling for in-person learners > Cohorting (subdividing classes into cohorts of 9 to 13 students) > Alternating attendance: Two groups of up to 13 students could attend on alternating Monday and on two designated days, either staggered (Tuesday and Thursday, or Wednesday and Friday) or in two-day blocks (Tuesday and Wednesday, or Thursday and Friday). Three groups of 9 students could attend on one designated day, and then on one day every two out of three weeks, or else one two-day block once every	1. Transmission - attack rate of cases observed or predicted with and without the intervention	1. Students	New York City (NYC), with the largest school district in the United States, was the first major US city to offer in-person instruction during the 2020-2021 school year despite persistent community transmission after the first SARS-CoV-2 pandemic wave.

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					three weeks. Finally, for older students, three groups of 9 students could attend in a 6-day rotation either once every three days, or two consecutive days in every six days.)			
Burns 2020	Modelling	1. Measures to reduce contacts - formation of cohorts 2. Measures making contacts safer - vaccinations 3. Surveillance and response measures - symptom based isolation	1. Students	6 - 12 years	> smaller class sizes	1. Transmission - attack rate of cases observed or predicted with and without the intervention	1. Students 2. Teachers 3. School staff	Not specified
Cohen 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Surveillance and response measures - testing; contact tracing	1. Students	Not specified	Seven scenarios: 1. All in-person with no countermeasures 2. All in-person with countermeasures 3. All in-person with countermeasures and A/B scheduling 4. Elementary and middle in-person with countermeasures, high	1. Transmission - number or proportion of infections 2. Healthcare utilization - number or proportion of cases requiring intensive care	1. Students	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					school remote 5. Elementary in-person with countermeasures, middle and high school remote 6. Elementary in-person with countermeasures and A/B scheduling, mid- dle and high school remote 7. All remote			
Di Domenico 2020	Modelling	1. Measures to reduce contacts - phased reopening of schools 2. Measures making contacts safer - physical distancing 3. Surveillance and response measures - testing; isolation	1. School population (unspecified)	0 - 19 years	Four scenarios: > Progressive (100%) : progressive reopening up to 100% attendance. We assume that 25% of students go back to school on the 1st week after lockdown is lifted, 50% on the 2nd, 75% on the 3rd, and 100% from the 4th week till summer holidays. > Progressive (50%) : progressive reopening up to 50% attendance. We assume that 25% of students go back to school on the 1st week after	1. Transmission - number or proportion of infections; reproduction number	1. Students 2. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					lockdown is lifted, and 50% from the 2nd week till summer holidays. > Prompt (50%) : partial reopening with 50% attendance from May 11. > Prompt (100%) : full reopening with 100% attendance from May 11.			
Espana 2020	Modelling	1. Measures to reduce contacts - phased reopening 2. Measures making contacts safer - masks	1. Students 2. Teachers 3. General population	Agre groups 0-20, 20-30, 30-40, 40-550, 50-60, 60-70, 70-80, 80-120	> Formation of cohorts (three levels of school operating capacity (50%, 75%, and 100%)) Multiple scenarios: Nine combinations of these scenarios to a scenario in which 153 schools reopened normally (100% capacity, 0% face-mask adherence) and to a scenario in which 154 schools operated remotely until the end of the calendar year.	1. Transmission - number or proportion of infections; attack rate of cases observed or predicted with and without the intervention 2. Healthcare utilization - number or proportion of hospitalizations	1. General population	Not specified
Germann 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of	1. Students 2. General population	0 - 4 years 5 - 18 years 19 - 29 years	> Alternating attendance: [alternations of in-class and remote teaching days]	1. Transmission - number or proportion of	1. Students 2. Staff (members of	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
		cohorts 2. Measures making contacts safer - masks; physical distancing		30 - 64 years 65+ years	> Full closure vs complete opening of the school, which is to say, the two most extreme choices of a fully remote teaching or regular 7 hours a day in-class activities for the whole year. > consider a variety of possible rates for the external source of infection. > model considers policies with opening or closure applied for entire weeks. > an initial period of closure, before progressing to a regular alternation of openings and closures. This is due to the assumed presence of 10% of cases at the start of the school year, and could be avoided with a very efficient screening before the start of the school year.	infections 2. Economic, social, and ecological outcomes - percentage of days in the school building for a typical student	the school community) 3. General population	
Gill 2020	Modelling	1. Measures to reduce contacts - alternating	1. Students 2. Teachers	Not specified	Seven scenarios: >Scenario A (baseline):	1. Transmission - number of cases	1. Students	In August, the statewide average

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
		attendance; formation of cohorts 2. Measures making contacts safer - masks	3. School staff		normal school >Scenario B (daily attendance with precautions) eg masks in bus and during schoolday >Scenario C (daily attendance with precautions and block scheduling). >Scenario D (daily attendance with precautions and students “podded” in one classroom). >Scenario E (rotating two days per week, precautions as in B) >Scenario F (weekly four-day rotations) >Scenario G (rotating one day per week) students devided in 5 small groups	detected; 2. Economic, social, and ecological outcomes - number of days spent in school (not an outcome for cohorting)		infection rate was approximately 40 detected cases per 100,000 per week, and reported county-level infection rates ranged from zero to approximately 200 detected cases per 100,000. The Pennsylvania Departments of Education and Health deem fewer than 10 detected cases per 100,000 over seven days to represent low levels of infection that can permit full-time reopening of schools. About 10 of Pennsylvania’s 67 counties had infection rates below this level in August.

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
Head 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - testing; isolation of cases	1. Students 2. Teachers 3. School staff 4. General population	0 - 17 years	Six scenarios: 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis53, with positive cases isolated and their class quarantined for 14 days."	1. Transmission - number or proportion of infections	1. Students 2. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
Isphording 2020	Quasi-experimental	1. Measures to reduce contacts - staggered start, break, finish times; formation of cohorts; cancellation of activities 2. Meausres making contacts safer - masks; physical distancing; modification of activities 3. Structural/environmental measures - ventilation 4. Surveillance and response measures - testing; isolation/quarantine	1. Students 2. Teachers 3. General population	Age groups 0-14, 15-34, 35-59, 60+	Measures reducing opportunity for contacts >> Staggered start, break and finish times >> Alternating attendance (e.g. days, weeks) >> Formation of cohorts (fixed group assignment) >> Cancellation of activities (e.g. music class, physical activity, school trips)	1. Transmission - number or proportion of infections	1. Students 2. General population	"Very low community spread" Schools re-opened during a time of in general low infection rates and cannot be interpreted as the flip side of school closures during the peak of the pandemic.
Jones 2020_2	Modelling	1. Measures to reduce contacts - formation of cohorts	1. Students 2. Teachers 3. School staff	Grades K-12 schools	> Reduced cohort size (55% of all students in the counties examined returned to in-person instruction during the report period, with 45% enrolled in virtual-learning programs or withdrawing from the district)	1. Transmission - number or proportion of infections	1. Students 2. General population	Analysis of 15,395 laboratory-confirmed cases of SARS-CoV-2 (COVID-19) in Florida K-12 schools during August 10 – November 14, 2020 showed disproportional infection rates in students (71%) compared to

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
								teachers and staff (29%), consistent with data provided by other states.
Kaiser 2020	Modelling	1. Measures to reduce contacts - formation of cohorts	1. Students	Model uses data for students ages 14-15 but assumes outcomes across all high school students	Four scenarios: >> Random cohorting: Two cohorts are formed by randomly allocating half of the students to each cohort; >> Gender-split cohorting: One cohort consists of boys, one of girls. Students from the smaller cohort (i.e., the underrepresented gender) are reallocated until both cohorts have the same size. >> Optimized cohorting: Two equally-sized cohorts are formed to minimize the number of cross-cohort out-of-school contacts. >> Network chain cohorting An initial student names all of her out-of-school contacts, who	1. Transmssion - number or proportion of infections 2. Healthcare utilization - Number or proportion of cases requiring intensive care	1. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					themselves name their out-of-school contacts, etc., until the resulting set of students comprises half of the classroom. This set of students forms the first cohort, the remainder the second cohort.			
Keeling 2020	Modelling	1. Measures to reduce contacts - phased reopening	1. Students 2. Teachers 3. School staff 3. General population	Age groups not specified; but children in grade 1-6 (ages 5-11) 2. Teachers of primary school 3. Staff of primary school	Measures reducing opportunity for contacts > Cohorting/phased reopening Eight scenarios of return to school (i) reception (year 0), year 1 and year 6 (full class sizes); (ii) reception, year 1 and year 6 (half class sizes); (iii) all primary schools; (iv) reception, years 1, 6, 10 and 12 (full class sizes); (v) reception, years 1, 6, 10 and 12 (half class sizes); (vi) primary schools plus year groups 10 and 12;	1. Transmission - number or proportion of infections	1. Students	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					(vii) all secondary schools; (viii) all schools."			
Kim 2020	Modelling	1. Measures to reduce contacts - phased reopening	1. Students	19 years and younger (children) and aged over 19 (adults).	Phased reopening: delay of opening Three Scenarios: I) School opening delay I: from March 2 to March 9 II) School opening delay II: from March 9 to March 23 III) School opening delay III: from March 23 to April 6 Authors tried to assess the impact of these delays.	1.Transmission - number or proportion of infections; reproduction number	1. General population	Not specified
Landeros 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Structural/environmental measures - physical distancing measures;	1. Students 2. Staff (members of the school community)	1. Student age group: <18 years 2. Whole population: >18 years	> Cohorting >>Rotating cohorts: 50% and 33% capacity with rotating cohorts >>Alternating cohorts/hybrid learning 50% attend school; 50% stay at home) >Outdoor instruction	1. Transmission - reproduction number	1. General Population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
		enhanced cleaning measures; enhanced ventilation measures 4. Surveillance and response measures - testing; isolation, reactive school closures						
Lee 2020	Modelling	1. Measures to reduce contacts - phased reopening	1. Students	Not specified	Four scenarios: > school closure alone > full lockdown > full school reopening > mixed reopening model, reopen for <10yrs only	1.Transmission - R0	1. Students 2. Teachers	Not specified
Mauras 2020	Modelling	1. Measures to reduce contacts - alternating attendance	1. School population (unspecified - primary and secondary)	Primary and secondary school age	Three scenarios: >>First, model considers on-off strategies, in which alternatively, either 100% of employees or students do face-to-face work, or 100% do telecommuting (distance learning). Such a strategy has, for example, been recommended as a way to exit the lockdown by alternating 4 days on and 10 days off. >>Second, model considers	1. Transmission - risk of transmission between schools; expected number of adjacent schools infected	1. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					rotating strategies, in which 50% of employees or students do face-to-face while the other 50% do distance learning, periodically switching between the two groups. Both types of strategies are implemented with different alternations: daily alternation (even day, odd day, not counting weekends) and weekly alternation (even week, odd week). >>Finally, model considers a full telecommuting strategy. This results in five strategies, which are compared in their ability to reduce the likelihood and intensity of epidemic outbreaks.			
Munday 2020	Modelling	1. Measures to reduce contacts - phased reopening	1. Students	4 - 18 years	Six scenarios: 1. Partial return of cohorts to school 2. Return of certain primary school cohorts	1. Transmission - number or proportion of infections 2. Educational -	1. Transmission - reproduction number	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					(Scenario 1 - 4; first two years and last year (transition year)) 3. Additional return of certain secondary school cohorts (Scenario 2 - 4; 10th grade, 12th grade, both) 4. Reopening of some school forms 5. Return of primary school cohorts only (scenario 5) 6. Return of secondary school cohorts only (scneario 6)	number of reactive classroom closures		
Naimark 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - isolation; reactive closure	1. School population (unspecified)	2 - 17 years	> Cohorting >> Class room size: primary and elementary class sizes were capped at 23, and high school classes were capped at 15 students; >> fixed cohorts: students remained in their assigned classrooms for the school day rather than moving among classrooms; > Alternating attendance	1. Transmission - timing of second wave of infection	1.Transmission - R0	We modelled three community-based NPI scenarios (1,2 and 3, eTable 3) in Ontario at the beginning of October 2020, in response to rising confirmed daily case incidence from 185 on September 1st to 675 on September 30th

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					(in designated high schools, in urban areas, students attended school only on alternate weekday) Two school reopening scenarios: 1) counterfactual scenario in which schools did not reopen on September 15, 2020 2) Schools re-opened on September 15, 2020, (scenario B) but with several measures in place to limit within-school transmission of COVID-19:			
Panovska-Griffiths 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening 2. Surveillance and response measures - testing and tracing; isolation	1. Students (primary and secondary) 2. General population	4 - 18 years	>Alternating attendance (rota system with students attending school on alternate weeks, with half of the students attending school one week and the other half the following week) >Cohorting/Phased reopening (Three vs. five	1. Transmission - reproduction number 2. Economic, social, ecological - numbers of student-days forfeited due to classroom closure	1. Transmission - risk of transmission between schools; expected number of adjacent schools infected	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					vs. all 13 school years returning to school)			
Phillips 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts	1. Students 2. School staff (unspecified) 3. General population	1. Student age group: 0 - 9 years 2. Adults: ages 25−44	> Formation of cohorts (reduction of class size; student-educator ratios of 8:1, 15:1, and 30:1); random allocation to cohort rather than siblings together > Alternating attendance (weekly) Five Scenarios for Low and High Transmission (=10 scenarios for primary schools) > 8:1 ratio > 8:1 ratio, alternating attendance > 15:1 ratio > 15:1 ratio, alternating attendance >30:1 attendance	1. Transmission - reproduction number	1. Transmission - number or proportion of infections 2. Educational - number of reactive classroom closures	Not specified
Rozhnova 2020	Modelling	1. Measures to reduce contacts - unspecified	1. Students 2. Teachers	Not specified	> Reduction of school contact was modelled in regard to different age groups (from no reduction	1. Transmission - number or proportion of infections	1. Transmission - timing of second wave of infection	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					up to school closure: 0 - 100% reduction)			
Shelley 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts	1. Students	Not specified	> Formation of cohorts (two or five cohorts; either by grade level > Alternating attendance Four scenarios: 1.) no schooling, 2.) school reopening plans (divide the population into subgroups of “school” and “town” using parallel single-patch deterministic models so that individuals remain within their subgroup throughout disease progression), 3.) two-cohort school reopening plans (students are split into two or five cohorts. Like in single cohort scenarios, cohorts attend school together for consecutive days, with greatly reduced mixing between students and town assumed on in-	1. Transmission - number or proportion of infections	1. Transmission - reproduction number 2. Economic, social, ecological - numbers of student-days forfeited due to classroom closure	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
					person school days and less reduced mixing between students and town assumed on distance learning days), 4.) five cohort reopening plan (students form cohorts by grade level, with each grade level using school facilities for a single day of in-person instruction) All scenarios were run with two differing R0 to take general mitigation measures into account (R= = 2.5-3.0 & R0 = 1.0 - 1.4 to simulate a uncontrolled and controlled transmission, respectively)			
Sparks 2020		1. Measures to reduce contacts - staggered start, break, and finish times; formation of cohorts 2. Measures making contacts safer - modification of activities	1. Students 2. Teachers 3. Staff	1. Students: Nursery, Reception, Year One: ages 0-6; c ohort 2: Years 2-6: ages 6-	> Formation of cohorts > staggered break times, start times etc.	1. Transmission - reproduction number	1. Transmission - reproduction number	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
				11; 2. cClassroom teachers and teaching assistants: adults 3. Staff: adults				
Zhang 2020	Modelling	1. Measures to reduce contacts - phased reopening	1. School population (unspecified) 2. General population	1. Student age groups: 0-6 yrs; 7-19 yrs 2. Whole population	> Phased reopening/cohorting: reopening of high schools vs. general opening of schools Study assesses implications of R0 on reopening of schools on R0; modelling various cointerventions in community and workplace	1. Students	1. Transmission - number or proportion of infections	Not specified

Tabelle 2: Summary of Findings Tabelle: Cohorting: General reduction of students (e.g. alternating attendance)

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	9 modelling studies (Baxter 2020, Bershteyn 2020, Cohen 2020, Germann 2020, Gill 2020, Head 2020, Naimark 2020, Shelley 2020, Sparks 2020)	All studies showed reductions in the number or proportion of cases. The numbers varied from very little effect to a large number or proportion of cases avoided. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks, physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these cohorting measures. These other measures may have moderated the effects of the cohorting strategies.	Low ⊕⊕◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies.
Reproduction number	4 modelling studies (Landeros 2020, Mauras 2020, Phillips 2020, Rozhnova 2020)	The four studies showed reductions in the reproduction number. The numbers varied from very little or no effect to large reductions in the reproduction number. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks, physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these cohorting measures. These other measures may have moderated the effects of the cohorting strategies.	Low ⊕⊕◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies.
Outcome category: Healthcare Utilization				

Number or proportion of hospitalizations	1 modelling study (Germann 2020)	One study found that reopening schools in any scenario would lead to increases in hospitalizations, and that the number of hosptializations would increase with increased school reopening.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide
Outcome category: Social, ecological and economic outcomes				
Number of days spent in school	1 modelling studies (Phillips 2020)	One study showed that effective cohorting leads to a reduction in days spent in school however, effective cohorting leads to more days in attandance in school compared to no cohorting, with or without reactive home schooling after detection of cases.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide

Tabelle 3: Summary of Findings Tabelle: Cohorting: Cohorting within the class (e.g. reduced class sizes)

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	13 modelling studies (Bershteyn 2020, Burns 2020, Cohen 2020, Germann 2020, Gill 2020, Head 2020, Jones 2020, Kaiser 2020, Landeros 2020, Naimark 2020, Phillips	All studies showed reductions in the number or proportion of cases. The numbers varied from very little effect to a large number or proportion of cases avoided. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks,	Low ⊕⊕◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to

	2020, Shelley 2020, Sparks 2020)	physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these cohorting measures. These other measures may have moderated the effects of the cohorting strategies.		no reporting of external validation in all included studies.
	1 Quasi-Experimental Study (Isphording 2020)	This study found that school reopenings, under strict mitigation strategies, did not increase the number of cases after the summer closure. Fixed groups were largely assigned on a classroom basis, in other cases on cohort basis. Multiple measures were implemented and studied alongside each other, therefore it is not possible to say whether cohorting measures alone were effective at reducing or minimizing transmission.	Low ⊕⊕◯◯	Downgraded for risk of bias due to moderate ROBINS-I assessment Downgraded for inconsistencies due to only study reporting on the outcome of interest.
Reproduction number	2 modelling studies (Landeros 2020, Phillips 2020)	All studies showed reductions in the reproduction number. The numbers varied from very little or no effect to large reductions in the reproduction number. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks, physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these cohorting measures. These other measures may have moderated the effects of the cohorting strategies.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide
Outcome category: Healthcare Utilization				
Number or proportion of hospitalizations	1 modelling study (Germann 2020)	The one study included found that reopening schools in any scenario would lead to increases in hospitalizations, and that the number of	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the

		hosptializations would increase with increased school reopening.		adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide

Tabelle 4: Summary of findings table: Cohorting: Phased reopening (e.g. opening only to certain grades)

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	7 modelling studies (Baxter 2020, Cohen 2020, Di Domenico 2020, Espana 2020, Head 2020, Keeling 2020, Kim 2020)	All studies showed reductions in the number or proportion of cases. The numbers varied from very little effect to a large number or proportion of cases avoided. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks, physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these cohorting measures. These other measures may have moderated the effects of the cohorting strategies.	Low ⊕⊕◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies.
Reproduction number	3 modelling studies (Espana 2020, Lee 2020, Zhang 2020)	The two studies showed reductions in the reproduction number. In many cases, other measures, such as other forms of cohorting (reduced class size or phased reopening) as well as face masks, physical distancing, and handwashing protocols, as well as screening, testing, case isolation, and quarantine, were implemented alongside these	Low ⊕⊕◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies.

		cohorting measures. These other measures may have moderated the effects of the cohorting strategies.		
Outcome category: Healthcare Utilization				
Number or proportion of cases requiring intensive care	3 modelling studies (Alvarez 2020, Di Domenico 2020, Keeling 2020)	The three studies found that reopening schools in any scenario would lead to increases in ICU admissions, and that the number of admissions would increase with increased school reopening.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide

Tabelle 5: Übersicht über die zum Outcome beitragenden Studien: Cohorting: General reduction of students (e.g. alternating attendance)

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to intervention	9 modelling studies (Baxter 2020, Bershteyn 2020, Cohen 2020, Germann 2020, Gill 2020, Head 2020, Naimark 2020, Shelley 2020, Sparks 2020)	**Baxter 2020:** This study modelled the effects of different reopening scenarios in schools in the USA. The modelled scenarios were: 1) schools closed schedule: all students receive online instruction; 2) alternating school day for younger children schedule: only children 10 years old or younger return to in-person instruction while following an alternating school day schedule; 3) alternating school day schedule: half of the students receive in-person instruction on Mondays and Wednesdays and the other half on Tuesdays and Thursdays; 4) younger children only schedule: only children 10 years old or younger return to in-person instruction; 5) regular schedule: all students return to in-person instruction. An alternating school day schedule performed almost as well as keeping schools closed, with the infection attack rate ranging from 38.5% to 39.8% compared to that of 37.7% under school closure. The relative ordering of the scenarios remains as scenario 1 through scenario 5 with 1 being lowest and 5 being highest regarding infections. **Bershteyn 2020:** This study modelled the impact of multiple policies implemented in schools by referring to global benchmarks for the secondary attack rate (SAR) of SARS-CoV-2 by simulating the potential for transmission with each policy. The study sought to model each scenario within the context of New York City schools. One scenario modelled the impact of choice of class scheduling for in-person learners. Cohort rotation schedules were simulated: two groups of up to 13 students could attend on alternating Monday and on two designated days, either staggered (Tuesday and Thursday, or Wednesday and Friday) or in two-day blocks (Tuesday and Wednesday, or Thursday and Friday) OR three groups of 9 students could attend on one designated day, and then on one day every two out of three weeks, or else one two-day block once every three weeks. For older students, three groups of 9 students could attend in a 6-day rotation either once every three days, or two consecutive days in every six days.) Smaller cohorts and commensurately reduced instruction time – cohorts of 9 attending one-third of days rather than cohorts of 13 attending one-half of days – reduced transmission risk. Between all-remote instruction and a hybrid of in-person and remote instruction there was a reduction of up to half the number potential index cases who unknowingly attend school while infected, and also reduced by half the number of susceptible individuals attending schools, for an overall transmission reduction of up to 75%. However, for a given cohort size, the choice of rotation schedule among those on the approved list had minimal impact on transmission. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts.

		Cohen: This study used an agent-based mathematical model of COVID-19 transmission and interventions to quantify the impact of school reopening on disease transmission in the USA. The study compared seven school re-opening strategies implemented with and without countermeasures within schools. The study modelled 7 reopening scenarios: 1. All in-person with no countermeasures 2. All in-person with countermeasures 3. All in-person with countermeasures and A/B scheduling 4. Elementary and middle in-person with countermeasures, high school remote 5. Elementary in-person with countermeasures, middle and high school remote 6. Elementary in-person with countermeasures and A/B scheduling, mid-dle and high school remote 7. All remote. The study finds that an A/B scheduling approach, in which classrooms are split into two groups that attend school two days a week on different days, reduces COVID-19 transmission in schools to 0.6 - 4.3% for teachers and staff and 0.4- 3.1% for students, depending upon the COVID case detection rate. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts because classes have been split into cohorts are those cohorts are alternating attendance. **Germann 2020:** This study used an an agent-based model that simulated communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening including 1) all students in school with or without social distancing measures in place; 2) two non-overlapping cohorts of students attending on different days or weeks, with or without deep cleaning of the school in between cohorts; 3) all students in school. Scenarios where split cohorts of students return to school in non-overlapping formats resulted in significant decreases in the clinical attack rate (i.e., the percentage of symptomatic individuals), potentially by as much as 75%. These split cohort scenarios have impacts which are only modestly lesser than the most impactful 100% distance learning scenario. Split cohort scenarios can also significantly avert the number of cases approximately 60M and 28M–depending on the scenario, at the national scale over the simulated eight-month period. The results of the simulations are highly dependent on the number of workplaces assumed to be open for in-person business, as well as the initial level of COVID-19 incidence within the simulated community. **Gill 2020:** This study used an agent based model to simulate the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. Modelled scenarios included: 1) normal school attendance; 2) daily attendance with precautions (eg masks in bus and during schoolday); 3) daily attendance with precautions and block scheduling; 4) daily attendance with precautions and students “podded” in one classroom; 5) rotating two days per week with precautions; 6) weekly four-day rotations; 7) rotating one day per week students devided in 5 small groups. A hybrid approach with students in two

		groups, each attending 40 percent of days (Scenarios 5 or 6) can reduce the number of predicted infections in a school where the community rate is 50 per 100,000 per week to a level comparable to a school running five days a week with precautions (Scenario 2) in a community where the local infection rate is only one-fifth as high (10 per 100,000 per week). The relative ordering of the scenarios remains as scenario 1 through scenario 7 with 1 being lowest and 7 being highest regarding infections. It is not possible to extract exact effect size data from this study. **Head 2020:** This study uses an agent-based SEIR model to simulate COVID-19 transmission under observed conditions and counterfactual intervention scenarios between March 17-June 1, and evaluated various school reopening strategies using data from the Bay area in California, USA. The study modelled six reopening scenarios: 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis, with positive cases isolated and their class quarantined for 14 days. The study estimates that strict adherence to staggered school weeks (either as half classes or grades), or combining stable cohorts (weak or strong) with masks (with at least 35% effectiveness in students and 50% in teachers) and monthly testing, is needed to reduce excess risk of symptomatic illness for teachers to less than 1%. **Naimark 2020:** This study used an agent-based model school reopening in different scenarios in Canada. A counterfactual scenario in which schools did not reopen on September 15, 2020 was used as a baseline. Other scenarios included schools reopening on September 15, 2020, but with several measures in place to limit within-school transmission of COVID-19: 1) primary and elementary class sizes were capped at 23, and high school classes were capped at 15 students; 2) students remained in their assigned classrooms for the school day rather than moving among classrooms; 3) universal masking was in place; 4) in designated high schools, in urban areas, students attended school only on alternate weekdays; and v) if more than two confirmed cases of COVID-19 occurred in a daycare or classroom less than two weeks apart, the daycare or classroom was closed for 14 days with the children in the class excluded from school rather than moved to another classroom. The study found that transmission within schools was heavily influenced by community-level non-pharmaceutical interventions (NPIs). When community-based NPIs were not enacted, the number of daily, new, confirmed cases on October 31, 2020, were 4,414 (95% credible interval, CrI: 3,491; 5,382) with schools closed, versus 4,740 (95% CrI 3,863; 5,691) with schools reopened, with an increase of cases of

		due to school reopening of 326 (95% CrI:196; 456). If community-based NPIs were implemented, the number of daily, new, confirmed cases on October 31, 2020, were 714 (95% CrI: 568; 908) with schools closed, versus 780 (95% CrI 580; 993) with schools reopened , with an increase of cases of due to school reopening of 66 (95% CrI: 40; 92). It is not possible to assess the effects of individual measures. **Shelley 2020:** This study used a compartmental model to model the impact of multiple school reopening scenarios on COVID-19 transmission in the USA. The scenarios modelled were: 1) full school closure; 2) single cohort reopening (divide the population into subgroups of "school" and "town" using parallel single-patch deterministic models so that individuals remain within their subgroup throughout disease progression); 3) two-cohort school reopening plans (students are split into two or five cohorts. Like in single cohort scenarios, cohorts attend school together for consecutive days, with greatly reduced mixing between students and town assumed on in-person school days and less reduced mixing between students and town assumed on distance learning days); 4) five cohort reopening plan (students form cohorts by grade level, with each grade level using school facilities for a single day of in-person instruction). All scenarios were run with two differing R0 to take general mitigation measures into account. The five-cohort scenario reduces overall cases from 60,089.49 cases in the baseline model to 16.72 cases (95% CI: 8.31, 33.63), a 99.97% reduction in cases in the uncontrolled scenario and from 58,335.56 cases to 3.42 (95% CI: 2.17, 5.41) cases, a reduction over 99.99%. Under controlled transmission conditions, the AB school model reduces total infections from 52,104.54 total cases under baseline distance learning to 17,541.99 (95% CI: 3,241.76, 43,245.67) total cases under the AB reopening plan, a 66% reduction in infection. With regard to infections in children, the AB reopening plan reduced total cases from 7,268.02 cases under baseline distance learning to 2,812.03 (95% CI: 561.14, 6,784.60) cases, a 61% reduction in infection. **Sparks 2020:** This study used an expert elicitation model to model the effects of school reopening under various scenarios in the UK. The study modelled the impact of modification of activities (learning and playing outdoors; lunch in classroom; packed lunch or take-away style cartons) as well as the formation of cohorts and staggered start, break, and end times. Measures also included the removal of furniture to allow for more space, rotation of toys and/or removal of certain play items, and student bubbles where students were allocated their own areas of the playground, their own toilets or their own lunchtime spaces. Overall, the interventions reduced the number of contacts between and within students and teachers but it is not possible to determine the impact of any one individual measure. It is not possible to extract exact effect size data from this study.

Reproduction number	4 modelling studies (Landeros 2020, Mauras 2020, Phillips 2020, Rozhnova 2020)	**Landeros 2020:** This study used a multi compartmental model to model the impact of various school reopening scenarios in the USA. Multiple measures were assessed including measures to make contacts safer (masks and hand washing policies), measures to reduce contacts (rotating cohorts and outdoor instruction), infrastructural measures (cleaning, ventilation, desk shields), and surveillance (closing schools once a threshold for cumulative prevalence had been reached). In terms of cohorting strategies, the study ssessed the following three scenarios: 1) reopening at full capacity; 2) allowing half of all children to return to in-person schooling while the other half continues with remote learning(parallel cohorts); 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts). Splitting a school community into even 2 or 3 rotating cohorts substantially reduces R0 under a wide range of parameter values and slows viral spread in cases of moderate transmissibility. Moving from full capacity to 2 cohorts reduces R0 by 50% for the range $0 \leq \beta 11, \beta 22 \leq 1$. Using three cohorts further reduces R0 for comparable β11 and β22. This parameter range is of interest because it corresponds to $R0 \approx 2$ in the full capacity scenario. Cohort separation tends to dramatically reduce the spread of infection. Under most of the parameter values, 2 parallel cohorts and 2 rotating cohorts show similar time to 5% infecteds, withthe parallel cohort strategy having a slight advantage when β11 and β22 are large. Overall, this model also shows that reduction of class density and the implementation of rapid viral testing, even with imperfect detection, have greater impact than moderate measures for transmission mitigation. **Mauras 2020:** This study used an SEIR transmission model to model different scenarios for phased reopening of schools and workplaces in France. The scenarios modelled are: 1) on-off strategies, in which alternatively, either 100% of employees or students do face-to-face work, or 100% do telecommuting (distance learning); 2) rotating strategies, in which 50% of employees or students do face-to-face while the other 50% do distance learning, periodically switching between the two groups; 3) a full telecommuting strategy. The study found that rotating strategies significantly dominate the On-Off strategies which in turns largely dominate the absence of any policy. As expected, the full-time telecommuting (with persistent contacts only) dominates all strategies. Weekly and daily alternations are very similar in terms of the probability of outbreak and of duration until outbreak, because these quantities depend on the beginning of the epidemic only. Compared to a baseline value $R0 = 1.25$, doing nothing leads to $Re = 1.25 > 1$, whereas, as long as $R0 < 1.38$, all strategies lead to $Re < 1$. **Phillips 2020:** This study used an agent-based model to model the impact of various school reopening strategies on COVID-19 transmission in Canada. Strategies included the formation of fixed cohorts with or without alternating school attendance for those cohorts. The cohorts used different teacher to student

		ratios. The scenarios were 1) 8:1 ratio; 2) 8:1 ratio, alternating attendance; 3) 15:1 ratio; 4) 15:1 ratio, alternating attendance; 5) 30:1 attendance. The study also modelled the effects of keeping sibling groups together in the same cohort. The study found that for each doubling of class size from 8 to 15 to 30 more than doubled the outbreak size and student-days lost, by factors of 2-5, respectively 2.5-4.5, depending on the scenario. Introducing more children into the classroom increases the effective reproductive ratio (Re) for both low and high rates of transmission while cohorting/alternation has little effect, and similar strategies (that is, differing by only 1 student or educator per class, or by alternation) give similar reproductive ratios Re. **Rozhnova 2020:** This study used a deterministic compartmental model and a next generation matrix model to evaluate the impact of school-related measures on the pandemic in the Netherlands. The study investigated the impact of targeting interventions at different age groups, starting from November 2020 with the effective reproduction number being 1. Using differe values for Re as a function of the reduction of school contacts in age groups of [0,5), [5,10) and [10,20) year olds, respectively. In each scenario, the study varied the number of school contacts in one age group while keeping the number of school contacts in the other two age groups constant. A 0% reduction corresponds to the situation in November 2020, and 100% reduction represents a scenario with schools for students in a given age group closed. The model predicts a maximum impact on Re from reducing contacts of 10 to 20 year old children. Closing schools for this age group only could decrease Re by about 8%. Schools closure for children aged 5 to 10 years would reduce Re by about 5%. Contact reductions among 0 to 5 year old children would have negligible impact on Re.
Outcome category: Healthcare Utilization		
Number or proportion of hospitalizations	1 modelling study (Germann 2020)	**Germann 2020:** This study uses an an agent-based model that simulates communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening including 1) all students in school with or without social distancing measures in place; 2) two non-overlapping cohorts of students attending on different days or weeks, with or without deep cleaning of the school in between cohorts; 3) all students in school. Scenarios where split cohorts of students return to school in non-overlapping formats resulted in the following outcomes in the community: in cases with fewer workplaces open, the total number of people hospitalized would be 1,798,188. In cases with more workplaces open, the total number of people hospitalized would be 2,064,544. Allowing 100% of students to return back to school is likely to lead to additional increases of infection under the current transmission dynamics in the U.S. and if schools reopen at the 80% or 100% level, school-age children could generate the largest number of cases. All scenarios

		where schools open even at the 80% levels will result in greater COVID-19 case rates requiring higher levels of hospitalizations. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts because classes have been split into cohorts are those cohorts are alternating attendance.
Outcome category: Social, ecological and economic outcomes		
Number of days spent in school	1 modelling study (Phillips 2020)	**Philips 2020:** This study used an agent-based model to model the impact of various school reopening strategies on COVID-19 transmission in Canada. Strategies included the formation of fixed cohorts with or without alternating school attendance for those cohorts. The cohorts used different teacher to student ratios. The scenarios were 1) 8:1 ratio; 2) 8:1 ratio, alternating attendance; 3) 15:1 ratio; 4) 15:1 ratio, alternating attendance; 5) 30:1 attendance. The study also modelled the effects of keeping sibling groups together in the same cohort. The study found that for each doubling of class size from 8 to 15 to 30 more than doubled the the student-days lost, by factors of 2-5, respectively 2.5-4.5, depending on the scenario.

Tabelle 6: Übersicht über die zum Outcome beitragenden Studien: Cohorting: Phased reopening (e.g. opening only to certain grades)

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to intervention	7 modelling studies (Baxter 2020, Cohen 2020, Di Domenico 2020, Espana 2020, Head 2020, Keeling 2020, Kim 2020)	**Baxter 2020:** This study modelled the effects of different reopening scenarios in schools in the USA. The modelled scenarios were: 1) schools closed schedule: all students receive online instruction; 2) alternating school day for younger children schedule: only children 10 years old or younger return to in-person instruction while following an alternating school day schedule; 3) alternating school day schedule: half of the students receive in-person instruction on Mondays and Wednesdays and the other half on Tuesdays and Thursdays; 4) younger children only schedule: only children 10 years old or younger return to in-person instruction; 5) regular schedule: all students return to in-person instruction. Each scenario evaluated for different timepoints of school reopening. Only allowing children 10 years or younger to return to in-person instruction did not reduce transmission as much as n alternating school day schedule. Delaying the reopening of schools had a minimal impact on reducing infections under most scenarios. It was not possible to extract exact effect size data from this study. **Cohen 2020:** This study used an agent-based mathematical model of COVID-19 transmission and interventions to quantify the impact of school reopening on disease transmission in the USA. The study compared seven school re-opening strategies implemented with and without countermeasures within schools. The study

		modelled 7 reopening scenarios: 1. All in-person with no countermeasures 2. All in-person with countermeasures 3. All in-person with countermeasures and A/B scheduling 4. Elementary and middle in-person with countermeasures, high school remote 5. Elementary in-person with countermeasures, middle and high school remote 6. Elementary in-person with countermeasures and A/B scheduling, mid-dle and high school remote 7. All remote. An A/B school scheduling approach that returns elementary schools in-person and keeps all other students remote would minimize the presence of COVID within (and outside of) schools. The predicted cumulative COVID-19 infection rate for people in schools could be as low as between 0.2 and 1.7% for teachers and staff and to between 0.1 and 1.0% for students, depending on the case detection rate. This represents at least a 14-fold reduction in the risk of COVID-19 for teachers and staff in schools relative to a strategy that returns all individuals in-person with no countermeasures. **Di Domenico 2020:** This study uses a stochastic discrete age-structured epidemic multi compartmental (SEIR+) model to evaluate the expected impact of reopening schools in the Île-de-France region under several scenarios of partial, progressive, or full school reopening, coupled with moderate social distancing interventions and large-scale tracing, testing, and isolation. Measures reducing opportunity for contacts. The study modelled three phased reopening scenarios: 1) Partial reopening with at most 50% of students return to school, with a rotation of students every half of the week or every week, or considering 50% attending in the morning and 50% in the afternoon; 2) Progressive reopening with an attendance of 25% in the first week that gradually increases over the following weeks, up to 50% (partial attendance) or 100% (full attendance); 3) Full reopening. Reopening pre-schools and primary schools would increase the number of new clinical cases at the start of summer holidays (July 5) 2 to 3.2 times the number expected with schools closed. With full attendance in middle and high schools the new number of clinical cases per day would be 4.5 to 5.5 times higher relatively to the school closure scenario at the start of the summer. **Espana 2020**: This study modelled the impact of a phased reopening of schools in the USA. The study modelled nine combinations of scenarios where schools were operating at 50%, 75%, and 100% capacity. The scenarios were modelled with and without adherence to face masks. With schools reopening at full capacity with low face mask adherence, there would be an increase of 81.7 times the number of infections. With schools reopening at full capacity with high face mask adherence there would be a proportional increase of 3.0 times the number of infections. With schools reopening at reduced capacity with high face mask adherence there would be an 11.6% increase in the number of infections. **Head 2020:** This study uses an agent-based SEIR model to simulate COVID-19 transmission under observed

		conditions and counterfactual intervention scenarios between March 17-June 1, and evaluated various school reopening strategies using data from the Bay area in California, USA. The study modelled six reopening scenarios: 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis, with positive cases isolated and their class quarantined for 14 days. The study estimates that strict adherence to staggered school weeks (either as half classes or grades), or combining stable cohorts (weak or strong) with masks (with at least 35% effectiveness in students and 50% in teachers) and monthly testing, is needed to reduce excess risk of symptomatic illness for teachers to less than 1%. It is not possible to assess the impact of the specific scenarios or to extract exact effect size data for each of the measures. **Keeling 2020:** This study used a deterministic age-structured SEIR model to model the impact of eight different scenarios for phased reopening of schools in the UK. The scenarios were: 1) opening reception (year 0), year 1 and year 6 (full class sizes); 2) opening reception, year 1 and year 6 (half class sizes); 3) opening all primary schools; 4) opening reception, years 1, 6, 10 and 12 (full class sizes); 5) opening reception, years 1, 6, 10 and 12 (half class sizes); 6) opening primary schools plus year groups 10 and 12; 7) opening all secondary schools; 8 opening all schools. The study found that reopening secondary schools resulted in larger increases than only reopening primary schools. The model also predicted a higher risk of increased transmission associated with reopening secondary schools compared to the reopening of primary schools. It was not possible to extract exact effect size data from this study. **Kim 2020:** This used an SEIR model to model the impact of three different scenarios for phased reopening of schools in South Korea. The three scenarios were: 1) school opening delay I: from March 2 to March 9; 2) chool opening delay II: from March 9 to March 23; 3) school opening delay III: from March 23 to April 6. The study determined that delayed reopening could reduce at least 200 cases and 900 cases assuming 10-fold and 30-fold increased transmission rates with different reopening dates. Extended school closure for two more weeks could reduce the magnitude of cases and speed up the end of epidemic; if the transmission rate will be increased 10-fold or 30-fold after school opening, the number of expected cases for children is, respectively, increased to approximately 33 or 255 cases for 14 days.
Reproduction number	3 modelling studies (Espana 2020, Lee 2020, Zhang 2020)	**Espana 2020:** This study modelled the impact of a phased reopening of schools in the USA. The study modelled nine combinations of scenarios where schools were operating at 50%, 75%, and 100% capacity. The scenarios

		were modelled with and without adherence to face masks. With schools reopening at full capacity with low face mask adherence, there would be an increase of 81.7 times the number of infections. With schools reopening at full capacity with high face mask adherence there would be a proportional increase of 3.0 times the number of infections. With schools reopening at reduced capacity with high face mask adherence there would be an 11.6% increase in the number of infections. If schools operate fully remotely, R0 would remain near current levels through the remainder of 2020. If schools reopen at full capacity without any use of face masks, R0 would increase to 1.94 by mid-September. **Lee 2020:** This study modelled the impact of different scenarios for reopening schools. The modelled scenarios were: 1) full school closure alone; 2) full lockdown; 3) full school reopening; 4) mixed reopening model where schools are only reopened for students <10yrs. The study found that that reopening schools for children < 10 years, even without reduction in daily contacts, is predicted to maintain post-intervention R0 <1 (and suppress virus transmission) up to a baseline R0 of ~ 4.5. The addition of school reopening with reduction in daily contacts among children aged 10–19 years to 33% of baseline is predicted to keep post intervention R0 < 1 up to a baseline R0 of ~ 3.3. **Zhang 2020:** This study modelled the impact of high schools vs. general opening of schools on the reproduction number, while modelling various cointerventions in community and workplace. When most community activities are halted, school closure leads to a 77% decrease in the reproductive number; in contrast, when social mixing outside of schools is at pre-pandemic level, school closure leads to a 5% reduction in transmission. The model assumes a homogeneous network of contacts (i.e., it does not account for the typical clustering of human populations).
Outcome category: Healthcare Utilization		
Number or proportion of hospitalizations	3 modelling studies (Alvarez 2020, Di Domenico 2020, Keeling 2020)	**Alvarez 2020:** This study modelled different scenarios related to the opening of schools in three regions of Chile. The study simulated the progressive opening of schools until reaching to 25%, 50%, 75%, and 100% of school activities. These simulations were compared with the current situation in Chile, which was assumed to be 0% of school activity. In all regions, demands on ICU beds increased as school reopening increased (37%-209% ICU capacity when schools opened at 25% to 121%-1221% ICU capacity when schools opened at 100%). Effects of school reopening were moderated by other contact tracing and isolation strategies outside of the school setting, and not described in this paper. **Di Domenico 2020:** This study uses a stochastic discrete age-structured epidemic multi compartmental (SEIR+)

		model to evaluate the expected impact of reopening schools in the Île-de-France region under several scenarios of partial, progressive, or full school reopening, coupled with moderate social distancing interventions and large-scale tracing, testing, and isolation. Measures reducing opportunity for contacts. The study modelled three phased reopening scenarios: 1) Partial reopening with at most 50% of students return to school, with a rotation of students every half of the week or every week, or considering 50% attending in the morning and 50% in the afternoon; 2) Progressive reopening with an attendance of 25% in the first week that gradually increases over the following weeks, up to 50% (partial attendance) or 100% (full attendance); 3) Full reopening. Reopening pre-schools and primary schools would increase the number of new clinical cases at the start of summer holidays (July 5) 2 to 3.2 times the number expected with schools closed. With full attendance in middle and high schools the new number of clinical cases per day would be 4.5 to 5.5 times higher relatively to the school closure scenario at the start of the summer. If current lockdown effects remain, model projections indicate that by May 11 the region may experience 18 new admissions in ICUs, with an ICU system occupied at 42% of currently strengthened capacity. With pre-schools and primary schools in session starting May 11, ICU occupation would remain below 1,500-bed capacity (at most 72% [62, 80]%) , as long as middle and high schools limit students' attendance or reopen one month later. Healthcare system would exceed foreseen capacity (136% [119%, 151%]) if middle and high school reopen earlier in May accepting all students. Adopting a progressive protocol for adolescents starting May 11 would delay the increase in the epidemic activity, but largely engage the healthcare system by mid-summer (ICU occupancy at 92% [80%, 103%]). **Keeling 2020:** This study used a deterministic age-structured SEIR model to model the impact of eight different scenarios for phased reopening of schools in the UK. The scenarios were: 1) opening reception (year 0), year 1 and year 6 (full class sizes); 2) opening reception, year 1 and year 6 (half class sizes); 3) opening all primary schools; 4) opening reception, years 1, 6, 10 and 12 (full class sizes); 5) opening reception, years 1, 6, 10 and 12 (half class sizes); 6) opening primary schools plus year groups 10 and 12; 7) opening all secondary schools; 8 opening all schools. The study found that reopening secondary schools resulted in larger increases than only reopening primary schools. Model also predicted a higher risk of increased transmission associated with reopening secondary schools compared to the reopening of primary schools. Reopening schools increased the number of ICU admissions - number of ICU admissions increased with different reproduction numbers (the higher the reproduction number, the higher the number of cases across all reopening scenarios).It was not possible to extract exact effect size data from this study.
Organizational measures |		

Tabelle 7 Übersicht über die zum Outcome beitragenden Studien: Cohorting: Cohorting within the class (e.g. reduced class sizes)

Outcome	Number of studies	Summary of findings
Outcome category: Transmission		
Cases avoided due to intervention	13 modelling studies (Bershteyn 2020, Burns 2020, Cohen 2020, Germann 2020, Gill 2020, Head 2020, Jones 2020, Kaiser 2020, Naimark 2020, Phillips 2020, Shelley 2020, Sparks 2020)	**Bershteyn 2020**: This study modelled the impact of multiple policies implemented in schools by referring to global benchmarks for the secondary attack rate (SAR) of SARS-CoV-2 by simulating the potential for transmission with each policy. The study sought to model each scenario within the context of New York City schools. One scenario modelled the impact of choice of class scheduling for in-person learners. Cohort rotation schedules were simulated: two groups of up to 13 students could attend on alternating Monday and on two designated days, either staggered (Tuesday and Thursday, or Wednesday and Friday) or in two-day blocks (Tuesday and Wednesday, or Thursday and Friday) OR three groups of 9 students could attend on one designated day, and then on one day every two out of three weeks, or else one two-day block once every three weeks. For older students, three groups of 9 students could attend in a 6-day rotation either once every three days, or two consecutive days in every six days.) Smaller cohorts and commensurately reduced instruction time – cohorts of 9 attending one-third of days rather than cohorts of 13 attending one-half of days – reduced transmission risk. Between all-remote instruction and a hybrid of in-person and remote instruction there was a reduction of up to half the number potential index cases who unknowingly attend school while infected, and also reduced by half the number of susceptible individuals attending schools, for an overall transmission reduction of up to 75%. However, for a given cohort size, the choice of rotation schedule among those on the approved list had minimal impact on transmission. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts. **Burns 2020:** This study used a computational model using data from the USA to model the impacts of symptom-based isolation, combined with smaller class sizes and vaccinations on the attack rate of the virus. The study determined that dividing the population into groups of half the normal size reduced the attack rateby 16%. This scenario was modelled along side symptom-based isolation so it is unclear whether or not this would mediate the effect of reduced class sizes. It was not possible to extract exact effect size data for the effects of smaller class sizes alone.

		Cohen 2020: This study used an agent-based mathematical model of COVID-19 transmission and interventions to quantify the impact of school reopening on disease transmission in the USA. The study compared seven school re-opening strategies implemented with and without countermeasures within schools. The study modelled 7 reopening scenarios: 1. All in-person with no countermeasures 2. All in-person with countermeasures 3. All in-person with countermeasures and A/B scheduling 4. Elementary and middle in-person with countermeasures, high school remote 5. Elementary in-person with countermeasures, middle and high school remote 6. Elementary in-person with countermeasures and A/B scheduling, mid-dle and high school remote 7. All remote. The study finds that an A/B scheduling approach, in which classrooms are split into two groups that attend school two days a week on different days, reduces COVID-19 transmission in schools to 0.6 - 4.3% for teachers and staff and 0.4- 3.1% for students, depending upon the COVID case detection rate. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts because classes have been split into cohorts are those cohorts are alternating attendance. **Germann 2020:** This study uses an an agent-based model that simulates communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening including 1) all students in school with or without social distancing measures in place; 2) two non-overlapping cohorts of students attending on different days or weeks, with or without deep cleaning of the school in between cohorts; 3) all students in school. Scenarios where split cohorts of students return to school in non-overlapping formats resulted in significant decreases in the clinical attack rate (i.e., the percentage of symptomatic individuals), potentially by as much as 75%. These split cohort scenarios have impacts which are only modestly lesser than the most impactful 100% distance learning scenario. Split cohort scenarios can also significantly avert the number of cases approximately 60M and 28M–depending on the scenario, at the national scale over the simulated eight-month period. The results of the simulations to be highly dependent on the number of workplaces assumed to be open for in-person business, as well as the initial level of COVID-19 incidence within the simulated community. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts because classes have been split into cohorts are those cohorts are alternating attendance. **Gill 2020:** This study uses an agent based model to simulate the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. Modelled scenarios included: 1)

		normal school attendance; 2) daily attendance with precautions (eg masks in bus and during schoolday); 3) daily attendance with precautions and block scheduling; 4) daily attendance with precautions and students “podded” in one classroom; 5) rotating two days per week with precautions; 6) weekly four-day rotations; 7) rotating one day per week students devided in 5 small groups. Block scheduling does not reduce infections because the increase in the length of classes cancels out the benefit of reducing the number of classes per day. The same tradeoff—time exposed to an infected person versus number of infected people potentially contacted—explains why Scenario 4 (which involves keeping students in a single classroom all day, while teachers rotate) does not show reduced infections relative to the more conventional scheduling of Scenario 2. The study suggests that block scheduling (Scenario 3) or podding (Scenario 4) would reduce infections somewhat relative to a more typical secondary schedule (Scenario 2), but the reductions would be much smaller than reductions from hybrid approaches. It is not possible to extract exact effect size data for each scenario. In typical and large secondary schools, infection rates under part-time hybrid operating scenarios remain substantially below infection rates in schools open full-time regardless of the closing approach. Indeed, in secondary schools in communities with moderate infection rates, hybrid operating strategies without temporary closures are likely to keep cumulative infection numbers substantially lower than full-time operation with temporary closures for each detected infection. **Head 2020:** This study uses an agent-based SEIR model to simulateCOVID-19 transmission under observed conditions and counterfactual intervention scenarios between March 17-June 1, and evaluated various school reopening strategies using data from the Bay area in California, USA. The study modelled six reopening scenarios: 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis, with positive cases isolated and their class quarantined for 14 days. The study estimates that strict adherence to staggered school weeks (either as half classes or grades), or combining stable cohorts (weak or strong) with masks (with at least 35% effectiveness in students and 50% in teachers) and monthly testing, is needed to reduce excess risk of symptomatic illness for teachers to less than 1%. It is not possible to extract effect size data for each of the specific scenarios.

		Jones 2020: This is an observational study that observed a reduced cohort 55% of all students in the counties returned to in-person instruction, with 45% enrolled in virtual-learning programs in Florida, US from August to October 2020. The total number of expected cases in K-12 schools was lower for 90% in-person enrollment at low levels of community infection (0.5 cases per 1,000 per week) than for half that amount (48%) in-person enrollment at much higher community incidence rates (3.0 cases per 1,000 per week). Thus, the level of infection within the community appears to be the primary factor that influences rate of infections in school, with the percent of in-person students by enrollment total a significant secondary influencer on case incidence. **Kaiser 2020:** This study modelled the effects of different cohorting scenarios on COVID-19 transmission in Europe. The scenarios modelled were: 1)Random cohorting: Two cohorts are formed by randomly allocating half of the students to each cohort; 2) Gender-split cohorting: One cohort consists of boys, one of girls. Students from the smaller cohort (i.e., the underrepresented gender) are reallocated until both cohorts have the same size; 3) Optimized cohorting: Two equally-sized cohorts are formed to minimize the number of cross-cohort out-of-school contacts; 4) Network chain cohorting An initial student names all of her out-of-school contacts, who themselves name their out-of-school contacts, etc., until the resulting set of students comprises half of the classroom. This set of students forms the first cohort, the remainder the second cohort. The study found that cohorting that considers out-of-school contact between classmates can lower the frequency of spread by 39%-79% relative to random cohorting. The average proportion of infections at the same time falls from 11% (random cohorting) to about 10% in gender-split, network chain and optimized cohorting, with reductions of 4% (gender-split strategy), 5% (network chain strategy) and 7% (optimization strategy). **Naimark 2020:** This study used an agent-based model school reopening in different scenarios in Canada. A counterfactual scenario in which schools did not reopen on September 15, 2020 was used as a baseline. Other scenarios included schools reopening on September 15, 2020, (scenario B) but with several measures in place to limit within-school transmission of COVID-19: i) primary and elementary class sizes were capped at 23, and high school classes were capped at 15 students; ii) students remained in their assigned classrooms for the school day rather than moving among classrooms; iii) universal masking was in place; iv) in designated high schools, in urban areas, students attended school only on alternate weekdays; and v) if more than two confirmed cases of COVID-19 occurred in a daycare or classroom less than two weeks apart, the daycare or classroom

		was closed for 14 days with the children in the class excluded from school rather than moved to another classroom. The study found that transmission within schools was heavily influenced by community-level non-pharmaceutical interventions (NPIs). When community-based NPIs were not enacted, the number of daily, new, confirmed cases on October 31, 2020, were 4,414 (95% credible interval, CrI: 3,491; 5,382) with schools closed, versus 4,740 (95% CrI 3,863; 5,691) with schools reopened, with an increase of cases of due to school reopening of 326 (95% CrI:196; 456). If community-based NPIs were implemented, the number of daily, new, confirmed cases on October 31, 2020, were 714 (95% CrI: 568; 908) with schools closed, versus 780 (95% CrI 580; 993) with schools reopened, with an increase of cases of due to school reopening of 66 (95% CrI: 40; 92). It is not possible to assess the effects of individual measures. **Phillips 2020:** This study modelled the impact of various school reopening strategies on COVID-19 transmission in Canada. Strategies included the formation of fixed cohorts with or without alternating school attendance for those cohorts. The cohorts used different teacher to student ratios. The scenarios were 1) 8:1 ratio; 2) 8:1 ratio, alternating attendance; 3) 15:1 ratio; 4) 15:1 ratio, alternating attendance; 5) 30:1 attendance. The study also modelled the effects of keeping sibling groups together in the same cohort. The study found that higher student-educator ratios facilitate faster disease spread through the school than smaller ones and that for each doubling of class size from 8 to 15 to 30 more than doubled the outbreak size and student-days lost, by factors of 2-5, respectively 2.5-4.5, depending on the scenario. **Shelley 2020:** This study used a compartmental model to model the impact of multiple school reopening scenarios on COVID-19 transmission in the USA. The scenarios modelled were: 1) full school closure; 2) single cohort reopening (divide the population into subgroups of “school” and “town” using parallel single-patch deterministic models so that individuals remain within their subgroup throughout disease progression); 3) two-cohort school reopening plans (students are split into two or five cohorts. Like in single cohort scenarios, cohorts attend school together for consecutive days, with greatly reduced mixing between students and town assumed on in-person school days and less reduced mixing between students and town assumed on distance learning days); 4) five cohort reopening plan (students form cohorts by grade level, with each grade level using school facilities for a single day of in-person instruction). All scenarios were run with two differing R0 to take general mitigation measures into account. The 50% capacity, two-day switch model under R0 conditions is not effective in reducing cases counts when compared to either of the

		baseline comparisons. The five-cohort scenario reduces overall cases from 60,089.49 cases in the baseline model to 16.72 cases (95% CI: 8.31, 33.63), a 99.97% reduction in cases in the uncontrolled scenario and from 58,335.56 cases to 3.42 (95% CI: 2.17, 5.41) cases, a reduction over 99.99%. Under controlled transmission conditions, the AB school model reduces total infections from 52,104.54 total cases under baseline distance learning to 17,541.99 (95% CI: 3,241.76, 43,245.67) total cases under the AB reopening plan, a 66% reduction in infection. With regard to infections in children, the AB reopening plan reduced total cases from 7,268.02 cases under baseline distance learning to 2,812.03 (95% CI: 561.14, 6,784.60) cases, a 61% reduction in infection. **Sparks 2020:** This study used an expert elicitation model to model the effects of school reopening under various scenarios in the UK. The study modelled the impact of modification of activities (learning and playing outdoors; lunch in classroom; packed lunch or take-away style cartons) as well as the formation of cohorts and staggered start, break, and end times. Measures also included the removal of furniture to allow for more space, rotation of toys and/or removal of certain play items, and student bubbles where students were allocated their own areas of the playground, their own toilets or their own lunchtime spaces. Overall, the interventions reduced the number of contacts between and within students and teachers but it is not possible to determine the impact of any one individual measure.
	1 Quasi-Experimental Study (Isphording 2020)	**Isphording 2020: T**his study investigated the spread of COVID-19 during staggered school reopenings comparing a control group to intervention after summer holidays across German federal states (from 03 Aug to 14 Sept 2020). Three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27 percent of a standard deviation within experimental group vs control group. The effect is strongest in the youngest age group of 0–14 year-old cases where the end of summer breaks is associated with a significant reduction in cases per 100K population of about 1.4 cases after 3 weeks for individuals up to 14 years (42 percent of a standard deviation). Reductions for older age groups are smaller and insignificant: 0.82 cases in the group of 15–34 years (21 percent of a standard deviation) and 0.43 cases in the group of 35–59 years (16 percent of a standard deviation). The more vulnerable population of 60+ years appears to be unaffected by the school openings.
Reproduction number	2 modelling studies (Landeros 2020, Phillips 2020)	**Landeros 2020:** This study used a multi compartmental model to model the impact of various school reopening scenarios in the USA. Multiple measures were assessed including measures to make contacts safer (masks and hand washing policies), measures to reduce contacts (rotating cohorts and outdoor instruction), infrastructural measures (cleaning, ventilation, desk shields), and surveillance

		(closing schools once a threshold for cumulative prevalence had been reached). In terms of cohorting strategies, the study ssessed the following three scenarios: 1) reopening at full capacity; 2) allowing half of all children to return to in-person schooling while the other half continues with remote learning(parallel cohorts); 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts). Splitting a school community into even 2 or 3 rotating cohorts substantially reduces R0 under a wide range of parameter values and slows viral spread in cases of moderate transmissibility. Moving from full capacity to 2 cohorts reduces R0 by 50% for the range $0 \leq \beta 11, \beta 22 \leq 1$. Using three cohorts further reduces R0 for comparable β11 and β22. This parameter range is of interest because it corresponds to $R0 \approx 2$ in the full capacity scenario. Cohort separation tends to dramatically reduce the spread of infection. Under most of the parameter values, 2 parallel cohorts and 2 rotating cohorts show similar time to 5% infecteds, withthe parallel cohort strategy having a slight advantage when β11 and β22 are large. Overall, this model also shows that reduction of class density and the implementation of rapid viral testing, even with imperfect detection, have greater impact than moderate measures for transmission mitigation. **Philips 2020:** This study used an agent-based model to model the impact of various school reopening strategies on COVID-19 transmission in Canada. Strategies included the formation of fixed cohorts with or without alternating school attendance for those cohorts. The cohorts used different teacher to student ratios. The scenarios were 1) 8:1 ratio; 2) 8:1 ratio, alternating attendance; 3) 15:1 ratio; 4) 15:1 ratio, alternating attendance; 5) 30:1 attendance. The study also modelled the effects of keeping sibling groups together in the same cohort. The study found that for each doubling of class size from 8 to 15 to 30 more than doubled the outbreak size and student-days lost, by factors of 2-5, respectively 2.5-4.5, depending on the scenario. Introducing more children into the classroom increases the effective reproductive ratio (Re) for both low and high rates of transmission while cohorting/alternation has little effect, and similar strategies (that is, differing by only 1 student or educator per class, or by alternation) give similar reproductive ratios Re. The primary school setting shows the same cascade of intensifying outbreaks and rapidly mounting student-days of closure as class sizes increase. Introducing more children into the classroom increases the Reff for both low and high rates of transmission while cohorting/alternation has little effect,and similar strategies (that is, differing by only 1 student or educator per class, or by alternation) give similar reproductive ratios.
Outcome category: Healthcare Utilization		

Number or proportion of hospitalizations	1 modelling study (Germann 2020)	**Germann 2020:** This study uses an an agent-based model that simulates communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening including 1) all students in school with or without social distancing measures in place; 2) two non-overlapping cohorts of students attending on different days or weeks, with or without deep cleaning of the school in between cohorts; 3) all students in school. Scenarios where split cohorts of students return to school in non-overlapping formats resulted in the following outcomes in the community: in cases with fewer workplaces open, the total number of people hospitalized would be 1,798,188. In cases with more workplaces open, the total number of people hospitalized would be 2,064,544. Allowing 100% of students to return back to school is likely to lead to additional increases of infection under the current transmission dynamics in the U.S. and if schools reopen at the 80% or 100% level, school-age children could generate the largest number of cases. All scenarios where schools open even at the 80% levels will result in greater COVID-19 case rates requiring higher levels of hospitalizations. It is not possible to assess the specific effects of alternating attendance vs. formation of cohorts because classes have been split into cohorts are those cohorts are alternating attendance.

Schlüsselfrage: Modifikation schulbezogener Aktivitäten

Inhalt

Tabelle 1: Übersicht über eingeschlossenen Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
Bershteyn 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing; modification of activities 3. Surveillance and response measures - daily symptom screening, active testing, reactive school closures, quarantine 4. Structural/environmental - enhanced ventilation	1. Students 2. Teachers	Not specified	Comparison between measures in New York and, for infection control, comparisons were made to previous studies of secondary attack rate in Korea, Germany and Israel.	1. Transmission - attack rate	1. Students 2. Teachers	New York City (NYC), with the largest school district in the United States, was the first major US city to offer in-person instruction during the 2020-2021 school year despite persistent community transmission after the first SARS-CoV-2 pandemic wave.
Bracis 2020	Modelling	1. Measures making contacts safer - handwashing; masks; phsyical distancing 2. Surveillance measures - testing	1. School population (unspecified)	Not specified	No intervention	1. Transmission - number of cases; reproduction number 2. Healthcare utlization - number of hospitalizations	1. General population	Ongoing community transmission

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
Cohen 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Surveillance and response measures measures - testing; contact tracing	1. Students	Not specified	All in-person schooling with no countermeasures	1. Transmission - infection rate	1. General population	Not specified
España 2020	Modelling	1. Measures to reduce contacts - phased reopening 2. Measures making contacts safer - masks	1. Students 2. Teachers 3. **General populati**on	Not specified	Comparison between nine scenarios of percentage attending in-person learning at school and mask adherence	1. Transmission - cumulative number of infections; reproduction number	1. General population	Not specified
Germann 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; physical distancing	1. Students 2. General population	Not specified	Baseline: All students physically in school with some social distancing (i.e., 100% enrollment).	1. Transmission - delay of epidemic peak (time to peak incidence (days); Cumulative cases per county per 100k; Peak incidence (case per 1000), Time to peak prevalence (days); Clinical attack rate (%)	1. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
						2. Healthcare utilization - Hospitalizations; Cases/Deaths/Hospitalizations averted; ICU bed usage		
Gill 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks	1. Students 2. Teachers 3. School staff	Not specified	Seven scenarios Scenario A (baseline): normal school Scenario B (daily attendance with precautions) eg masks in bus and during schoolday Scenario C (daily attendance with precautions and block scheduling). Scenario D (daily attendance with precautions and students "podded" in one classroom). Scenario E (rotating two days per week, precautions as in B) Scenario F	1. Transmission - number of cases detected; 2. Economic, social, and ecological outcomes - number of days spent in school	1. School population (unspecified) 2. General population	In August, the statewide average infection rate was approximately 40 detected cases per 100,000 per week, and reported county-level infection rates ranged from zero to approximately 200 detected cases per 100,000. The Pennsylvania Departments of Education and Health deem fewer than 10 detected

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
					(weekly four-day rotations) Scenario G (rotating one day per week) students devided in 5 small groups			cases per 100,000 over seven days to represent low levels of infection that can permit full-time reopening of schools. About 10 of Pennsylvania's 67 counties had infection rates below this level in August.
Head 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - testing; isolation of cases	1. Students 2. Teachers 3. School staff 4. General population	0-17 years	Six school reopening scenarios 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable	1. Transmission - number of infections	1. Students 2. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
					cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis53, with positive cases isolated and their class			

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
					quarantined for 14 days."			
Isphording 2020	Quasi-experimental	1. Measures to reduce contacts - staggered start, break, finish times; formation of cohorts; cancellation of activities 2. Meausres making contacts safer - masks; physical distancing; modification of activities 3. Structural/environmental measures - ventilation 4. Surveillance and response measures - testing; isolation/quarantine	1. Students 2. Teachers 3. General population	6 - 19 years	Three scenarios 1. Masks use 2. Limited mask use 3. No recommendation on mask use	1. Transmission - number of cases avoided due to the intervention	1. Students	"Very low community spread" Schools re-opened during a time of in general low infection rates and cannot be interpreted as the flip side of school closures during the peak of the pandemic.
Landeros 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3.		Under 18 years	Three scenarios 1) reopening at full capacity 2) allowing half of all children to return to in-person schooling while the other half continues	1.Transmission - reproductive number; cumulative prevalence	1. Students 2. Staff (members of the school community) 3. General population	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
		Structural/environmental measures - physical distancing measures; enhanced cleaning measures; enhanced ventilation measures 4. Surveillance and response measures - testing; isolation, reactive school closures			with remote learning(parallel cohorts) 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts)			
Monod 2020	Modelling	1. Measures making contacts safer - masks	1. Students	0 - 11 years	School opening under measures making contacts safer vs school closure	1. Transmission - number of cases; number of deaths	1. General population	Not specified
Naimark 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - isolation; reactive closure	1. Students 2. General population	2 - 17 years	Two school reopening scenarios: 1) counterfactual scenario in which schools did not reopen on September 15, 2020 2) Schools re-opened on September 15, 2020, (scenario	1. Transmission - number or proportion of infections	1. Students 2. General population	We modelled three community-based NPI scenarios (1,2 and 3, eTable 3) in Ontario at the beginning of October 2020, in response to rising confirmed

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
					B) but with several measures in place to limit within-school transmission of COVID-19:			daily case incidence from 185 on September 1st to 675 on September 30th
Panovska-Griffiths 2020 Preprints	Modelling	1. Measures making contacts safer - masks 2. Surveillance and response measures - testing; tracing	1. Students 2. School staff (unspecified)	12 - 19 years	Two scenarios: 1. 50% coverage of face coverings in schools (only secondary schools); 30% efficacy of face coverings 2. 50% coverage of face coverings in schools (only secondary schools), 60% efficacy of face coverings	1. Transmission - cumulative number of infections	1. Students (ages 12-19)	Not specified
Sruthi 2020	Modelling	1. Measures making contacts safer - masks	1. Unspecified	12 - 19 years	Three scenarios: Scenario 1: Closed schools Scenario 2: Open with mask-requirements on pupils in all	1. Transmission - reproduction ratios	1. Unspecified	Not specified

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
					secondary-schools or when the distance between pupils is less than 2.25 meters Scenario 3: Open with no mask-requirements			

Tabelle 2: Summary of Findings Tabelle

Outcome	Number of studies	Summary of findings	Certainty of evidence
Outcome category: Transmission			
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	2 modelling studies (Bershteyn 2020, Sparks 2020)	In two studies, activities were modified in a way to make them safer for kids. This ranged from shortening the length of a school day to modifications of certain activities (e.g. sport, music). The study looking at shortening of school days found that shorter length of a school day. Since the effect of modified activities was assessed alongside other measures, it is not possible to assess the effect of these modifications.	Very low ⊕◯◯◯
	1 observational study (Vlachos 2020)	One study looks at the infection rate among teachers, parents, and teachers partners in cases where schools were open and closed in Sweden. In schools that were open, several measures were implemented to reduce COVID-19 transmission including enhanced facilities for hand washing and disinfection; posters encouraging hand washing; increased distance in classrooms and dining halls, if possible; avoidance of large gatherings, as far as possible; minimize activities like open houses and parental meetings; increased outdoor activities, if possible; avoidance of close contacts between staff and students and between students; enhanced cleaning of heavily exposed areas and keyboards/tablets. This study does not look at these measures individually. It demonstrates the rate of infection in cases where schools were open with these measures, and in cases where schools were closed.	Very low ⊕◯◯◯
	1 quasi-experimental study (Isphording 2020)	This study found that school reopenings, under strict mitigation strategies, did not increase the number of cases after the summer closure. Multiple measures were implemented and studied alongside each other, among those modifications of certain classes (e.g. music, sport). Due to the nature of the study it is not possible to say whether testing and isolation measures alone were effective at reducing or minimizing transmission.	Low ⊕⊕◯◯

Tabelle 3: Übersicht nach Studien

Outcome	Number of studies	Overview of effect by study
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	2 modelling studies (Bershteyn 2020, Sparks 2020)	Bershteyn 2020: This study modelled the impact of multiple policies implemented in schools by referring to global benchmarks for the secondary attack rate (SAR) of SARS-CoV-2 by simulating the potential for transmission with each policy. The study sought to model each scenario within the context of New York City schools. One scenario modelled the impact of organization measures to reduce transmission including the use of wearing face coverings, maintaining at least 6 feet of physical distance between people in the school, handwashing or hand sanitizing policies, canceling large gatherings such as assemblies, and consuming meals in classrooms rather than cafeterias. The study also modified activities to make them safer ((canceling large gatherings such as assemblies, and consuming meals in classrooms rather than cafeterias). Based on data from Germany, Israel and South Korea, the study found that the secondary attack rate in school re-opening in the absence of infection control measures was 625-fold higher than the secondary attack rate in South Korean schools in which infection control was implemented. The measurement of the secondary attack rate in France, where infection control was implemented, was 21.8-fold higher than the attack rate in Israel, but this may be an overestimate due to the use antibody testing rather than viral testing. Given the fact that individual measures were assessed together under the broad category of 'infection control measures,' we are unable to assess the impact of any of these measures individually. Sparks 2020: This study used an expert elicitation model to model the effects of school reopening under various scenarios in the UK. The study modelled the impact of modification of activities (learning and playing outdoors; lunch in classroom; packed lunch or take-away style cartons) as well as the formation of cohorts and staggered start, break, and end times. Overall, the interventions reduced the number of contacts between and within students and teachers but it is not possible to determine the impact of any one individual measure.
	1 observational study (Vlachos 2020)	Vlachos 2020: This study is an observational study that looks at the infection rate among teachers, parents, and teachers partners in cases where schools were open and closed in Sweden. In schools that were open, several measures were implemented to reduce COVID-19 transmission including enhanced facilities for hand washing and disinfection; posters encouraging hand washing; increased distance in classrooms and dining halls, if possible; avoidance of large gatherings, as far as possible; minimize activities like open houses and parental meetings; increased outdoor activities, if possible; avoidance of close contacts between staff and students and between students; enhanced cleaning of heavily exposed areas and keyboards/tablets. This study does not look at these measures individually. It demonstrates the rate of

		infection in cases where schools were open with these measures, and in cases where schools were closed. The study found that, among parents, exposure to open rather than closed schools resulted in a small increase in PCR-confirmed infections [OR 1.17; CI95 1.03–1.32]. Among lower secondary teachers the infection rate doubled relative to upper secondary teachers [OR 2.01; CI95 1.52–2.67]. This spilled over to the partners of lower secondary teachers who had a higher infection rate than their upper secondary counterparts [OR 1.29; CI95 1.00–1.67]. When analyzing COVID-19 diagnoses from healthcare visits and the incidence of severe health outcomes, results are similar for teachers but weaker for parents and teachers' partners. The results for parents indicate that keeping lower secondary schools open had minor consequences for the overall transmission of SARS-CoV-2 in society. The results for teachers suggest that measures to protect teachers could be considered.
	1 quasi-experimental study (Isphording 2020)	This quasiexperimental study found that school reopenings, under strict mitigation strategies, did not increase the number of cases after the summer closure. Multiple measures were implemented and studied alongside each other, among those modifications of certain classes (e.g. music, sport); therefore it is not possible to say whether testing and isolation measures alone were effective at reducing or minimizing transmission.

Schlüsselfrage: Tragen eines Mund-Nasen-Schutzes

Inhalt

Tabelle 1: Übersicht über eingeschlossenen Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
Bershteyn 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing; modification of activities 3. Surveillance and response measures - daily symptom screening, active testing, reactive school closures, quarantine 4. Structural/environmental - enhanced ventilation	1. Students 2. Teachers	Not specified	Comparison between measures in New York and, for infection control, comparisons were made to previous studies of secondary attack rate in Korea, Germany and Israel.	1. Transmission - attack rate	1. Students 2. Teachers	Ongoing community transmission
Bracis 2020	Modelling	1. Measures making contacts safer - handwashing; masks; phsyical distancing 2. Surveillance measures - testing	1. School population (unspecified)	Not specified	No intervention	1. Transmission - number of cases; reproduction number 2. Healthcare utlization - number of hospitalizations	1. General population	Ongoing community transmission
Cohen 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of	1. Students	Not specified	All in-person schooling with no countermeasures	1. Transmission - infection rate	1. General population	Not specified

		cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Surveillance and response measures measures - testing; contact tracing						
España 2020	Modelling	1. Measures to reduce contacts - phased reopening 2. Measures making contacts safer - masks	1. Students 2. Teachers 3. **General populati**on	Not specified	Comparison between nine scenarios of percentage attending in-person learning at school and mask adherence	1. Transmission - cumulative number of infections; reproduction number	1. General population	Not specified
Germann 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; physical distancing	1. Students 2. General population	Not specified	Baseline: All students physically in school with some social distancing (i.e., 100% enrollment).	1. Transmission - delay of epidemic peak (time to peak incidence (days); Cumulative cases per county per 100k; Peak incidence (case per 1000), Time to peak prevalence (days); Clinical attack rate (%) 2. Healthcare utilization - Hospitalizations; Cases/Deaths/Hospitalizations averted; ICU bed usage	1. General population	Not specified
Gill 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts	1. Students 2. Teachers 3. School staff	Not specified	Seven scenarios Scenario A (baseline): normal school	1. Transmission - number of cases detected; 2. Economic, social, and	1. School population (unspecified)	In August, the statewide average infection rate

		2. Measures making contacts safer - masks			Scenario B (daily attendance with precautions) eg masks in bus and during schoolday Scenario C (daily attendance with precautions and block scheduling). Scenario D (daily attendance with precautions and students "podded" in one classroom). Scenario E (rotating two days per week, precautions as in B) Scenario F (weekly four-day rotations) Scenario G (rotating one day per week) students devided in 5 small groups	ecological outcomes - number of days spent in school	2. General population	was approximately 40 detected cases per 100,000 per week, and reported county-level infection rates ranged from zero to approximately 200 detected cases per 100,000. The Pennsylvania Departments of Education and Health deem fewer than 10 detected cases per 100,000 over seven days to represent low levels of infection that can permit full-time reopening of schools. About 10 of Pennsylvania's

								67 counties had infection rates below this level in August.
Head 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - testing; isolation of cases	1. Students 2. Teachers 3. School staff 4. General population	0-17 years	Six school reopening scenarios 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort); 3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups;	1. Transmission - number of infections	1. Students 2. General population	Not specified

					5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis53, with positive cases isolated and their class quarantined for 14 days."			
Isphording 2020	Quasi-experimental	1. Measures to reduce contacts - staggered start, break, finish times; formation of cohorts; cancellation of activities 2. Meausres making contacts safer - masks; physical distancing; modification of activities 3. Structural/environmental measures - ventilation 4. Surveillance and response measures - testing; isolation/quarantine	1. Students 2. Teachers 3. General population	6 - 19 years	Three scenarios 1. Masks use 2. Limited mask use 3. No recommendation on mask use	1. Transmission - number of cases avoided due to the intervention	1. Students	"Very low community spread" Schools re-opened during a time of in general low infection rates and cannot be interpreted as the flip side of school closures during the peak of the pandemic.

Landeros 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Structural/environmental measures - physical distancing measures; enhanced cleaning measures; enhanced ventilation measures 4. Surveillance and response measures - testing; isolation, reactive school closures		Under 18 years	Three scenarios 1) reopening at full capacity 2) allowing half of all children to return to in-person schooling while the other half continues with remote learning(parallel cohorts) 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts)	1.Transmission - reproductive number; cumulative prevalence	1. Students 2. Staff (members of the school community) 3. General population	Not specified
Monod 2020	Modelling	1. Measures making contacts safer - masks	1. Students	0 - 11 years	School opening under measures making contacts safer vs school closure	1. Transmission - number of cases; number of deaths	1. General population	Not specified
Naimark 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures -	1. Students 2. General population	2 - 17 years	Two school reopening scenarios: 1) counterfactual scenario in which schools did not reopen on September 15, 2020	1. Transmission - number or proportion of infections	1. Students 2. General population	We modelled three community-based NPI scenarios (1,2 and 3, eTable 3) in Ontario at the beginning of

		isolation; reactive closure			2) Schools re-opened on September 15, 2020, (scenario B) but with several measures in place to limit within-school transmission of COVID-19:			October 2020, in response to rising confirmed daily case incidence from 185 on September 1st to 675 on September 30th
Panovska-Griffiths 2020 Preprints	Modelling	1. Measures making contacts safer - masks 2. Surveillance and response measures - testing; tracing	1. Students 2. School staff (unspecified)	12 - 19 years	Two scenarios: 1. 50% coverage of face coverings in schools (only secondary schools); 30% efficacy of face coverings 2. 50% coverage of face coverings in schools (only secondary schools), 60% efficacy of face coverings	1. Transmission - cumulative number of infections	1. Students (ages 12-19)	Not specified
Sruthi 2020	Modelling	1. Measures making contacts safer - masks	1. Unspecified	12 - 19 years	Three scenarios: Scenario 1: Closed schools Scenario 2: Open with mask-requirements on pupils in all secondary-	1. Transmission - reproduction ratios	1. Unspecified	Not specified

					schools or when the distance between pupils is less than 2.25 meters Scenario 3: Open with no mask-requirements			

Tabelle 2: Summary of Findings Tabelle

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	10 modelling studies (Bracis 2020, Bersthyn 2020, Cohen 2020, Espana 2020, Germann 2020, Gill 2020 Head 2020, Monod 2020, Panovska-Griffiths 2020_Preprints)	Most studies look at masks among other measures implemented in the school setting. an reduction in the cases avoided due to the intervention, reporting on outcomes such as (cumulative) number of cases or attack rates. In the studies that allow for drawing conclusions with regards to the effect of masks, wearing masksn reduced the number of cases. The effect depends on the initial level of COVID-19 incidence within the simulated community, the countries affected by the measure (e.g. South Korea) as well as on the assumed compliance to wearing masks.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide
	1 quasi-experimental study (Isphording 2020)	One study looks at mask among other measures implemented in the school setting and number of cases avoided due to the intervention. The effect cannot be considered separately due to the way the data is presented. Comparing states with recommended, limited or no mask use in the graphs does not provide strong indications for the effectiveness of masks, while the overall effect of multiple interventions is positive.	Very low ⊕◯◯◯	Downgraded for risk of bias due to ROBINS-I rating being moderate Downgraded for indirectness, due to no reporting of external validation in the study Downgraded for inconsistency because only study assesses the outcome of interest
Reproduction number	2 modelling studies (Bracis 2020, Sruthi 2020)	Two studies show the positive effect of multiple measures implemented in the school setting on the reproduction number. In one study, mask was one of multiple intervention components implemented which is why the effect of masks cannot be disentangled from other effects	Low ⊕⊕◯◯	Downgrade for risk of bias due to quality concerns related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's

		(Bracis 2020). In the other study, wearing masks in secondary schools in Switzerlands leads to an estimated reduction of Rt 0.011 (CI. 0.008-0.0127) (Sruthi 2020). However, there is no consideration of compliance in the model.		uncertainty Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide
Outcome category: Healthcare utilization				
Healthcare utilization (Hospitalization)	2 modelling studies (Bracis 2020, Germann 2020)	Two studies looked at multiple measures and their effect on hospitalization. They found that the results of the simulations to be highly dependent on community transmission, and the number of workplaces assumed to be open for in-person business, as well as the initial level of COVID-19 incidence within the simulated community.	Very low ⊕◯◯◯	Downgraded for risk of bias due to moderate quality concerns in both studies realted to the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for imprecision for lack of accounting for uncertainty in one of the studies Downgraded for inconsistency because only study assesses the outcome of interest
Outcome category: Economic, social, ecological outcomes - Number of days spent in school				
Number of days spent in school	1 modelling study (Gill 2020)	One study looking at masks among other measures implemented in the school setting and shows that under very low community infection rates (10 reported infections per 100,000 population over the last seven days), most students can expect to attend nearly every day even in schools operating full-time.	Very low ⊕◯◯◯	Downgraded for risk of bias due to moderate quality concerns in both studies realted to the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness due to non reporting of internal and external validation of the model Downgraded for inconsistency because only one study assesses the outcome of interest

Tabelle 3: Übersicht nach Studien

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	10 modelling studies (Bracis 2020, Bersthyn 2020, Cohen 2020, España 2020, Germann 2020, Gill 2020 Head 2020, Monod 2020, Panovska-Griffiths 2020_Preprints)	Bershteyn 2020: This simulation model focused on the impact of multiple policies implemented in schools by referring to global benchmarks for the secondary attack rate (SAR) of SARS-CoV-2 by simulating the potential for transmission with each policy. The study sought to model each scenario within the context of New York City schools, USA. One scenario modelled the impact of organization measures to reduce transmission including the use of wearing face coverings, maintaining at least 6 feet of physical distance between people in the school, handwashing or hand sanitizing policies, canceling large gatherings such as assemblies, and consuming meals in classrooms rather than cafeterias. The study also looked at ventilation measures (all occupied rooms had at least one operable window, mechanical exhaust fan, supply fan, or unit ventilator delivering airflow to the space). Based on data from Germany, Israel and South Korea, the study found that the secondary attack rate in school re-opening in the absence of infection control measures was 625-fold higher than the secondary attack rate in South Korean schools in which infection control was implemented. The measurement of the secondary attack rate in France, where infection control was implemented, was 21.8-fold higher than the attack rate in Israel, but this may be an overestimate due to the use antibody testing rather than viral testing. Given the fact that individual measures were assessed together under the broad category of 'infection control measures,' we are unable to assess the impact of any of these measures individually. Bracis 2020: This study employed a SIR: Deterministic age-stratified compartment model to quantify COVID-19 transmission during and after various reopening scenarios in King County, USA, where physical distancing (a cumulative of reduced physical contacts, hand hygiene policies and face masks) and test and isolation are in place from May to July 2020. Physical distancing reduced SARS-CoV-2 transmission by 65% when fully implemented with a range of 54%-83% (UI) from the sampled parameter sets. Had transmission not been reduced by physical distancing, we estimate that by May 15, more than three quarters of King County residents would have been infected. It was not possible to disaggregate the impact of the three individual measures which formed a part

		of 'physical distancing'. Cohen 2020: This study used an agent-based mathematical model of COVID-19 transmission and interventions to quantify the impact of school reopening on disease transmission in the USA. The study compared seven school re-opening strategies implemented with and without countermeasures within schools. The countermeasures that were implemented were face masks, maintaining at least 6 feet of physical distance between people in the school, and hand-washing, along with screening, testing, and contact tracing. The study found that that implementing countermeasures that limit transmission and detect, trace, and quarantine cases within schools would lead to reductions in the cumulative COVID-19 infection rate among students, teachers, and staff over 4-fold, at a case detection rate of 110 per 100,000. However, these measures were implemented alongside classroom cohorting, symptomatic screening, testing and tracing in schools so it is not possible to comment on the impact of these measures alone. España 2020: This study used an agent-based mathematical model to assess the impact of a phased reopening of schools with and without adherence to fask mask wearing in the USA. The study modelled nine combinations of scenarios where schools were operating at 50%, 75%, and 100% capacity. The scenarios were modelled with and without adherence to face masks. With schools reopening at full capacity with low face mask adherence, there would be an increase of 81.7 times the number of infections. With schools reopening at full capacity with high face mask adherence there would be a proportional increase of 3.0 times the number of infections. With schools reopening at reduced capacity with high face mask adherence there would be an 11.6% increase in the number of infections. Germann 2020: This study uses an an agent-based model that simulates communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening where they compare certain scenarios of reopening with prepandemic behaviour. Two of the scenarios relate to wearing masks and other measures (e.g. physical distancing) at school (25 vs 50% reduction in contacts of preschool and elementary school-age children). The

		study found the results of the simulations to be highly dependent on the number of workplaces assumed to be open for in-person business, as well as the initial level of COVID-19 incidence within the simulated community. When there were fewer workplaces open there were 59,664,577 compared to 68,242,756 when there were more workplaces open. The time to peak prevalence was one day quicker (65 versus 66 days) and clinical attack rate was higher (44.8% versus 42.4%) when more, compared to fewer workplaces were open. Gill 2020: This study used an agent based model to simulate the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. Modelled scenarios included: 1) normal school attendance; 2) daily attendance with precautions (eg masks in bus and during schoolday); 3) daily attendance with precautions and block scheduling; 4) daily attendance with precautions and students “podded” in one classroom; 5) rotating two days per week with precautions; 6) weekly four-day rotations; 7) rotating one day per week students devided in 5 small groups. Precautions such as mask wearing and lunch in classrooms (Scenario 2) substantially reduce total infections relative to operating without precautions (Scenario 1). There are no effect estimates available. Head 2020: This study simulated COVID-19 transmission using an individual based stochastic model under observed conditions and counterfactual intervention scenarios between March 17-June 1, and evaluated various school reopening strategies using data from the Bay area in California, USA. One of the modelled scenarios was that schools reopened fully and that students and teachers wore masks. There was reduced transmission in the mask-wearing scenario but the effect was not as strong as with scenarios modelling cohorting. The following figures show the excess proportion of infections (25.95(4.89, 40.5)), symptomatic infections (5.43(1.01, 8.9)), hospitilisations (0.17(0,4.75)), and deaths (0(0,0)) experienced by students if schools were allowed to reopen with mandatory mask wearing. School staff and teachers' data were as follows; infections (13.58(2.38, 24.64)), symptomatic infections (9.33(1.42, 17.21)), hospitilisations (33.77(-47.17, 142.86)), and deaths (2.63(0,46.95)). Monod 2020: This study used a bayesian semi-mechanistic contact and infection model to look at scenarios of school reopening for primary students with or

		without the use of measures, including masks, to make contacts safer in the USA. The study focused on school opening scenarios in which children aged 0-11 return to engage in typical contact patterns with their peers. The study assumed disease transmission from and to children aged 0-11 was reduced by 50% due to face mask use and other non-pharmaceutical interventions, considering also the range 0%-80%. The scenarios were evaluated over 90 days and contrasted to continued school closure scenarios. Across all 37 states and metropolitan areas evaluated, the study estimated that by November 24, 2020 a 253.7 [199.3%-366.9%] increase in infections among children aged 0-11. Naimark 2020: This study used an agent-based model school reopening in different scenarios. A counterfactual scenario in which schools did not reopen on September 15, 2020 was used as a baseline. Other scenarios included schools reopening on September 15, 2020, (scenario B) but with several measures in place to limit within-school transmission of COVID-19: i) primary and elementary class sizes were capped at 23, and high school classes were capped at 15 students; ii) students remained in their assigned classrooms for the school day rather than moving among classrooms; iii) universal masking was in place; iv) in designated high schools, in urban areas, students attended school only on alternate weekdays; and v) if more than two confirmed cases of COVID-19 occurred in a daycare or classroom less than two weeks apart, the daycare or classroom was closed for 14 days with the children in the class excluded from school rather than moved to another classroom.The study found that transmission within schools was heavily influenced by community-level non-pharmaceutical interventions (NPIs). When community-based NPIs were not enacted, the number of daily, new, confirmed cases on October 31, 2020, were 4,414 (95% credible interval, CrI: 3,491; 5,382) with schools closed, versus 4,740 (95% CrI 3,863; 5,691) with schools reopened, with an increase of cases of due to school reopening of 326 (95% CrI:196; 456). If community-based NPIs were implemented, the number of daily, new, confirmed cases on October 31, 2020, were 714 (95% CrI: 568; 908) with schools closed, versus 780 (95% CrI 580; 993) with schools reopened, with an increase of cases of due to school reopening of 66 (95% CrI: 40; 92). It is not possible to assess the effects of individual measures. Panovska-Griffiths 2020_Preprints: This study used COVASIM, a stochastic

		agent-based simulator, extended the previous modelling of COVID-19 transmission through individuals' contact networks adapted to the UK context. Test and trace models, combined with mask wearing in the community and secondary schools were modelled. Results suggest that there is a greater benefit of mandatory masks in secondary schools if the effective coverage of masks is high (30%). Under current testing and tracing levels (24% testing, 47% tracing) and masks' effective coverage of 30%, the predicted second COVID-19 wave would be less than half of the original wave if masks were mandatory in secondary schools as well as used in community settings. The minimum testing levels necessary to avoid a second wave, under scaled up TTI, is 8-11% less when masks are mandatory in schools than if they are not, depending on the effective coverage of masks (76% and 57% compared to 68% and 46%). If masks were mandatory in secondary schools, assuming that current tracing levels of 47% continue, 68% or 46% of those with symptomatic infection would need to be tested respectively under scenarios of 15% and 30% mask effective coverage. If masks were not mandatory at secondary schools, the respective numbers would be 76% and 57% for 15% and 30% effective coverage of masks in the relevant community settings.
	1 quasi-experimental study (Isphording 2020)	**Isphording 2020**: This study investigated the spread of COVID-19 during staggered school reopenings comparing a control group to intervention after summer holidays across German federal states (from 03 Aug to 14 Sept 2020). In almost all states, mask wearing was mandatory for older students, partly even during class. For primary school students, masks were mostly worn on the way to the classroom, yet were not worn during class. Three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27 percent of a standard deviation within experimental group vs control group. The effect is strongest in the youngest age group of 0–14 year-old cases where the end of summer breaks is associated with a significant reduction in cases per 100K population of about 1.4 cases after 3 weeks for individuals up to 14 years (42 percent of a standard deviation). Reductions for older age groups are smaller and insignificant: 0.82 cases in the group of 15–34 years (21 percent of a standard deviation) and 0.43 cases in the group of 35–59 years (16 percent of a standard deviation). The more vulnerable population of 60+ years appears to be unaffected by the school openings.
Reproduction number	2 modelling studies (Bracis 2020, Sruthi 2020)	Bracis 2020: This study employed a SIR: Deterministic age-stratified compartment model to quantify COVID-19 transmission during and after various

		reopening scenarios in King County, USA, where physical distancing (a cumulative of reduced physical contacts, hand hygiene policies and face masks) and test and isolation are in place from May to July 2020. Physical distancing reduced SARS-CoV-2 transmission by 65% when fully implemented with a range of 54%-83% (UI) from the sampled parameter sets. The effective reproductive number (Rt) decreased from 2.43 (BF, range 2.19-2.55 UI) at the start of the epidemic to 0.81 (BF, range 0.40-0.93 UI) by the end of April and remained below 1 at the time when reopening started for all parameterizations. Had transmission not been reduced by physical distancing, we estimate that by May 15, more than three quarters of King County residents would have been infected with 17300 additional excess deaths (BF). It was not possible to disaggregate the impact of the three individual measures which formed a part of 'physical distancing'. Sruthi 2020: The study used an artificial intelligence model to assess the impact of wearing masks in secondary schools and its impact on the reproduction number in Switzerland. This study compared three scenarios; closed schools, open schools with no mask requirements and open with mask requirements on pupils in all secondary schools or when the distance between pupils is less thatn 2.25 meters. Mask requirements led to an reduction of R estimated reduction of Rt 0.011 (CI. 0.008-0.0127).
Outcome category: Healthcare utilization		
Healthcare utilization (Hospitalization)	2 modelling studies (Bracis 2020, Germann 2020)	Bracis 2020: This study simulated COVID-19 transmission during and after various reopening scenarios in King County, USA, where physical distancing (a cumulative of reduced physical contacts, hand hygiene policies and face masks) and test and isolation are in place from May to July 2020. In a normal school reopening scenario without interventions, in half of the simulations, the number of current COVID-19 hospitalizations is expected to surpass 1700 exceeding more than three times the state mandated maximum of 10% occupancy. The threshold of 15 deaths per day would likely be met in October but possibly as early as August under these conditions. In a scenario where schools reopen to 75% of pre-COVID physical interactions but interventions, including mandatory masks, fail the number of current COVID-19 hospitalizations is expected to surpass 2000 by November 1 which corresponds to almost 40% occupancy. Inpatient treatment would lower deaths significantly but would provide no relief for the pressure on the health care system as the hospitalization rate would remain unchanged. In a scenario where schools reopen to 60% of pre-COVID physical interactions with

		effective interventions, including masks, treatment of isolated cases (TIT_S) alone would lower the cumulative deaths by 81% through November, reducing the maximum daily deaths to 13 (BF) with 90% of the acceptable parameterizations remaining below 10 deaths per day under the baseline reopening plan. Adding treatment to isolated cases and contacts (TIT_S+C) would allow at least 60% pC-PI without an increase in mortality, with 90% of the parameterizations remaining below 8 deaths per day by November 1. Current COVID-19 hospitalizations are expected to remain significantly lower than state mandated goal of 10% occupancy. It was not possible to disaggregate the impact of the individual measures. Germann 2020: This study uses an an agent-based model that simulates communities across the United States including daycares, primary, and secondary schools to quantify the relative health outcomes of reopening schools. The study modelled multiple scenarios for reopening where they compare certain scenarios of reopening with prepandemic behaviour. Two of the scenarios relate to wearing masks and other measures (e.g. physical distancing) at school (25 vs 50% reduction in contacts of preschool and elementary school-age children). The study found the results of the simulations to be highly dependent on the number of workplaces assumed to be open for in-person business, as well as the initial level of COVID-19 incidence within the simulated community. When there were fewer workplaces open; the number hospitalized= 1,798,188, and deaths= 107,322. Whereas, when there were more workplaces open, these figures were higher; hospitalized= 2,064,544, and deaths= 120,162.
Outcome category: Economic, social, ecological outcomes - Number of days spent in school		
Number of days spent in school	1 modelling study (Gill 2020)	**Gill 2020:** This study simulated the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. Modelled scenarios included: 1) normal school attendance; 2) daily attendance with precautions (eg masks in bus and during schoolday); 3) daily attendance with precautions and block scheduling; 4) daily attendance with precautions and students “podded” in one classroom; 5) rotating two days per week with precautions; 6) weekly four-day rotations; 7) rotating one day per week students devided in 5 small groups. Precautions such as mask wearing and lunch in classrooms (Scenario 2) substantially reduce total infections relative to operating without precautions (Scenario 1). At very low community infection rates (10 reported infections per 100,000 population over the last seven days), most students can expect to attend nearly every day even in schools operating full-time, as long as the schools

		implement precautions such as mask wearing. There are no effect estimates available.

Schlüsselfrage: Schulweg

Tabelle 1: Übersicht über inkludierte Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age of population targeted by intervention	Comparison (Scenarios)	Outcomes	Population in which outcomes are assessed	Level of community transmission
Sruthi 2020	Modelling	1. Measures making contacts safer - masks in secondary schools; masks in public transport	1. School population 2. General population	12 – 19 years	Three scenarios: Scenario 1: Closed schools Scenario 2: Open with mask-requirements on pupils in all secondary-schools or when the distance between pupils is less than 2.25 meters Scenario 3: Open with no mask-requirements	1. Transmission - reproduction ratios	1. General population	Not specified
Panovska-Griffiths 2020_Preprints	Modelling	1. Measures making contacts safer - masks 2. Surveillance and response measures - testing; tracing; isolation	1. Students 2. School staff (unspecified) 3. General population	12 – 19 years	Two scenarios: 1. 50% coverage of face coverings in schools (only secondary schools); 30% efficacy of face coverings 2. 50% coverage of face coverings in schools (only secondary schools), 60% efficacy of face coverings	1. Transmission - timing of second wave of infection 2. Other - proportion of people that need to be tested	1. Students	Not specified
Gill 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making	1. Students 2. Teachers 3. School staff	Children attending elementary schools, typical secondary schools, large secondary schools	Seven scenarios >Scenario A (baseline): normal school >Scenario B (daily attendance with precautions) eg masks in bus and during schoolday >Scenario C (daily	1. Transmission - number or proportion of infections 2. Economic, social, and ecological outcomes - percentage of days in	1. School population (unspecified) 2. General population	Not specified

		contacts safer - masks			attendance with precautions and block scheduling). >Scenario D (daily attendance with precautions and students “podded” in one classroom). >Scenario E (rotating two days per week, precautions as in B) >Scenario F (weekly four-day rotations) >Scenario G (rotating one day per week) students devided in 5 small groups	the school building for a typical student		

Tabelle 2: Summary of Findings Tabelle

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	3 modelling studies (Gill 2020, Panovska-Griffiths 2020_Preprint_Sruthi 2020)	In three studies, the authors model the use of masks in public transport. In one study authors compared the no-mask requirement from the pre-lockdown period to a mandatory mask in public transport (Sruthi 2020). This intervention contributed to a reduction of 0.0139 (CI. 0.0132-0.0144). The combined effect of the use of mask in public transport and at secondary schools leads to a reduction in Rt of 0.025 (CI. 0.018-0.030). Potential seasonal changes or variable compliances to the NPIs, are not considered in the model. In the other studies, the effect from wearing a mask in public transport (Panovska-Griffiths_Preprint 2020) or in buses (Gill 2020) cannot be separated from the effect of other measures implemented alongside. Additionally, it has to be considered that these measures target the community rather than the school population who might use public transport, too.	Very low ⊕◯◯◯	Downgraded for risk of bias, due to major quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide

Tabelle 3: Übersicht über die zum Outcome beitragenden Studien

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	3 modelling studies (Gill 2020, Panovska-Griffiths 2020_Preprint_Sruthi 2020)	**Sruthi 2020**: The study used an artificial intelligence model to assess the impact of wearing masks in all public transport and its impact on the reproduction number in S witzerland. The study authors compared the no-mask requirement from the pre-lockdown period to a mandatory mask in public transport. This intervention contributed to a reduction of 0.0139 (CI. 0.0132-0.0144). The combined effect of the use of mask in public transport and at secondary schools leads to a reduction in Rt of 0.025 (CI. 0.018-0.030). Potential seasonal changes or variable compliances to the NPIs, are not considered in the model. **Panovska-Griffiths 2020_Preprint:** This study uses a stochastic agent-based simulator (COVASIM) to model two scenarios. In the UK, the scenarios are that (i) masks will be mandatory in parts of community, such as public transport from June 15, 2020, and then extended to more places, such as shops, from July 24, 2020, but not in schools from 1st September, or that (ii) masks will be mandatory in parts of community from June 15, 2020, and then in more places from July 24 and also in the communal areas of secondary schools outside of the classroom from 1st September. Due to the setup of these scenarios, it is not possible to assess the effect of this measure. **Gill 2020:** This study uses an agent based model to simulate the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. One of the scenarios assesses daily attendance with precautions, such as masks in bus and during schoolday. Due to setup of these scenarios, it is not possible to assess the effect of this measure.

Schlüsselfrage: Quarantäne

Inhalt

Tabelle 1: Übersicht über eingeschlossenen Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age group of population targeted by the intervention	Comparison	Outcomes	Population in which outcomes are assessed	Community transmission
Bracis 2020	Modelling	1. Measures making contacts safer - handwashing; masks; phsyical distancing 2. Surveillance measures - testing	1. School population (unspecified)	Not specified	Scenarios: No intervention, uniform expansion of physical contacts across age groups (Baseline): Gradually increase physical interactions to predefined post-reopening levels over 2-month period (May 15-July 15) for all age groups assuming that diagnostic rates remain unchanged. Extended physical distancing for	1. Transmission - number/proportion of cases; reproduction number 1. Transmission -deaths 2. Other - proportion of people that remain undiagnosed	1. General population	Washington State (WA) holds a special place in the history of the COVID epidemic with both the first US case of COVID-19 (Jan 20) and the first death due to COVID-19 (Feb 29).4 Shortly thereafter, state authorities began imposing travel and gathering restrictions

					seniors (Protect seniors): Gradually increase physical interactions to predefined post-reopening levels over 2-month period (May 15-July 15) for age groups 1,2 and 3 only. All diagnostic rates remain unchanged. Schools reopening in fall (Reopen schools): Additional increase of the physical interactions of the youngest group to 80% of the pre-COVID on Sept.1 Interventions Effective inpatient treatment			and many local businesses started implementing “work from home” policies. The process culminated with the “Stay Home, Stay Healthy” order of the Governor issued on March 23. 5 On May 1, a plan for reopening in 4 phases was announced which, if implemented without interruptions would have resumed all public interactions

					• Reduce mortality rate among hospitalized by 50% • Improve recovery rate among hospitalized by 20% Rapid test and isolate symptomatic • IncreQase diagnostic rates among symptomatic to 10% daily (Rates up to 50% explored) • Reduce transmission from diagnosed by 50% Rapid test, isolate and treat symptomatic • Increase diagnostic rates among symptomatic to 10% daily (Rates up to 50%			with physical distancing by July 15.6 This plan was consequentl y updated multiple times with the majority of WA counties (including King County, home of the Seattle metro area) have not progressed beyond phase 2 as of July 30 due to ongoing widespread incident infection.

					explored) • Reduce transmission from diagnosed by 75% • Reduce hospitalization rate from diagnosed by 50% Rapid test and isolate symptomatic + trace, test and isolate contacts • Increase diagnostic rates among symptomatic to 10% daily (Rates up to 50% explored) • Reduce transmission from diagnosed by 50% • Increases diagnostic rates among asymptomatic and pre-symptomatic to 5% daily			

					Rapid test, isolate and treat symptomatic + trace, test and treat contacts • Increase diagnostic rates among symptomatic to 10% daily (Rates up to 50% explored) • Reduce transmission from diagnosed by 75% • Reduce hospitalization rate from diagnosed by 50% • Increases diagnostic rates among asymptomatic and pre-symptomatic to 5% daily Mass testing and isolate (MTI) • Increase diagnostic rates among			

					asymptomatic, pre-symptomatic and symptomatic by 0.5 percentage points daily (Increase up to 4.5 percentage points explored) • Reduce transmission from diagnosed by 50% Mass testing, isolate and treat • Increase diagnostic rates among asymptomatic, pre-symptomatic and symptomatic by 0.5% percentage points daily (Increase up to 4.5 percentage points explored) • Reduce transmission from diagnosed by 75% • Reduce hospitalization			

					rate from diagnosed by 50%			
Campbell 2020	Modelling	1. Surveillance and response measures - active testing	1. Students	5 - 18 years	Not relevant - this is a health economic analysis of different scenarios of surveillance testing in Canadian schools ranging from universal testing to targeting at risk populations over various time frames	1. Economic, social, and ecological outcomes - cost of intervention; human resource capacity; laboratory capacity	1. General population	Not specified
Cohen 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Surveillance and response measures -	1. Students	5- 18 years	Seven scenarios: 1. All in-person with no countermeasures 2. All in-person with countermeasures 3. All in-person with countermeasures and A/B	1. Transmission - infection rate	1. General population	Not specified

		testing; contact tracing			scheduling 4. Elementary and middle in-person with countermeasures, high school remote 5. Elementary in-person with countermeasures, middle and high school remote 6. Elementary in-person with countermeasures and A/B scheduling, middle and high school remote 7. All remote			
Di Domenico 2020	Modelling	1. Measures to reduce contacts - phased reopening of schools 2. Measures making contacts safer - physical distancing 3. Surveillance and response measures - testing; isolation	1. School population (unspecified)	0 -11 years, 11-19 years	Three sets of scenarios with four scenarios are modelled. Sets of scenarios: > reopening of pre-schools and primary schools only, on May 11, whereas middle and high schools	1. Transmission - number or proportion of infections 2. Healthcare utilization - number or proportion of cases requiring intensive care	1. General population (four age - groups considered: [0-11], - pre-school and primary school children [11-19], -	Not specified

					would remain closed till next school calendar > Progressive reopening (100%) for pre-school and primary schools starting May 11, coupled with the reopening of middle and high schools 4 weeks after (June 8) > All schools reopen on may 11. Scenarios (for all 3 sets of scenarios) > Progressive (100%) : progressive reopening up to 100% attendance. We assume that 25% of students go back to school on the 1st week after lockdown is		middle and high school children [19-65], and 65+ years old)	

					lifted, 50% on the 2nd, 75% on the 3rd, and 100% from the 4th week till summer holidays. > Progressive (50%) : progressive reopening up to 50% attendance. We assume that 25% of students go back to school on the 1st week after lockdown is lifted, and 50% from the 2nd week till summer holidays. > Prompt (50%) : partial reopening with 50% attendance from May 11. > Prompt (100%) : full reopening with 100% attendance from May 11.			

Gill 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks	1. Students 2. Teachers 3. School staff	Not specified	The study models three different school responses to detected infections: quarantining of close contacts without school closure, quarantining of close contacts with a three-day closure for deep cleaning, and quarantining of close contacts with a 14-day closure to (temporarily) eliminate the possibility of further transmission in the school.	1. Transmission - number of cases detected; 2. Economic, social, and ecological outcomes - number of days spent in school	1. School population (unspecified) 2. General population	In August, the statewide average infection rate was approximately 40 detected cases per 100,000 per week, and reported county-level infection rates ranged from zero to approximately 200 detected cases per 100,000. The Pennsylvania Departments of Education and Health deem fewer than 10 detected cases per 100,000

								over seven days to represent low levels of infection that can permit full-time reopening of schools. About 10 of Pennsylvania's 67 counties had infection rates below this level in August.
Head 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening; formation of cohorts 2. Measures making contacts safer - masks 3. Surveillance and response measures - testing; isolation of cases	1. Students 2. Teachers 3. School staff 4. General population	0 - 17 years	Six school reopening scenarios 1) schools open without precautions; 2a) classroom groups are enforced, reducing other grade and school contacts by 50% (weak stable cohort), or 2b) 75% (strong stable cohort);	1. Transmission - number of infections	1. Students 2. General population	Not specified

					3) class sizes are cut in half, and each half attends two staggered days each week; 4) class sizes maintained, and half the school attends two staggered days each week according to grade groups; 5) students and faculty wear masks; 6a) faculty and/or students are tested with 85% sensitivity on a weekly or 6b) monthly basis53, with positive cases isolated and their class quarantined for 14 days."			
Hoehl 2020	Observational	1. Surveillance and response measures - testing	1. Teachers	21 - 67 years (teachers)	Not relevant - this is an observational study that	1. Other - diagnostic test accuracy	1. Teachers	The 7-day local incidence of SARS-CoV-

					assess accuracy of antigen tests			2 infections in the general population was 9 to 348 cases per 100000 inhabitants.
Isphording 2020	Quasi-experimental	1. Measures to reduce contacts - staggered start, break, finish times; formation of cohorts; cancellation of activities 2. Meausres making contacts safer - masks; handwashing; physical distancing; modification of activities 3. Structural/environmental measures - ventilation 4. Surveillance and response measures - testing; isolation/quarantine	1. Students 2. Teachers 3. General population	6 - 19 years	Free testing: Yes/No Quarantine: Yes/No	1. Transmission - number of cases avoided due to the intervention	1. Students	Very low community spread Schools re-opened during a time of in general low infection rates and cannot be interpreted as the flip side of school closures during the peak of the pandemic.
Landeros 2020	Modelling	1. Measures to reduce contacts - alternating	1. Students 2. Staff	Under 18 years	Three scenarios 1) reopening at full capacity	1.Transmission - reproductive number;	1. Students 2. Staff	Not specified

		attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing 3. Structural/environmental measures - physical distancing measures; enhanced cleaning measures; enhanced ventilation measures 4. Surveillance and response measures - testing; isolation, reactive school closures	(members of the school community)		2) allowing half of all children to return to in-person schooling while the other half continues with remote learning(parallel cohorts) 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts)	cumulative prevalence 2. Transmission - epidemic progression	(members of the school community) 3. General population	
Lyng 2020	Modelling	1. Surveillance and response measures - testing	1. School population (unspecified)	Not specified	Various scenarios of test sensitivity and specificity, testing frequency, cost, and sample pooling	1. Transmission - number or proportion of infections 2. Economic, social, ecological - cost	1. General population	Not specified
Naimark 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts	1. School population (unspecified)	2 - 17 years	Two school reopening scenarios: 1) counterfactual scenario in	1. Transmission - number or proportion of infections 2. Educational -	1. Students 2. General population	We modelled three community-based NPI

		2. Measures making contacts safer - masks 3. Surveillance and response measures - isolation; reactive closure			which schools did not reopen on September 15, 2020 2) Schools re-opened on September 15, 2020, (scenario B) but with several measures in place to limit within-school transmission of COVID-19:	number of reactive classroom closures		scenarios (1,2 and 3, eTable 3) in Ontario at the beginning of October 2020, in response to rising confirmed daily case incidence from 185 on September 1st to 675 on September 30th
Panovska-Griffiths 2020	Modelling	1. Measures to reduce contacts - alternating attendance; phased reopening 2. Surveillance and response measures - testing and tracing; isolation	1. Students (primary and secondary) 2. General population	Primary school: 4 - 5 years, 5 - 6 years, 10 - 11 years; Secondary school: 14 - 15 years; 17 - 18 years All students: 4 - 18 years	Six different scenarios Combination of two school reopening strategies (full time and a part-time rota system with 50% of students attending school on alternate weeks) and three testing scenarios (68%	1. Transmission - timing of second wave of infection 2. Other - proportion of people that need to be tested	1. General population	Not specified

					contact tracing with no scale-up in testing, 68% contact tracing with sufficient testing to avoid a second COVID-19 wave, and 40% contact tracing with sufficient testing to avoid a second COVID-19 wave).			
Panovska-Griffiths 2020 Preprints	Modelling	1. Measures making contacts safer - masks 2. Surveillance and response measures - testing; tracing; isolation	1. Students 2. School staff (unspecified)	12 - 19 years	Two scenarios: 1. 50% coverage of face coverings in schools (only secondary schools); 30% efficacy of face coverings 2. 50% coverage of face coverings in schools (only secondary schools), 60% efficacy of face coverings	1. Transmission - timing of second wave of infection	1. Students (ages 12-19)	Not specified
Tupper 2020	Modelling	1. Surveillance and response measures - testing; tracing; isolation	1. Students	5 - 18 years	Reponse to one positive student in a contact group (5	1. Transmission - number or proportion of	1. Students	Not specified

					students per group) Scenario 1 ("BAseline"): no further action is taken. Symptomatic student are remain home and cannot infect other students, but the class continues to operate so that any other presymptomatic or asymptomatic students may infect others. Scenario 2 ("Contact") only the studens in the contact group are isolated (sent home from the class) and no longer able to infect other students. It is possible for any number of groups to be	infections (cluster size)		

					isolated, and under this protocol those decisions are made independently. Scenario 4 ("Whole class"): In the whole class protocol, when a symptomatic student receives a positive test result, all students are isolated and further transmission is prevented Response to two or more contact groups being detected ("two groups is an outbreak") Scenario 3: In the two groups is an outbreak protocol, as in the contact model, groups			

					with a student receiving a positive test are isolated an outbreak is declared and all students go into isolation, preventing any further transmission Additionally modelling of three scenarios in combination: symptomativ vs. asymptomatic index case; low/high infectiousness index case; low/high transmission environment/activity			
Williams 2020	Modelling	1. Surveillance and response measures - testing; isolation	1. School population (unspecified)	Not specified	Six Series: Series A: no sampling Series B: simple random sampling in the general	1. Transmission - number of cases	1. School population (unspecified)	Not specified

					population, regardless of symptoms, to select individual agents for testing; If a selected agent tests positive, they are isolated with complete efficacy for two weeks. Series C: cluster sampling on communities. The same proportion of each community is selected for testing. Once the community proportion is calculated, individual agents from each community are randomly selected for testing. Series D: uses cluster sampling on schools. The same proportion			

					of each school is selected for testing, except in cases where schools are small, in which case at least one student is selected from each school. Because the D series concentrates on schools, only school-aged agents are selected for testing and adults are never selected. Series E: pooled sampling with pools of two people each. All agents are placed into pools of two people with others in their community. Pools are randomly sampled from the population			

					for testing. If a pool tests positive (i.e. either agent in the pool is infected), then both agents in the pool are subject to isolation. Series F: pooled sampling with pools of five people each. All agents are placed into pools of five people with others in their community. Pools are randomly sampled from the population for testing. If a pool tests positive (i.e. any one one agent in the pool is infected), then all agents in the pool are subject to isolation.			

					Three scenarios within the six series: Scenario 1: isolates only the agents who are sampled with STQ procedures and test positive (“tested-positive” agents). Scenario 2: isolates the tested-positive agents and their household members Scenario 3: isolates the tested-positive agents, symptomatic agents, and the household members of both			

Tabelle 2: Summary of Findings Tabelle

Outcome	Number of studies	Summary of findings	Certainty of evidence	Comments
Outcome category: Transmission				
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	6 modelling studies (Cohen 2020, Di Domenico 2020, Head 2020, Lyng 2020, Tupper 2020) Williams 2020	Six studies assessed the impact of testing and isolation/quarantine on the number of cases. Overall, the studies demonstrated that implementing measures to detect, trace, and quarantine cases within schools could lead to reductions in the COVID-19 infection/transmission rate among students, teachers, and staff. These measures were often implemented alongside other transmission mitigation measures such as physical distancing and cohorting strategies which may have moderated the effects of the testing and isolation strategies.	Low ⊕⊕◯◯	Downgraded for indirectness, due to no reporting of external validation in all included studies. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.
	1 experimental study (Isphording 2020)	This study found that school reopenings, under strict mitigation strategies, did not increase the number of cases after the summer closure. Multiple measures were implemented and studied alongside each other, therefore it is not possible to say whether testing and isolation measures alone were effective at reducing or minimizing transmission.	Low ⊕⊕◯◯	Downgraded for risk of bias due to moderate ROBINS-I assessment Downgraded for inconsistencies due to only study reporting on the outcome of interest
Epidemic progression	3 modelling studies (Landeros 2020, Panovska-Griffiths 2020, Panovska-Griffiths 2020_Preprints)	The three studies that assessed the impact of testing and isolation strategies on the timing and progression of the epidemic found that testing and isolation could slow or prevent a second wave of the epidemic. The studies suggest that the timing of the epidemic depends on the degree to which testing and isolation strategies are been implemented and the combination of testing and tracing.	Low ⊕⊕◯◯	Downgraded for risk of bias due to moderate quality concerns in some studies related to the appropriateness of the model's structural elements, the input parameters, and the adequacy of assessment of the model's uncertainty Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.

Deaths	1 modelling study (Bracis 2020)	This study found that that opening schools was likely to more rapidly increase the death count if the only existing policy is diagnosing and isolating symptomatic cases, as opposed to a scenario where asymptomatic testing and tracing strategies were implemented.	Low ⊕⊕◯◯	Downgraded for inconsistencies due to only study reporting on the outcome of interest. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.
Resources (cost, human resources)	1 health economic analysis (Campbell 2020)	One study found that universal testing for at-risk populations would cost $1.3 billion for each round of testing. Surveillance testing helps to understand the extant and dynamics of SARS-CoV-2 in at-risk population and can be completed at a lower cost. Testing of at-risk groups, in particular testing all 6,012,144 students and employees in primary and secondary schools over 1.5 months would require an added 20,956 health care professionals, 22,950 clerical staff and 2462 laboratory staff, costing $816.0 million.	Low ⊕⊕◯◯	Downgraded for inconsistencies due to only study reporting on the outcome of interest. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.
Resources (Cost per person)	1 modelling study (Lyng 2020)	One study looked at cost of a test per person. The model assumes a perfect compliance to isolation protocols. At sensitivities of 98% the models predict that a two-day delay in results will result in a just a 59% reduction in infections experienced at a 14-day testing frequency. As the testing frequency is increased, the number of missed infections reduces rapidly by >99% from no testing at all to a daily testing frequency, even with the two-day delay. Increasing testing frequency was associated with a non-linear positive effect on cases averted over 100 days. While precise reductions in cumulative number of infections depended on community disease prevalence, testing every 3 days versus every 14 days (even with a lower sensitivity test) reduces the disease burden substantially. Pooling provided cost savings and made a high-frequency approach practical; one high-performing strategy, testing every	Low ⊕⊕◯◯	Downgraded for inconsistencies due to only study reporting on the outcome of interest. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.

		3 days, yielded per person per day costs as low as $1.32		
Number or proportion of cases requiring intensive care	1 modelling study (Di Domenico 2020)	This study found that reopening schools in any reopening scenario would lead to increases in ICU admissions, and that the number of admissions would increase with increased school reopening. Community or school-based testing may influence the number of admissions but it is not possible to assess this from this study.	Very low ⊕◯◯◯	Downgraded for inconsistencies due to only study reporting on the outcome of interest. Downgraded twice for indirectness as it is not possible to assess whether the testing intervention would lead to outcomes.
Number of days spent in the classroom	1 modelling study (Gill 2020)	One study looked at the number of days spent in the classroom in scenarios where testing and isolation measures were implemented and found that community infection rates are more disruptive to schools operating full-time in person than to schools using hybrid approaches. Students in a hybrid secondary school will miss fewer days due to quarantines than students in schools that are fully open. Policies that close the school when infections are detected substantially reduce the total number of days that students can attend in person. These effects are larger in schools operating full-time than in schools using hybrid approaches. In secondary schools where students are attending daily and the community infection rate is at a moderate level, closing the school for 14 days for each detected infection would be highly disruptive. Even in the absence of a school closure policy, quarantines of the classmates and bus-mates of infected students are likely to reduce in-person attendance for the typical student.	Low ⊕⊕◯◯	Downgraded for inconsistencies due to only study reporting on the outcome of interest. Downgraded for imprecision, due to a wide range of plausible effects and some of the effects not being provide.

Tabelle 3: Übersicht nach Studien

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	6 modelling studies (Cohen 2020, Di Domenico 2020, Head 2020, Lyng 2020, Tupper 2020) Williams 2020	Cohen 2020: This study used an agent-based mathematical model of COVID-19 transmission and interventions to quantify the impact of school reopening on disease transmission in the USA. The study compared seven school re-opening strategies implemented with and without countermeasures within schools. The countermeasures that were implemented were face masks, maintaining at least 6 feet of physical distance between people in the school, and hand-washing, along with screening, testing, and contact tracing. The study found that that implementing countermeasures that limit transmission and detect, trace, and quarantine cases within schools would lead to reductions in the cumulative COVID-19 infection rate among students, teachers, and staff over 4-fold, at a case detection rate of 110 per 100,000. However, these measures were implemented alongside classroom cohorting, fask masks, physical distancing, and handwashing protocols in schools so it is not possible to comment on the impact of these measures alone. Di Domenico 2020: This study uses a stochastic discrete age-structured epidemic multi compartmental (SEIR+) model to evaluate the expected impact of reopening schools in the Île-de-France region under several scenarios of partial, progressive, or full school reopening, coupled with moderate social distancing interventions and large-scale tracing, testing, and isolation. They model for 50% of the cases being isolated and conduct a sensitivity analysis for 25% of cases being isolated. The authors provide no effect estimates for testing, tracing and isolation, but provide results in a graphical way for both assumptions (25% and 50% case isolation). Reopening schools maintaining the epidemic under control would however fast and massive tracing and testing of cases to allow their isolation but it is unclear if testing is more effective at the school level or in the community. Head 2020: This study uses an agent-based SEIR model to simulate COVID-19 transmission under observed conditions and counterfactual intervention scenarios between March 17-June 1, and evaluated various school reopening strategies using data from the Bay area in California, USA. One of the modelled scenarios was that schools) faculty and/or students are tested with 85% sensitivity on a weekly or monthly basis, with positive cases isolated and their class quarantined for 14 days. The study

		found that in the absence of other interventions, testing and isolation/quarantine strategies have low effectiveness, but when combined with strict social distancing measures, a modest reduction in community cases is possible as infectious individuals and their contacts identified in the school environment are quarantined (i.e., have their community contacts reduced by 75% for 14 days). Lyng 2020: This study used a susceptible, infectious, removed (SIR) compartmental model to simulate COVID-19 transmission, modelling the impact of variables including test sensitivity, testing frequency, results lag, sample pooling, disease prevalence, externally-acquired infections, and test cost on outcomes case reduction in the USA. The model assumes a perfect compliance to isolation protocols. At sensitivities of 98% the models predict that a two-day delay in results will result in a just a 59% reduction in infections experienced at a 14-day testing frequency. As the testing frequency is increased, the number of missed infections reduces rapidly by >99% from no testing at all to a daily testing frequency, even with the two-day delay. Increasing testing frequency was associated with a non-linear positive effect on cases averted over 100 days. While precise reductions in cumulative number of infections depended on community disease prevalence, testing every 3 days versus every 14 days (even with a lower sensitivity test) reduces the disease burden substantially. Tupper 2020: This study uses a stochastic individual-based model to model the effects of surveillance measures to reduce transmission of SARS-CoV-2 in schools in Canada. The measures were testing: weekly or every three day testing or environmental monitoring covering all individuals in the class, and a series of isoation/quarantine scenarios in response to one positive student in a group of 5: 1) (baseline): no further action is taken. Symptomatic student are remain home and cannot infect other students, but the class continues to operate so that any other presymptomatic or asymptomatic students may infect others; 2) only the studens in the contact group are isolated (sent home from the class) and no longer able to infect other students. It is possible for any number of groups to be isolated, and under this protocol those decisions are made independently; 3) when a symptomatic student receives a positive test result, all students are isolated and further transmission is prevented. The study also modelled a scenario where, in response to two or more contact groups being detected, groups with a student receiving a positive test are isolated an outbreak is declared and all students go into isolation, preventing any further transmission. In all scenarios, if individuals have not already been identified through the relevant protocol,

		transmission stops when symptoms begin as symptomatic individuals do not attend (or they leave when symptoms arise). In scenario 4, the mean cluster size was reduced from 11.9 to 6.5 in the aysmptomatic case, whereas the group and two group protocols reduce it to 8.3 and 7.5 students, respectively. Over all the scenarios the whole class protocol reduced cluster sizes roughly in half, with the contact and two group protocols performing slightly worse. Williams 2020: This study used an agent based model to determine the impact of testing and quarantine strategies on the transmission of COVID-19 in schools in Seattle, Washington, USA. The study modelling multuple scenarios with different testing strategies. Of relevance to the school setting were 1) cluster sampling on schools - the same proportion of each school is selected for testing, except in cases where schools are small, in which case at least one student is selected from each school; 2) pooled sampling with pools of two people each - all agents are placed into pools of two people with others in their community. Pools are randomly sampled from the population for testing. If a pool tests positive (i.e. either agent in the pool is infected), then both agents in the pool are subject to isolation; 3) pooled sampling with pools of five people each - all agents are placed into pools of five people with others in their community. Pools are randomly sampled from the population for testing. If a pool tests positive (i.e. any one one agent in the pool is infected), then all agents in the pool are subject to isolation. In all cases, agents that tested positive were placed in quarantine. Clustering on communities, where the same proportion of each community is selected for testing, performs about the same or even slightly worse when tested-positive and symptomatic agent and their household members were isolated. Under this full isolation scenario, the best sampling procedure where individuals are selected is clustering on schools, where the sameproportion of each school is selected for testing and it is only children who are tested with surveillance/test/quarantine procedures. Isolating household members of individuals who experience symptoms is estimating to avert 2.22 times more symptomatic cases than not isolating them. The multiplicative effect is slightly higher for surveillance/test/quarantine scenarios and highest for cluster sampling on schools, where 3.37 times more symptomatic cases are averted by isolating household members.
	1 experimental study (Isphording 2020)	Isphording 2020: This study investigated the spread of COVID-19 during staggered school reopenings comparing a control group to intervention after summer holidays across German federal states (from Aug to Sept 2020). Three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27 percent of a standard

		deviation within experimental group vs control group. The effect is strongest in the youngest age group of 0–14 year-old cases where the end of summer breaks is associated with a significant reduction in cases per 100K population of about 1.4 cases after 3 weeks for individuals up to 14 years (42 percent of a standard deviation). Reductions for older age groups are smaller and insignificant: 0.82 cases in the group of 15–34 years (21 percent of a standard deviation) and 0.43 cases in the group of 35–59 years (16 percent of a standard deviation). The more vulnerable population of 60+ years appears to be unaffected by the school openings. Free testing in schools was a minimum requirement for five states, was limited in five states, specified not to be a minimum requirement in one state and data were missing for four states. However, effects of individual interventions cannot be disaggregated and results were not reported separately by state.
Epidemic progression	3 modelling studies (Landeros 2020, Panovska-Griffiths 2020, Panovska-Griffiths 2020_Preprints)	Landeros 2020: This study used a multi compartmental model to model the impact of various school reopening scenarios in the USA. Multiple measures were assessed including measures to make contacts safer (masks and hand washing policies), measures to reduce contacts (rotating cohorts and outdoor instruction), infrastructural measures (cleaning, ventilation, desk shields), and surveillance (closing schools once a threshold for cumulative prevalence had been reached). The study found that reopening with a surveillance program in place may provide 10 to 12 weeks of continuous instruction with low infection risk. Infections after closing are driven by a lack of interventions outside of school; testing and isolation in this context can curtail this growth. In general, the results support the importance of testing and complete school closure in preventing a major disease outbreak after reopening. Overall, this model also shows that reduction of class density and the implementation of rapid viral testing, even with imperfect detection, have greater impact than moderate measures for transmission mitigation. Panovska-Griffiths 2020: This study used COVASIM: stochastic agent-based simulator to model the effects of a testing (sufficient and insufficent testing; 100% SE/SP; delay of 1 day to receive the test result); tracing(68% and 40% contact tracing); and isolation (immediately be isolated for 14 days.), alongside a phased reopening or alternating attendance strategy in the UK. The findings suggest that it might be possible to avoid a second pandemic wave across both school reopening scenarios if enough people with symptomatic infection can be tested, and contacts of those diagnosed can be traced and effectively isolated. Assuming 68% of contacts could be traced, the study estimates that 75% of those with symptomatic infection would need to be tested and

		isolated if schools return full time in September, or 65% if a part-time rota system were used. If only 40% of contacts could be traced, these figures would increase to 87% and 75%, respectively. Across both scenarios of school reopening and different tracing levels, the test–trace–isolate strategy would need to test a sufficiently large proportion of the population with COVID-19 symptomatic infection and trace their contacts with sufficiently large coverage, for R to diminish below 1. Specifically, the simulations suggest that the timepoint at which R diminishes depends on the degree to which the test– trace–isolate strategy had been implemented and the combination of testing and tracing. Panovska-Griffiths 2020_Preprints: This study extended the previous modelling of COVID-19 transmission through individuals' contact networks adapted to the UK context using COVASIM: stochastic agent-based simulator. Test and trace models, combined with mask wearing in the community and secondary schools were modelled. Results suggest that there is a greater benefit of mandatory masks in secondary schools if the effective coverage of masks is high (30%). Under current testing and tracing levels (24% testing, 47% tracing) and masks' effective coverage of 30%, the predicted second COVID-19 wave would be less than half of the original wave if masks were mandatory in secondary schools as well as used in community settings. The minimum testing levels necessary to avoid a second wave, under scaled up TTI, is 8-11% less when masks are mandatory in schools than if they are not, depending on the effective coverage of masks. The simulations suggest that the timepoint at which R diminishes depends on the degree to which the test– trace–isolate strategy had been implemented and the combination of testing and tracing.
Deaths	1 modelling study (Bracis 2020)	Bracis 2020: This study used a deterministic age-stratified compartment model to simulate COVID-19 transmission during and after various reopening scenarios in King County, USA, where physical distancing (a cumulative of reduced physical contacts, hand hygiene policies and face masks) and test and isolation are in place from May to July 2020. Simulations of schools reopening demonstrate the need to maintain physical interactions below 60% and to include effective contact tracing to the intervention strategies against COVID-19. The modelleing demonstrates that opening schools is likely to more rapidly increase the death count to more than 15 per day if the only existing policy is diagnosing and isolating symptomatic cases with the Best Fit parametrization crossing that threshold Sept. 22 and 46% of the parameterizations crossing that threshold compared to only 17% with the baseline scenario. In comparison, school reopening shows little impact if early infections are identified

		through contact tracing with only 1% of the parameterizations reaching 15 daily deaths by the end of 2020. This result suggests that at moderate physical interactions of 60%, school opening is only possible with successful contact tracing.
Resources (cost, human resources)	1 modelling study (Campbell 2020)	Campbell 2020: This study used a health economic analysis of different scenarios of surveillance testing in Canadian schools ranging from universal testing to targeting at risk populations over various time frames. Results show that universal testing for at-risk populations would cost $1.3 billion for each round of testing. Surveillance testing helps to understand the extant and dynamics of SARS-CoV-2 in at-risk population and can be completed at a lower cost. Testing of at-risk groups, in particular testing all 6,012,144 students and employees in primary and secondary schools over 1.5 months would require an added 20,956 health care professionals, 22,950 clerical staff and 2462 laboratory staff, costing $816.0 million. A strategy of actively testing large population groups who are at increased risk of acquiring SARS-CoV-2 is feasible and affordable in Canada. This testing approach should be an integral component of a broad strategy to allow all Canadians to return safely to work and school.
Resources (Cost per person)	1 modelling study (Lyng 2020)	Lyng 2020: This study used a susceptible, infectious, removed (SIR) compartmental model to simulate COVID-19 transmission, modelling the impact of variables including test sensitivity, testing frequency, results lag, sample pooling, disease prevalence, externally-acquired infections, and test cost on outcomes case reduction in the USA. The model assumes a perfect compliance to isolation protocols. At sensitivities of 98% the models predict that a two-day delay in results will result in a just a 59% reduction in infections experienced at a 14-day testing frequency. As the testing frequency is increased, the number of missed infections reduces rapidly by >99% from no testing at all to a daily testing frequency, even with the two-day delay. Increasing testing frequency was associated with a non-linear positive effect on cases averted over 100 days. While precise reductions in cumulative number of infections depended on community disease prevalence, testing every 3 days versus every 14 days (even with a lower sensitivity test) reduces the disease burden substantially. Pooling provided cost savings and made a high-frequency approach practical; one high-performing strategy, testing every 3 days, yielded per person per day costs as low as $1.32.
Number or proportion of cases requiring intensive care	1 modelling study (Di Domenico 2020)	**Di Domenico 2020: This study uses a stochastic discrete age-structured epidemic multi compartmental (SEIR+) model to evaluate the expected impact of reopening schools in the Île-de-France region under several scenarios of partial, progressive, or full school reopening, coupled with moderate social distancing interventions and large-scale tracing, testing, and isolation. Measures reducing opportunity for contacts. The study modelled three phased reopening scenarios:**

		1) Partial reopening with at most 50% of students return to school, with a rotation of students every half of the week or every week, or considering 50% attending in the morning and 50% in the afternoon; 2) Progressive reopening with an attendance of 25% in the first week that gradually increases over the following weeks, up to 50% (partial attendance) or 100% (full attendance); 3) Full reopening. Reopening pre-schools and primary schools would increase the number of new clinical cases at the start of summer holidays (July 5) 2 to 3.2 times the number expected with schools closed. With pre-schools and primary schools in session starting May 11, ICU occupation would remain below the foreseen 1,500-bed capacity (at most 72% [62, 80]%) , as long as middle and high schools limit students' attendance or reopen one month later. Healthcare system would exceed foreseen capacity (136% [119%, 151%]) if middle and high school reopen earlier in May accepting all students. Adopting a progressive protocol for adolescents starting May 11 would delay the increase in the epidemic activity, but largely engage the healthcare system by mid-summer (ICU occupancy at 92% [80%, 103%]). There is no specific description of where testing, tracing, and isolation would occur (in the community or in schools), but the authors state that in either case, even with 25% case detection and isolation, ICUs would be overwhelmed. Modelling results for school reopening scenarios are obtained considering moderate social distancing interventions coupled with 50% case isolation.
Number of days spent in school	1 modelling study (Gill 2020)	**Gill 2020:** This study uses an agent based model to simulate the spread of COVID-19 in schools under a range of different scenarios for reopening schools in the USA. The study modelled multiple reopening scenarios, including: 1) normal school attendance; 2) daily attendance with precautions (eg masks in bus and during schoolday); 3) daily attendance with precautions and block scheduling; 4) daily attendance with precautions and students "podded" in one classroom; 5) rotating two days per week with precautions; 6) weekly four-day rotations; 7) rotating one day per week students devided in 5 small groups. Across all scenarios, he study models three different school responses to detected infections: quarantining of close contacts without school closure, quarantining of close contacts with a three-day closure for deep cleaning, and quarantining of close contacts with a 14-day closure to (temporarily) eliminate the possibility of further transmission in the school. High community infection rates are more disruptive to schools operating full-time in person than to schools using hybrid approaches, as can be seen in the slower rate of attendance decline for Scenarios 5, 6, and 7 as the community infection rate increases from low (10 cases per 100,000 per

		week, on the left of each scenario's set of bars) to high (175 cases per 100,000 per week, on the right of each scenario's set of bars). Even at 100 reported community infections per 100,000 per week (represented by the fourth of the five bars in each operating scenario), the typical student in a hybrid secondary school (Scenarios 5, 6, and 7) can expect to miss only a very few days due to quarantines, while the typical student in a secondary school open full-time with precautions (Scenario 2) might be sent home for about 15 percent of possible days due to quarantines. Delays in testing would have large effects in schools implementing no precautions: as testing turnaround time increases from zero to 10 days from left to right, the number of infections in the school increases substantially (in a community with a moderate infection rate of 50 per 100,000 per week and a school that is quarantining close contacts but not shutting down). Policies that close the school (for 3 days or 14 days) when infections are detected substantially reduce the total number of days that students can attend in person. These effects are larger in schools operating full-time than in schools using hybrid approaches because schools using hybrid approaches experience fewer infections that lead to quarantines or closures. In secondary schools where students are attending daily and the community infection rate is at a moderate level (50 per 100,000 per week), closing the school for 14 days for each detected infection would be highly disruptive, such that the typical student would be able to attend only about half of all school days. Even in the absence of a school closure policy, quarantines of the classmates and bus-mates of infected students are likely to reduce in-person attendance for the typical student by about 10 percent in a school open full-time with precautions.

Schlüsselfrage: Ventilation

Tabelle 1: Übersicht über inkludierte Studien

Study ID	Methods	Intervention	Population group targeted by intervention	Age group of population targeted by the intervention	Comparison	Outcomes	Population in which outcomes are assessed	Level of community transmission
Bershteyn 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; physical distancing; modification of activities 3. Surveillance and response measures - daily symptom screening, active testing, reactive school closures, quarantine 4. Structural/environmental - enhanced ventilation	1. Students 2. Teachers	Not specified	Not specified	1. Transmission - attack rate	1. Students 2. Teachers	
Curtius 2020	Modelling/Experimental	1. Structural/environmental - enhanced ventilation (air purifier)	1. Students 2. Teachers	Secondary school students (10-19 years)	Not specified	1. Transmission - Concentration of aerosol particles containing virus RNA in the room, Inhaled dose of virus RNA for a susceptible person	1. Students 2. Teachers	Not specified
Isphording 2020	Quasi-experimental	1. Measures to reduce contacts - staggered start,	1. Students 2. Teachers	Primary and secondary	Airing (not specified)	1. Transmission - number of cases	1. Students	"Very low community

		break, finish times; formation of cohorts; cancellation of activities 2. Meausres making contacts safer - masks; physical distancing; modification of activities 3. Structural/environmental measures - ventilation 4. Surveillance and response measures - testing; isolation/quarantine	3. General population	school in Germany (6 - 19 years)		avoided due to the intervention		spread" Schools re-opened during a time of in general low infection rates and cannot be interpreted as the flip side of school closures during the peak of the pandemic.
Landeros 2020	Modelling	1. Measures to reduce contacts - alternating attendance; formation of cohorts 2. Measures making contacts safer - masks; handwashing; modification of activities 3. Structural/environmental measures - physical distancing measures; enhanced cleaning measures; enhanced ventilation measures 4. Surveillance and response measures - testing; isolation, reactive school closures	1. Students 2. Staff (members of the school community)	Under 18 years	Three scenarios 1) reopening at full capacity 2) allowing half of all children to return to in-person schooling while the other half continues with remote learning(parallel cohorts) 3) alternating sessions in which different cohorts of students attend school by the week (rotating cohorts)	1.Transmission - reproductive number; cumulative prevalence	1. Students 2. Staff (members of the school community) 3. General population	Not specified

Tabelle 2: Summary of Findings Tabelle

Outcome	Number of studies	Summary of findings	Certainty of evidence
Outcome category: Transmission			
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	2 modelling studies (Bershteyn 2020, Landeros 2020)	Ventilation is considered alongside other measures and thus it is not possible to draw any conclusions with regards to the effect of ventilation.	Very low ⊕◯◯◯
	1 quasi-experimental study (Isphording 2020)	Ventilation is considered alongside other measures and thus it is not possible to draw any conclusions with regards to the effect of ventilation.	Low ⊕⊕◯◯
Concentration of aerosol particles containing virus RNA in the room and Inhaled dose of virus RNA for a susceptible person	1 modelling study (Curtius 2020)	One study assessed the effect of four air purifiers equipped with HEPA filters in a high school classroom in Germany with an infected person in the room with regards to the inhaled dose of particles containing virus RNA. This dose is reduced by a factor of six. The density of people in the room can be considered an effect modifier.	Very low ⊕◯◯◯

Tabelle 3: Übersicht über die zum Outcome beitragenden Studien

Outcome	Number of studies	Overview of effect by study
Outcome category: Transmission		
Cases avoided due to the intervention: e.g., number, proportion, attack rate of cases observed or predicted with and without the intervention	2 modelling studies (Bershteyn 2020, Landeros 2020)	**Bershteyn 2020:** This study modelled the impact of multiple policies implemented in schools by referring to global benchmarks for the secondary attack rate (SAR) of SARS-CoV-2 by simulating the potential for transmission with each policy. The study used data from Germany, Israel and South Korea, Among others, the study looked at ventilation only as part of a broader summary of 'infection control' measures and we therefore cannot assess specific effects of ventilation. **Landeros 2020:** This study used a multi compartmental model to model the impact of various school reopening scenarios in the USA. Multiple measures were assessed including measures to make contacts safer (masks and hand washing policies), measures to reduce contacts (rotating cohorts and outdoor instruction), infrastructural measures (cleaning, ventilation, desk shields), and surveillance (closing schools once a threshold for cumulative prevalence had been reached). Mask wearing, handwashing, cleaning, ventialation, and general physical distancing policies were assessed together in this study and it is not possible to assess the impact of each individual measure.
	1 quasi-experimental study (Isphording 2020)	**Isphording 2020:** This study investigated the spread of COVID-19 during staggered school reopenings comparing a control group to intervention after summer holidays across German federal states (from Aug to Sept 2020). Three weeks after school openings, cases per 100,000 people decreased by 0.55 or 27 percent of a standard deviation within experimental group vs control group. The effect is strongest in the youngest age group of 0–14 year-old cases where the end of summer breaks is associated with a significant reduction in cases per 100K population of about 1.4 cases after 3 weeks for individuals up to 14 years (42 percent of a standard deviation). Reductions for older age groups are smaller and insignificant: 0.82 cases in the group of 15–34 years (21 percent of a standard deviation) and 0.43 cases in the group of 35–59 years (16 percent of a standard deviation). The more vulnerable population of 60+ years appears to be unaffected by the school openings. Airing/ventilation was a minimum requirement for 11 states and data were missing for four states. However, effects of individual interventions cannot be disaggregated and results were not reported separately by state.
Concentration of aerosol particles containing virus RNA in the room, Inhaled dose of virus RNA for a susceptible person	1 modelling study (Curtius 2020)	**Curtius 2020**: This study comprised an experimental design, combined with elements of modelling to test the efficiency and practicability of operating four air purifiers equipped with HEPA filters in a high school classroom in Germany while regular classes were taking place. Using air purifiers with an air

		exchange rate of 5.7 h-1 and equipped with HEPA filters (H13 or H14), for a person spending two hours in a room with an infectious person, the inhaled dose of particles containing virus RNA is reduced by a factor of six. Air purifiers can reduce the aerosol load in a classroom in a fast, efficient and homogeneous way and reduce the risk of aerosol infection. Other factors which need to be considered include the noise levels of the air purifiers and their maintenance, such as regular cleaning.

AWMF S3-Leitlinie Schulmaßnahmen & COVID-19
Evidenzpakete indirekte Evidenz, Hintergrundevidenz

Über dieses Dokument

Sehr geehrte Kolleginnen und Kollegen,

mit den beigefügten Studien möchten wir Ihnen die Arbeit an Ihrer Schlüsselfrage erleichtern. Neben der direkten Evidenz, die wir Ihnen separat zur Verfügung stellen, finden Sie hier weiterführende, indirekte Evidenz. Auf der nächsten Seite haben wir systematische Übersichtsarbeiten bereitgestellt, die für den Kontext der Leitlinie allgemein relevant sind, danach sind ergänzende relevante systematische Übersichtsarbeiten für die Schlüsselfragen aufgelistet. Zum Teil sind diese um bestehende Leitlinien/Empfehlungen und Primärstudien ergänzt.

Das methodische Vorgehen unserer Suchen ist unter 4. dargestellt. Wir möchten darauf hinweisen, dass die Suchen nach systematischen Übersichtsarbeiten systematisch und umfassend waren, während die Primärstudien, die wir zum Teil bereitstellen, nicht in einer systematischen Suche nach Primärstudien identifiziert wurden.

Für Rückfragen stehen wir gerne zur Verfügung.

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Inhalt

Hintergrund, Evidenz für alle Schlüsselfragen

Systematische Reviews			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Viner et al, 2020	Systematic review of reviews of symptoms and signs of COVID-19 in children and adolescents (Link)	9 Oct 2020	systematic review of reviews of the prevalence of symptoms and signs of COVID-19 in those aged under 20 years.
Viner et al, 2020	Susceptibility to SARS-CoV-2 Infection Among Children and Adolescents Compared With AdultsA Systematic Review and Meta-analysis (Link)	July 28 2020	systematic review aiming to "systematically review the susceptibility to and transmission of SARS-CoV-2 among children and adolescents compared with adults"
ECDC 2020	COVID-19 in children and the role of school settings in transmission-first update (Link)	n.a., report published 23/12/2020	very recent ECDC report (not a formal systematic review) examining a broad evidence base including certainty of the evidence (qual appraisal not formalised). **Evidence-based summaries of important background details**: 1) What is the epidemiology of SARS-CoV-2 in children? 2) What is known about children and transmissionof SARS-CoV-2 in household and community settings? 3) What is known about SARS-CoV-2 transmission in school settings? 4) What can be done to mitigate SARS-CoV-2 transmission in school settings? 5) What is the impact of school closures?
Brooks et al, 2020	The impact of unplanned school closure on children’s social contact: rapid evidence review (Link)	5 Feb. 2020	rapid systematic review summarising the existing literature on children's activities and social contacts made outside the home during unplanned school closures.
Lo Moro et al, 2020	Reopening Schools during the COVID-19 Pandemic: Overview and Rapid Systematic Review of Guidelines and Recommendations on Preventive Measures and the Management of Cases (Link)	20 Oct 2020	"This overview aimed to describe the main measures planned for the 2020–2021 academic year within the WHO European Region" based on a rapid systematic review and review of guidelines from the European region
Chu et al (Schuenemann Review), 2020	Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis (Link)	May 3, 2020	largest systematic review and meta-analysis to date drawing exclusively on SARS and MERS studies to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses

Sytematische Übersichtsarbeiten (preprint)			
Walsh et al, 2021	Do school closures reduce community transmission of COVID-19? A systematic review of observational studies (Link)	12 Oct 2020, preprint published 4 Jan 2021	systematic review including observational data from the COVID-19 pandemic only to estimate effectiveness of school closures on community transmission of SARS-CoV-2; results: "Effect sizes ranged from no association to substantial and important reductions in community transmission."

Leitlinien/Empfehlungen			
Robert-Koch-Institut, 2020	Präventionsmaßnahmen in Schulen während der COVID-19-Pandemie (Link)	n.a. Veröffentlichung am 12.10.2020	RKI Empfehlungen für alle "für den Schulbetrieb und für Gesundheit und Hygiene an Schulen verantwortliche Personen"

Tragen eines Mund-Nasen-Schutzes

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Chu et al (Schueneman n Review), 2020	Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis (link)	May 3, 2020	largest systematic review and meta-analysis to date drawing exclusively on SARS and MERS studies to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses
Li et al, 2020	Face masks to prevent transmission of COVID-19: A systematic review and meta-analysis (Link)	10 October 2020	systematic review and meta-analysis to evaluate the effectiveness of masks to prevent SARS-CoV-2 transmission in health care workers and non-HCW, meta-analysis of 6 studies; evidence from cohort and case control studies

Weitere Reviews			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Rohde, 2020	Effectiveness of face masks worn in community settings at reducing the transmission of SARS-CoV-2: A rapid review (Link)	27 August 2020	"aim of this review was to synthesise direct evidence on the effectiveness of wearing face masks at reducing the transmission of SARS-CoV-2 in community settings."
Bakhit, 2020	Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis (Link)	18 May 2020	SR seeking to "identify, appraise, and synthesise studies evaluating the downsides of wearing facemasks in any setting."

Leitlinien, Empfehlungen			
WHO, 2020	Advice on the use of masks for children (Link)		

Lüften und Luftreinigung

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Chu et al, 2020	Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis (Link)	May 3, 2020	large systematic review and meta-analysis including only SARS&MERS studies to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses;
Guo, 2020	Review and comparison of HVAC operation guidelines in different countries during the COVID-19 pandemic (Link)	n.r. (article submitted 10 July 2020)	non-systematic review of HVAC and ventilation guidelines for COVID-19 prevention

Weitere Reviews			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Morawska	How can airborne transmission of COVID-19 indoors be minimised? (Link)	n.a. (article submitted 20 April 2020)	not a systematic review, detailed overview article
Li, 2007	Role of ventilation in airborne transmission of infectious agents in the built environment - a multidisciplinary systematic review (Link)	2005	somewhat dated systematic review that investigates minimum ventilation requirements to minimise the transmission of airborne infectious diseases in different indoor environments (some health, some offices and schools)
Hoover, 2020	Balancing incomplete COVID-19 evidence and local priorities: risk communication and stakeholder engagement strategies for school re-opening (Link)	n.r. (published 01 oct)	In this mini-review, we discuss ventilation as a potentially valuable engineering control for educational institutions preparing to resume operations.
Mousavi, 2020	COVID-19 Outbreak and Hospital Air Quality: A Systematic Review of Evidence on Air Filtration and Recirculation (Link)	n.r. (article submitted 26 May 2020)	SR that assesses air filtration and recirculation in healthcare facilities. Includes trials as well as current guidelines. Provides some theoretical background on air-flow

			mechanisms in building ventilation.
Nagraj, 2020	Interventions to reduce contaminated aerosols produced during dental procedures for preventing infectious diseases (Link)	17 September 2020	SR that assesses the effectiveness of methods used during dental treatment procedures to minimize aerosol production and reduce or neutralize contamination in aerosols
Noorimotlagh, 2021	A systematic review of possible airborne transmission of the COVID-19 virus (SARS-CoV-2) in the indoor air environment (Link)	n.r. (article submitted 18 Sept 2020)	The SR was conducted to compile studies on airborne transmission of virus in indoor air. Therefore, some procedures are presented such as improving ventilation, especially in hospitals and crowded places, and observing the interpersonal distance of more than 2 m so that experts in indoor air quality consider them to improve the indoor air environments.

Leitlinien, Empfehlungen			
Umweltbundesamt, 2020	Stellungnahme Kommission Innenraumlufthygiene zu Luftreinigern (Link)	n/a, (veröffentlicht 16.11.2020)	
Umweltbundesamt, 2020	Das Risiko einer Übertragung von SARS-CoV-2 in Innenräumen lässt sich durch geeignete Lüftungsmaßnahmen reduzieren (Link)	n/a (veröffentlicht 12.8.2020)	
DGKH, 2020	Stellungnahme zum Einsatz von dezentralen Luftreinigern (Link)	n/a (veröffentlicht 25.9.2020)	
ECDC	Heating, ventilation and air-conditioning systems in the context of COVID-19: first update (Link)	n/a (published 11.11.2020)	"document provides guidance on heating, ventilation and air-conditioning (HVAC) systems in closed spaces in the context of the COVID-19 pandemic" and includes overview of policies/recommendations across the European countries

Anwesenheitsregelungen bei Erkältungssymptomen

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Viner et al, 2020	Systematic review of reviews of symptoms and signs of COVID-19 in children and adolescents (Link)	9 Oct 2020	systematic review of reviews of the prevalence of symptoms and signs of COVID-19 in those aged under 20 years.
Viner et al, 2020	Susceptibility to SARS-CoV-2 Infection Among Children and Adolescents Compared With AdultsA Systematic Review and Meta-analysis (Link)	July 28 2020	systematic review aiming to "systematically review the susceptibility to and transmission of SARS-CoV-2 among children and adolescents compared with adults"
Struyf, 2020	Signs and symptoms to determine if a patient presenting in primary care or hospital outpatient settings has COVID-19 disease (Link)	27/04/2020	Cochrane SR zu klinischen Symptomen von COVID-19

Quarantäne von Kontaktpersonen

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Nussbaumer-Streit et al., 2020	Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review (Link)	23 June 2020.	Study assessed effects of quarantine (alone or in combination with other measures) of individuals who had contact with confirmed or suspected cases of COVID-19, who travelled from countries with a declared outbreak, or who live in regions with high disease transmission. Findings consistently indicate that quarantine is important in reducing incidence and mortality during the COVID-19 pandemic, although there is uncertainty over the magnitude of the effect. Early implementation of quarantine and combining quarantine with other public health measures is important to ensure effectiveness.
Webster et al., 2020	How to improve adherence with quarantine: rapid review of the evidence (Link)	30 January 2020	"We conducted a rapid review to identify factors associated with adherence to quarantine during infectious disease outbreaks."
Panda et al, 2020	Psychological and Behavioral Impact of Lockdown and Quarantine Measures for COVID-19 Pandemic on Children, Adolescents and Caregivers: A Systematic Review and Meta-Analysis (Link)	15 August 2020	SR on psychological problems of children and care.taker during COVID-19
Imran et al., 2020	Psychological burden of quarantine in children and adolescents: A rapid systematic review and proposed solutions. (Link)	n/a (article submitted 16 Jun 2020)	"This rapid review takes into account the impact of quarantine on mental health of children and adolescents, and proposes measures to improve psychological outcomes of isolation."
Fong et al., 2020	Child and Family Outcomes Following Pandemics: A Systematic Review and Recommendations on COVID-19 Policies. (Link)	April 15 2020	"The objectives were to evaluate the quality of existing studies on this topic, determine what is known about mental health outcomes and needs of children and families, and provide recommendations for how COVID-19 policies can best support children and families."

Kohortierung

- keine indirekte Evidenz identifiziert -

Schulwege, ÖPNV

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Chu et al	Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis	May 3, 2020	"systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses"
Zhen et al., 2020	Transmission of respiratory viruses when using public ground transport: A rapid review to inform public health recommendations during the COVID-19 pandemic (Link)	March 2020	This study aimed at assessing transmission of COVID-19 when using public transport. Included studies suggest an increased risk of viral transmission with public transportation use that may be reduced with improved ventilation.
Liu et al., 2020	Cluster infections play important roles in the rapid evolution of COVID-19 transmission: A systematic review (Link)	15 June 2020	This review aims at summarising the major types of SARS-CoV-2 cluster infections worldwide through a comprehensive systematic review. "The major types of cluster infections were families, community transmission, nosocomial infection, gatherings, transportation, shopping malls, conferences, tourists, religious organisations, workers, prisons, offices, and nursing homes."
Noakes et al., 2020	Transmission and Control of SARS-CoV-2 on Public Transport (Link)	16 May 2020	This paper collates evidence on transmission and control of COVID-19 in public transport.

Musik- und Sportunterricht

Systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Chu et al, 2020	Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis (Link)	May 3, 2020	"systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses"
Lo Moro et al, 2020	Reopening Schools during the COVID-19 Pandemic: Overview and Rapid Systematic Review of Guidelines and Recommendations on Preventive Measures and the Management of Cases (Link)	20 Oct 2020	"This overview aimed to describe the main measures planned for the 2020–2021 academic year within the WHO European Region" based on a rapid systematic review and review of guidelines from the European region

a) Musik

Nicht-systematische Übersichtsarbeiten			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Mürbe et al, 2020	Beurteilung der Ansteckungsgefahr mit SARS-CoV-2-Viren beim Singen (Link)	n.r., veröffentlicht Mai 2020	Narrative Übersicht über Aerosolverbreitung und Transmission beim Singen inklusive Handlungsempfehlungen, von der Klinik für Audiologie und Phonometrie & Institut für Hygiene und Umweltmedizin der Charité
Dhar, Sujan & Manjula Das, 2020	Music in the time of COVID-19 (Link)	n.r., published in October 2020	"Mini-Review" summarizing the currently available information on musical performances and assessing the possible impact on transmission
Naunheim et al., 2020	Safer Singing During the SARS-CoV-2 Pandemic: What We Know and What We Don't (Link)	n.r., published in July 2020	Narrative review on the role of Singing in the transmission of COVID-19

Leitlinien und Empfehlungen			
Autor, Jahr	**Titel**	**Datum Datenbank-**	**Zusammenfassung**

		suche (bzw Publikation	
Firle et al	Musizieren während der SARS-CoV-2-Pandemie Empfehlungen der Deutschen Gesellschaft für Musikphysiologie und Musikermedizin (DGfMM) zum Infektionsschutz beim Musizieren (Link)	n.r., letzte Aktualisierung Juli 2020	Leilinie der Dt. Gesellschaft für Musikphysiologie und Musikermedizin
Spahn et al	Risikoeinschätzung einer Coronavirus-Infektion im Bereich Musik (Link)	n.r., letzte Aktualisierung Dezember 2020	Risikoeinschätzung und Handlungleitsätze zum Musizieren, basierend auf eigenen Untersuchungen, Literaturstudium und Expertenmeinungen
Ministerium für Bildung Rheinland-Pfalz	Leitfaden für musikpraktisches Arbeiten in Schulen (Link)	n.r.	Handlungsempfehlungen der Regierung des Landes Rheinland-Pfalz zum musikpraktischen Arbeiten in Schulen

Primärstudien			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Echternach et al	Impulse dispersion of aerosols during singing and speaking (Link)	n/a, 16 Oct 2020	Studie zur Aerosolausbreitung bei professionellen Sänger:innen
Mürbe et al	Aerosol emission of child voices during speaking, singing and shouting (Link)	n/a (posted 18 Sept 2020)	Preprint: Studie zur Aerosolausbreitung bei Kindern
Spahn et al	Airflow and air velocity measurements while playing wind instruments, with respect to risk assessment of a SARS-CoV-2 infection (Link)	n/a (posted 23 Dec 2020)	Preprint: Studie zur Aerosolausbreitung beim Spielen verschiedener Instrumente

b) Sport

Leitlinien und Empfehlungen			
Autor, Jahr	**Titel**	**Datum Datenbank-suche (bzw Publikation**	**Zusammenfassung**
Scottish government	Coronavirus (COVID-19) Advisory Sub-Group on Education and Children’s Issues: advisory note on physical	n/a, letzte Aktualisierung September 2020	Handlungsempfehlungen der Schottischen Regierung zu Sportunterricht in Schulen

	education, music and drama in schools (Link)		
DAKJ/Simon et. al	Maßnahmen zur Aufrechterhaltung eines Regelbetriebs und zur Prävention von SARS-CoV-2-Ausbrüchen in Einrichtungen der Kindertagesbetreuung oder Schulen unter Bedingungen der Pandemie und Kozirkulation weiterer Erreger von Atemwegserkrankungen (Link)	n/a	Handlungsempfehungen der Deutschen Akademie für Kinder und Jugendmedizin zum Betrieb von Schulen und Kitas

Methoden Evidenzsuche

1) Identifikation von Evidenz für den Hintergrund der Leitlinie
    a) systematische Übersichtsarbeiten

Sichtung des Grundstocks systematischer Übersichtsarbeiten, die im Rahmen der Recherchen der Arbeitsgruppe EBPH der LMU München für einen Cochrane Scoping Review und einen Cochrane Rapid Review zu Schulmaßnahmen in der SARS-CoV-2 Pandemie idenfitiziert wurden.
Darüber hinaus wurden die systematischen Reviews, welche im Rahmen des Snowballings Screenings des o.g. Projekts identifiziert wurden, gesichtet und bzgl ihrer Relevanz für die Leitlinie geprüft.

Aus diesem Pool an Evidenz wurden für die Leitlinienerstellung systematische Reviews eingeschlossen, die eine Übersicht i) zum Transmissionsgeschehen bei Kindern und Jugendliche sowie ii) Transmission im Schul-Setting und iii) zu Symptomen, klinischem Verlauf und Epidemiologie von SARS-CoV-2 Infektionen bei Kindern geben.

Ergänzend erfolgte am 5.1.2021 die zielgerichtete Sichtung von systematischer Übersichtsarbeiten, “Overviews” und Evidenzsynthesen der WHO COVID-19 Datenbank mit der Suche *tw:((tw:(school*)) OR (tw:(child*))) AND type_of_study:("systematic_reviews" OR "policy_brief" OR "overview")* zur Identifikation weiterer relevanter systematischer Übersichtsarbeiten für i), ii) und iii).

    b) internationale Leitlinien für Schulmaßnahmen

Internationale Leitlinien wurden im Rahmen der Arbeit an zwei Cochrane Reviews zu Schulmaßnahmen der AG EBPH der LMU Münche identifiziert. Weitere Leitlinien wurden von Kolleg*innen der McMaster University, Kanada, bereitgestellt. -- *noch ausstehend* --

Aus dem Pool internationaler Leitlinien wurden die für die vorliegende Leitlinie relevanten Leitlinien identifiziert. -- *noch ausstehend* --

2) Identifikation von Evidenz für die Schlüsselfragen
    a) direkte Evidenz

Direkte Evidenz für die Schlüsselfragen der Leitlinie wurde einerseits über die Arbeit an einem Cochrane Review zu Schulmaßnahmen in der SARS-CoV-2 Pandemie von der Arbeitsgruppe EBPH der LMU München bereitgestellt.

Ergänzend wurden systematische Reviews, die den PICO-Kategorien der Schlüsselfrage entsprechen, aus folgenden Quellen identifiziert und bereitgestellt:

- Zielgerichtete Sichtung der Übersicht systematischen Übersichtsarbeiten, welche im Rahmen der beiden Cochrane Reviews der Arbeitsgruppe identifiziert wurden
- Zielgerichtete Sichtung von systematischer Übersichtsarbeiten, “Overviews” und Evidenzsynthesen der WHO COVID-19 Datenbank mit der Suche *tw:((tw:(school*)) OR (tw:(child*))) AND type_of_study:("systematic_reviews" OR "policy_brief" OR "overview")* am 5.1.2021
- Vorwärts Snowballing relevanter Reviews in google scholar (wo kapazitär möglich)
- Rückwärts Snowballing relevater Reviews und Leitlinien (manuell, wo kapazitär möglich)

b) indirekte Evidenz

Aufgrund der z.T. eingeschränkten und fehlenden direkten Evidenz für die Schlüsselfragen, wurde im nächsten Schritt systematisch indirekte Evidenz gesucht und identifiziert. Dies beinhaltete folgende Schritte:

- Formulierung alternativer PICO-Schlüsselfragen, v.a. Ersetzen der Population „Schülerinnen und Schüler/Lehrer*innen“ mit der Allgemeinbevölkerung und Erweiterung des Settings um nicht-schulische Bereiche
- Sichtung der Cochrane Special Collection zu COVID-19 (Link) zur Identifikation relevanter systematischer Reviews zu den alternativen PICO-Schlüsselfragen
- an die alternativen PICOs angepasste Suchen in der WHO COVID-19 Datenbank (Link, jeweils mit Filter für Systematische Reviews, Evidenzsynthesen, „Overviews“, Screening mittels der Software Rayyan
- an die alternativen PICOs angepasste Suchen in Pubmed (Link), Screening mittels der Software Rayyan
- Vorwärts-Snowballing der als relevant identifizierten Reviews in google scholar (wo kapazitär möglich)
- Rückwärts-Snowballing relevanter Leitlinien (manuell)
- wo im Rahmen der Suche für eine spezifische Schlüsselfrage Evidenz identifiziert wurde, die für andere Schlüsselfragen und/oder den Hintergrund relevant war, wurde diese entsprechend dokumentiert

Stand des Dokuments: 11.1.2021
Datum der Suchen: 4.-8.1.2021
Mitarbeitende: Kerstin Sell, Karin Geffert, Suzie Kratzer, Julia Rabe
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