

Outcome data for hospitalisations due to Covid-19

Children hospitalised with Covid during first year of Pandemic in Spanish multi-centre study

Clinical spectrum of COVID-19 and risk factors associated with severity in Spanish children

European Journal of Paediatrics Nov 5 2021

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8568563/>

In total, 76 hospitals collected data from the beginning of the epidemic in Spain (March 12th) until March 22nd, 2021.

Of the 666 children who were admitted to hospital from the emergency department (so not counting children who presented to ED and then went home) 18.4% (123/666) children required PICU (paediatric intensive care)

A total of 127/666 (19.1% of hospitalised) children were diagnosed with MIS-C. The median age was 9.2 years. Of them, 35 (27.6%) fulfilled the criteria for Kawasaki disease, and 76/127 (59.8%) needed admission to a PICU.

1.3% of children admitted to hospital died. This was 9/666 children who were admitted to hospital.

A total of 206/666 (30.9%) hospitalised patients had complications. The most frequent complications were cardiological 75/666 (11.3%) and 59/666 (8.9%) shock. Cardiological complications included myocardial dysfunction 7.2%; valve dysfunction 2.6%; arrhythmia 2%; coronary abnormalities 1.8%; and aneurysms 0.5%.

Authors concluded "Age, asthma or recurrent wheezing and heart diseases are risk factors for PICU admission." Interestingly, asthmatic patients were not admitted to the PICU due to asthma flare, but due to pneumonia or MIS-C. Additionally, immunosuppressive treatments were risk factors for MIS-C.

Outcome of MIS-C

MIS-C Outcome in UK

Clinical features and outcomes of 76 patients with COVID-19-related multi-system inflammatory syndrome in children

[Clin Rheumatol.](#) 2021 Jun 5 : pp1–12.

The MIS-C patients under 18 years old diagnosed and treated in three referral centers between July 2020 and March 2021

76 children with MIS-C in study, 27 (35.5%) required PICU admission, 1 child who had preexisting leukemia died

Long Covid

Source NHS – Re the UK

https://www.england.nhs.uk/2021/06/nhs-sets-up-specialist-young-peoples-services-in-100-million-long-covid-care-expansion/?fbclid=IwAR15Kp9AVHkqleJtMNSvmlfX17tYuiqSeibE_7DQ5O5BXNPRAYIYb00m2KU

- “More than one million people have reported suffering from long COVID, according to the [Office for National Statistics](#). Symptoms include shortness of breath and extreme fatigue with almost a third of sufferers saying it has a significant impact on their daily life.
- While the majority of children and young people are not severely affected by COVID, ONS data has shown that 7.4% of children aged 2-11 and 8.2% of those aged 12-16 report continued symptoms.”

Source: Office for National Statistics (UK) Nov 4th 2021 Report Prevalence of ongoing symptoms following coronavirus covid19 infection in UK

<https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/prevalenceofongoingsymptomsfollowingcoronaviruscovid19infectionintheuk/4november2021>

- “compared with the previous month, prevalence of self-reported long COVID was notably higher among people aged 12 to 16 years or 17 to 24 years, with the latter now comparable to people aged 35 to 69 years.”

This is self-reported symptoms, with parents completing the forms for under 12s.

Long Covid Australian study

Source: Post-acute Covid-19 outcomes in children with mild and asymptomatic disease. The Lancet, 5(6) June 2021 Say et al (2021).

- 12 (8%) children had post-acute COVID-19 symptoms, all of whom were symptomatic with acute COVID-19 ([table](#)). The most common post-acute COVID-19 symptoms were mild post-viral cough (six [4%] of 151 children), fatigue (three [2%] children) or both post-viral cough and fatigue (one [1%] child). The duration of post-viral cough ranged from 3 weeks to 8 weeks and of post-viral fatigue. Two (1%) children had post-acute COVID-19 inflammatory conditions temporally associated with SARS-CoV-2:

Australian data for covid hospitalisations, MIS-C and Long Covid

Grand Rounds webinar 15 Sept 21, Royal Children’s Hospital Melbourne re Delta in Kids

Source: <https://blogs.rch.org.au/grandrounds/2021/09/15/delta-in-kids-what-we-do-and-dont-know/>

- Review study by Russell Viner of 13 international studies and 18 reviews of hospital and community settings, in children
 - Up to 42% asymptomatic
 - <1-2% hospitalisation rate – pneumonia and respiratory distress
 - PIMS-TS / MIS-C – quite rare – 4 confirmed cases and 2 possible in Australia
 - 4500 MIS-C cases and 41 deaths in USA from 5 million cases in kids
 - Long covid – no agreed definition, but potentially an important issue for kids
 - Same definition not used but two cited studies in UK
 - Zoe study UK – 4% after 4 weeks, 2% after 8 weeks but control group 1% also had symptoms after 4 wks
 - Clocks study (12-17yo) up to 14% 3+ symptoms after 3 months
 - May have big implications for impact on children

Data from Australia - A/Professor Margie Danchin

22% of total cases under 19 years old up to 11 sept 21

No deaths in a child under age of 10, 1 death in teenager

Until Aug 31st, Australia had 3,500 cases in children, and 65 admissions, most managed at home, 9 admitted to ICU. Data from national centre for immunisation research and surveillance around cases in school and early childhood settings had 102 paediatric cases acquired at school and childcare and no hospitalisations.

Recent NSW outbreak June – August 2021, a 7 week period, 70 kids admitted out of approx. 2800 cases in kids, 5 kids in ICU, a third admission for social reasons. Hard to interpret hospitalisation data in Australia

Internationally

UK 1st year to March 21, pre delta, showed 6000 hospitalisations 1.3% in kids, 250 ICU and 25 deaths

Since delta prevalent, 1 death under 14 and 52 in 0-19 year olds in UK

Hospitalisations until end Aug, highest admission in 55-64 yr olds and no significant increase in hospitalisations in children with delta

USA – morbidity and mortality weekly report

Hospital admissions birth up to 17 yr olds from June to mid Aug 2021 with delta circulating, 5X increase in hospitalisation rate in children up to 17 and 10x increase in hospitalisation rate in children under 4 but proportion of severe disease is similar, over pandemic not a significant increase in severity during the delta period

Hospitalisations were ten times higher in unvax'd adolescents. Critical need for multilayered strategies and vaxing adults.

Kids with underlying medical conditions at higher risk, and preterm babies,

Infants under 12 months, premmie babies or underlying respiratory disease at far higher risk according to data from Indonesia

Professor Nigel Curtis – Long Covid

14 studies of long covid and children/adolescents, predominantly in teens, 4 and 12 weeks post covid the most common length of time studied

Symptoms have rarely lasted for more than 12 weeks

Majority of studies don't have a control group,

Wide variability with 0% to nearly 60% long covid being reported

Australian study 8% at 4 weeks and resolved by 12 weeks

5 studies have a control group

1. German study had a control group, no diff between cases and controls, up to 35% of cases and controls reported Symptoms, therefore no evidence of long covid in children

2. UK study 5% covid and 2% controls had symptoms, sig difference between the groups suggesting it is due to long covid

3. Another UK study - At 4 weeks 4% reporting symptoms in cases and 1% in controls was sig (and therefore suggesting due to long covid), at 8 weeks, half of cases had symptoms resolved (but there was no 8wk controls, so not able to say for sure due to covid)

4. Switzerland study – cases and controls had similar Symptoms, no difference therefore no evidence of long covid in children

5. Clock study in UK – a good study, of those who tested positive vs those who didn't but had a covid test - 66% of those with covid had symptoms of long covid vs 53% of those who didn't have covid reporting symptoms at same later time period, this was highly significant (supporting that kids are getting long covid) and is where the 1 in 7 statistic comes from, so 1 in 7 children will have long covid. However Prof does not think it is really as high as this as all studies have major limitations. He thinks the data is not that great/accurate. Prof asks: is the rate of long covid considerably less:

-lack of control groups limiting the study (post pandemic syndrome may also produce symptoms not just covid per se)

-No agreed case definition for long covid, & follow up lengths different.

-Not always test confirmed covid cases in the studies and

-most are self or parent reported surveys (not diagnosed by an independent observer)

He also thinks different things are being lumped together - Includes other complications of covid, pulmonary fibrosis, clotting, mental health, nonspecific like chronic fatigue and ME

Finally – each study has different biases, response bias, Clock study has a selection bias, 13% of those asked to take part completed the survey – highly likely those with symptoms more likely to respond and those without long covid symptoms to not bother taking part, thus a selection bias.

Israel study – 11% of children have long covid, but again similar problems with the research as no control group, prolonged lockdowns etc impact children and self-reporting not a clinical diagnosis.

Summary – studies to date have limitations, don't know the prevalence, he suspects it will be a lot less than is being reported at the moment, so a lot less than the 1 in 7 children.

Unvaccinated children are at lower risk of covid than adults who are vaccinated.

Professor Fiona Russell – Delta in schools (I don't really understand what attack rate means or how they work it out).

NSW early childhood settings with with delta are 5 times higher than last year for transmission

Secondary attack rate, 5% vs 1% last year, and household transmission higher this year, about 75%, so very likely if you take it home others in the household will get infected

Primary, secondary attack rate 1.7%

Early childhood – 36 cases and 32 staff infected, 1500 contacts, secondary attack rate 6.4% 16/32 early childhood cases had evidence of transmission, staff to staff was highest and 8% staff to children

UK – infections in June (delta) infection rate less than .3% in primary,

The infection rates in children attending school was less than those not attending school in UK (rapid testing, masking and cohort students) {BUT this was prior to the return of compulsory school I think}

Scotland, (size Victoria) opened up schools, since then has been a spike in infections in schools 12-15 year olds and 5-11 year olds

Hospitalisation in Scotland: children under 18 years, 0-1 yr olds about 20-30 admissions,

USA – 50% attack rate in a primary school, teacher reading a story unmasked to children in classroom, children seated closest were worse off. Mitigations – mask wearing, get vaccinated, stay home if sick.

No covid outbreaks in schools in San Francisco – out of school contacts the source of child infections.

Under 18s infections have stabilized overseas when high vax rates [???really???? I wonder if this is old data now]

The best long covid/post covid data to date?

Post Covid Symptoms in children-German study

<https://www.medrxiv.org/content/10.1101/2021.10.21.21265133v1>

BUT – there is a study from University of Technology Dresden in pre-print called

Post COVID-19 in children, adolescents, and adults: results of a matched cohort study including more than 150,000 individuals with COVID-19

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should *not* be used to guide clinical practice.

- laboratory confirmed diagnosis of COVID-19 until June 2020
- COVID-19 and control cohorts were followed for incident morbidity outcomes documented at least three months after the date of COVID-19 diagnosis. Examined health care records and the control group was matched to the covid group for the health care incidence in 2019 pre pandemic, and as timing was the same for both groups this controls for the impact of lockdowns etc.
- Health insurance data included ICD-10 diagnoses
- 11,950 children/adolescents as well as adults
- Most of the children/adolescents had not be hospitalized (the proportions of children/adolescents who were hospitalized with COVID-19 (n=117; 1.0%) and received intensive care and/or ventilation (n=51; 0.4%).
- Among the specific outcomes with the highest IRR and an incidence rate of at least 1/100 person-years in the COVID-19 cohort in children and adolescents were malaise/fatigue/exhaustion, cough, and throat/chest pain.
- With regard to all of the symptoms and illnesses analyzed, the prevalence of newly documented illness was approximately 30% higher in children and adolescents who had previously been diagnosed COVID-19 as in those who had not been diagnosed with COVID-19.
- This study makes an important contribution to the sparse empirical literature on long-term sequelae of COVID-19, particularly in children and adolescents. Thus, it addresses one of the most urgent and relevant questions at the current stage of the COVID-19 pandemic. Based on data from 157,134 individuals with confirmed COVID-19, we provide novel evidence on documented post COVID-19 morbidity in both children/adolescents and adults. Our findings indicate a higher incidence of predefined adverse health outcomes documented in routine healthcare data not only among adults but also in children and adolescents with

COVID-19 compared to matched controls.... These results suggest that long-term sequelae of COVID-19 may play a role in both younger and older age groups.

- Our study therefore extends previous research as it is the first that suggests relevant post COVID-19 healthcare utilization and new-onset morbidity patterns documented by physicians in children and adolescents following COVID-19 disease in a large sample of patients with confirmed COVID-19 compared to a matched control group.
- The fact that our study replicates previous studies on post COVID-19 outcome patterns in adults [6,7,20,22] is an important argument for the validity of the new evidence reported for children/adolescents. Our study suggests that children and adolescents with COVID-19 disease may be at increased long-term risk for a broad spectrum of medical conditions including malaise/fatigue/exhaustion, cough, throat/chest pain, adjustment disorder, somatization disorder, headache, fever, anxiety disorder, abdominal pain, and depression. Particularly post COVID-19 mental health problems appear to be more frequent in children and adolescents relative to the control group. Adverse post COVID-19 pulmonary outcomes, however, appear to be less frequent in children and adolescents compared to adults.
- In summary, our findings demonstrate that post COVID-19 cannot be dismissed among children and adolescents.

Hospitalisations, deaths and MIS-C in USA

Source: Covid 19 American Academy of Paediatrics

“...children can get sick from COVID-19 and can spread COVID-19 to others. Some children may develop severe illness. Children with underlying medical conditions are at increased risk for severe illness compared to children without underlying medical conditions.*

*Current evidence on which underlying medical conditions in children are associated with increased risk is limited. Current evidence suggests that children with special healthcare needs, including genetic, neurologic, metabolic conditions, or with congenital heart disease can be at increased risk for severe illness from COVID-19. Similar to adults, children with obesity, diabetes, asthma or chronic lung disease, sickle cell disease, or immunosuppression can also be at increased risk for severe illness from COVID-19.

Total deaths in 0-11 year olds - 475

Total deaths in 12-17 year olds - 427

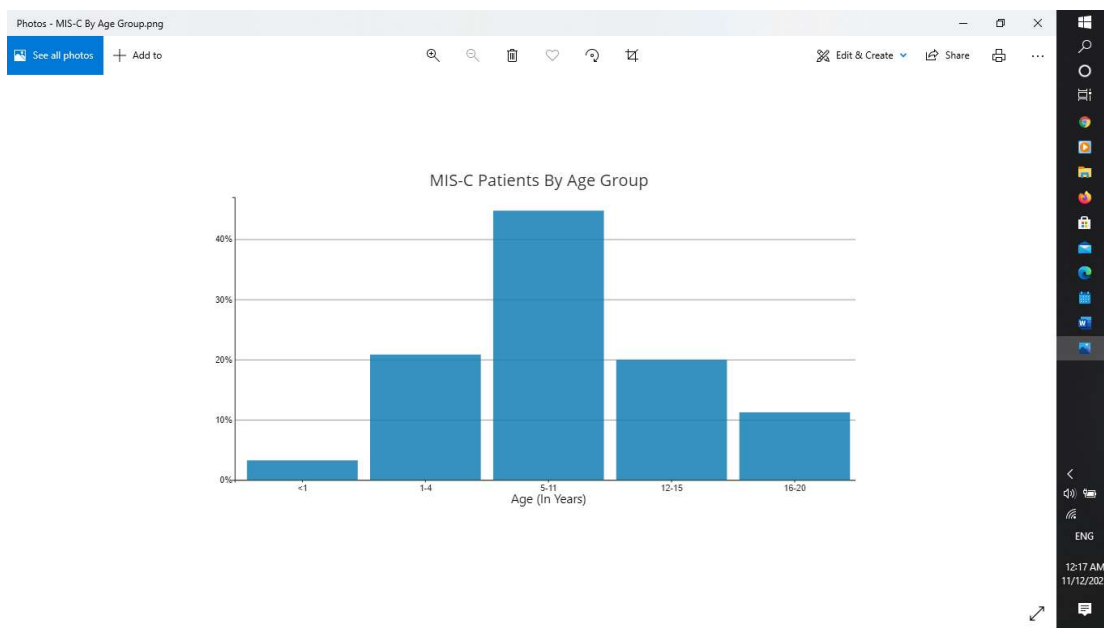
Age Group	Percentage of deaths	Count of deaths	Percent of US population
0-4 Years	<0.1	285	6

Age Group	Percentage of deaths	Count of deaths	Percent of US population
5-11 Years	<0.1	190	8.7
12-15 Years	<0.1	220	5.1
16-17 Years	<0.1	207	2.5

MIS-C can occur weeks after COVID-19 and even if the child or family did not know the child had COVID-19.

The primary school aged (over 40%) make up the higher proportion of MISC cases in US

<https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance>



Hospitalisations in USA

Source: Hospitalization Rates and Characteristics of Children Aged <18 Years Hospitalized with Laboratory-Confirmed COVID-19 — COVID-NET, 14 States, March 1–July 25, 2020

- Analysis of pediatric COVID-19 hospitalization data from 14 states found that although the cumulative rate of COVID-19–associated hospitalization among children (8.0 per 100,000 population) is low compared with that in adults (164.5), one in three hospitalized children was admitted to an intensive care unit.

Diabetes and Covid in Children

<https://www.frontiersin.org/articles/10.3389/fped.2021.628810/full>

- At the start of this year 2021 there were a few articles I found suggesting that rates of diabetes in children had gone up in children who had covid, but then that line of enquiry seemed to go cold. I could not find anything strong enough to list at this point, however it is something to keep an eye out for....

COVID-19 Modelling and schools in Australia

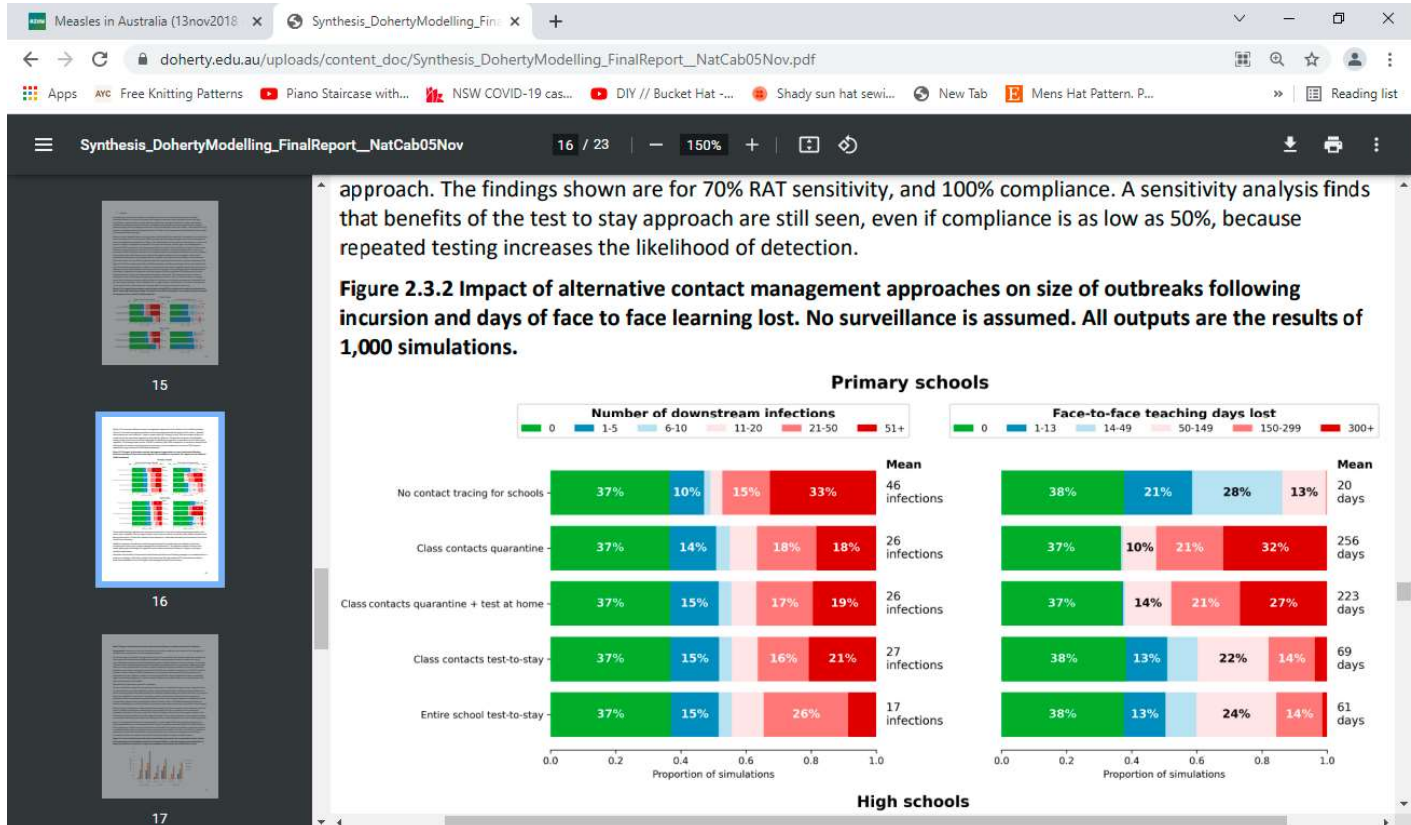
Source – Doherty Report Final Report to National Cabinet 5th Nov

https://www.doherty.edu.au/uploads/content_doc/Synthesis_DohertyModelling_FinalReport_NatCab05Nov.pdf

Section 3 – Schools p15

- [In the context of discussing an incursion of Covid virus into the school setting what is the modelling of what will happen based on one school community modelling assumption, NB – the modelling seems to be focused on minimizing days of school lost, rather than cases per se, cases per se seem to only matter in that it will impact the days of school lost, as long as it is not out of control]:
 - “As community transmission becomes established, incursions into school settings will be inevitable. Returning students to in-person learning and keeping schools open safely during this phase has been identified as a national priority.”
 - “in the absence of screening or any form of contact tracing or management, between 37-47% of incursions will ‘die out’ given the heterogeneous nature of COVID transmission”
 - **“But between one third to one half of introductions will result in 20 or more infections and sometimes as many as 50. These figures show the case for both high schools, where we assume that 80% of students and staff are vaccinated and primary schools where children are too young to be immunized.”**
 - “Teacher vaccination has less influence on transmission within the school, even at 100% uptake, but would be anticipated to materially impact on importation risk.”

- “Twice weekly testing of students markedly increases the chances of nipping an outbreak in the bud. **There is a small increase in average school days lost** (aka modelling is focused on school attendance not illness rates) because we are looking harder for infections and so detect asymptomatic individuals, but far fewer large outbreaks”
- “These findings are for a single infection introduction.”



- “These model findings reproduce the outcomes observed in a real world study comparing quarantine and test to stay in England. They strongly endorse test to stay as a policy to maintain face to face education and keep schools open. It should be noted that the reduction in outbreaks achieved by this measure is less than surveillance screening.”
- “completion of that phase of National Plan modelling it has become clear from published studies that the Delta variant is more likely to be associated with severe clinical outcomes than Alpha. The most informative study in the peer reviewed literature reports the odds ratio (OR) for hospitalisation given symptoms as 2.08 compared with the Wuhan strain. Given the same ‘benchmark’ (Wuhan) strain for both viruses, an OR of 2.08 for Delta represents an increase but not a doubling in severity compared to Alpha, for which the assumed OR was 1.42.”
- “An OR is not the same as a percentage increase or decrease. If hospitalisation is rare as is the case for children, then it is approximately true that the OR of 2.08 means hospitalisation is twice as likely. Compared with Alpha, Delta may therefore result in an increase in admissions in this age group by as much as 40-50%. However, for older adults, in whom hospitalisation is a

common outcome, the additional increased chance for hospitalisation due to the virus per se will be relatively lower, meaning that absolute numbers of hospitalisations may increase by as little as 10-15%.”

Doherty Report Attachment on Schools

https://www.doherty.edu.au/uploads/content_doc/AttachmentD_WP2_Schools.pdf

“Returning students to in-person learning and keeping schools open has been identified as a national priority”.

“Delphi process; Scott et al. [2] Measured as relative to household transmission per contact - e.g. a typical day's worth of contact in school is 75% less likely to result in transmission than a typical day's worth of contact at home.”

- “If schools reopen with high levels of COVID-19 transmission in the community, rates of incursions into schools will also be higher, and the current approach to managing cases in schools may be unsustainable and inconsistent with the national priority of maximizing face-to-face teaching. Equally, allowing infections to spread within schools and the school community can lead to adverse health outcomes for students, their households and family members (e.g., parents and grandparents).”
- Critique: School modelling was run for 45 days (this is presumably calendar days) An average school term is 70 days, term 4 this year is closer to 77 days). What happens after 45 days?

Assumptions in the Doherty modelling for schools

- School size is 298 pupils – this is small for city schools??
- Assume class size is 22 in primary school and that students are assigned to a single class, the only mixing outside of the 22 is in the playground (but this is not how it is working on the ground in some schools, eg. In Stages of 3 x 24 kids inside various classrooms that move around, personal experience)
- average number of student-student non classroom contacts per day = 2 (is this in the playground? Is this realistic?)