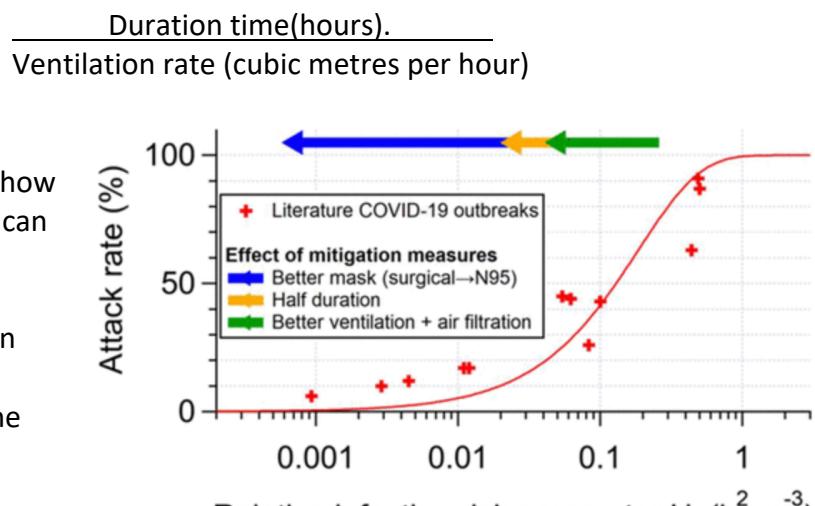


New assessment of the risk reduction for Covid and other airborne diseases

A large international team has carried out some very helpful research into the chances the spread of an airborne disease, like covid, influenza and measles. Here are my thoughts on it; if you wish, you can download the paper from:

<https://pubs.acs.org/doi/10.1021/acs.est.1c06531?fig=abs1&ref=pdf>

In many ways its findings are consistent with the advice we already shared within the Circuit, but it also assesses of the relative risk in the kinds of situations that exist in churches, schools, theatres, offices etc. They use a relative infection risk factor, termed H_r , in this figure which has units of:



Their estimation of risk mitigation procedures show how a high level of risk reduction can be achieved by combining measures. Indeed they specifically say that relying on one alone is rarely a safe approach. Here they show the benefits of air quality (ventilation, air purification monitored by CO₂ sensors), reducing the duration of events, and moving to FFP2 or FFP3 masks.

The absolute risk of infection (H in this paper) will also depend upon what they are doing in the space: breathing rates vary greatly between silent prayer and five-aside football. It also depends upon how infectious the disease is, and how many people are already infected . Indeed the risks assessed in the paper (submitted in September 2021) have already been afforded increased values due to the high infection rate of the Omicron variant, as shared on Twitter yesterday (see the table below). The table is based estimated on a local infection rate of 0.1% of the population having the Omicron variant.

The authors have used a traffic light system of the table to highlight bands of likelihood of attack (or infection) rate:

- Green, below 0.01% (1 in 10,000)
- Yellow, below 0.02% (1 in 5000)
- Orange, below ~0.03% (1 in 3000)
- Red, below ~ 0.1% (1 in 1000)
- Darker red, below ~ 1% (1 in 100)
- Deep red, above ~10% (1 in 10)

The parameters used for an indoor space were a volume of 300 cubic metres, with a short duration being 1 hour and a long duration 10 hours. Low and high occupancy within that room were set at 10 and 30 respectively, with poorly- and well-ventilated spaces having one

or six air changes per hour, respectively. Our services would almost all therefore be classed at of short time duration (\sim 1 hour) and low occupancy (30 cubic metres per person).

Type and level of group activity	Low occupancy			High occupancy		
	Outdoor and well ventilated	Indoor and well ventilated	Poorly ventilated	Outdoor and well ventilated	Indoor and well ventilated	Poorly ventilated
Wear face coverings, contact for short time						
Silent	<0.001%	0.042%	0.25%	0.002%	0.15%	0.87%
Speaking	0.002%	0.21%	1.2%	0.009%	0.73%	4.3%
Shouting, singing	0.015%	1.2%	7.2%	0.052%	4.3%	23%
Heavy exercise	0.035%	2.9%	16%	0.12%	9.7%	46%
Wear face coverings, contact for prolonged time						
Silent	0.005%	0.42%	2.5%	0.017%	1.4%	8.4%
Speaking	0.025%	2.1%	12%	0.087%	7.0%	35%
Shouting, singing	0.15%	12%	53%	0.52%	35%	93%
Heavy exercise	0.35%	25%	83%	1.2%	64%	>99%
No face coverings, contact for short time						
Silent	0.001%	0.12%	0.71%	0.005%	0.42%	2.5%
Speaking	0.007%	0.59%	3.5%	0.025%	2.1%	12%
Shouting, singing	0.043%	3.5%	19%	0.15%	12%	53%
Heavy exercise	0.10%	8.0%	39%	0.35%	25%	83%
No face coverings, contact for prolonged time						
Silent	0.014%	1.2%	6.9%	0.050%	4.1%	22%
Speaking	0.071%	5.8%	30%	0.25%	19%	71%
Shouting, singing	0.43%	30%	88%	1.5%	71%	>99%
Heavy exercise	0.99%	57%	>99%	3.4%	95%	>99%

Advice for churches.

These are estimates based on idealised models, and so it is good to give them a safety margin. There is no reason to consider that these are very flawed and so we can use them as a planning basis while the Omicron infection rate is in the region of 1 in 1000. In our circuit it is closer to 1 in 100, but the demographic of our congregations suggests that our collective infection rate is lower than the average.

It is not easy to define ‘acceptable risk’. If one does utilise a 1 in 1000 risk (0.1%), as suggested by the figure above. To achieve that low level of risk then indoor gatherings must require good ventilation, and wearing of masks which afford high protection (FFP2 or FFP3); air purification may also lower risk by a further factor of \sim 5.

With all these mitigations in place, services with silence and speaking should probably be of acceptable risk. Singing is borderline, and so it would be preferable for masks to be worn by the bulk of the congregation throughout.

John Evans, 7 January 2022