# Children and School Singing During the COVID-19 Pandemic

**Professor Martin Ashley**

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# Making the case for singing in schools

To begin, 'during' is used in the title of this report because although children are going back to school, the pandemic is by no means over. Leading epidemiologists such as Neil Ferguson remind us that to keep the "R number" (the general infection rate and hence rate of spread) below 1 a combination of case isolation, social distancing of the entire population and either household quarantine or school and university closure are required in perpetuity.[1] So, yes, it is very much "during the pandemic" at present and we cannot even discount children being sent home again. Against this, however, we have reports such as the Royal Society DELVE paper that argue that the risks to children not attending school outweigh the risks to population health. DELVE is a substantial piece of work with 185 references. It covers a whole raft of disbenefits including increased inequality and mental health issues as well as the more obvious one of learning and skill loss. However, in over 29,300 words, the words "music" and "singing" are not mentioned once.[2]

So, we are on the familiar territory of having to advocate for musical education and for what we believe to be the indispensable role of singing in not just music education but those very issues of mental, physical health and social equality on which DELVE wax lyrical. That case has been made many times, by Sing Up and by many others, myself included! The added burden we face now is of having to make the case when head teachers, facing huge pressures and many competing priorities, may make risk-averse responses. The TES highlighted as number 1 on its list of "8 return-to-school rules for autumn you may have missed" the very get-out clause that could silence children's singing:

> One notable element of the guidance is a warning that "singing, chanting, playing wind or brass instruments or shouting" can increase the risk of infection – even if individuals are at a distance.[3]

We, in music education, are not alone. The Association of Science Education (ASE) has grappled with risk aversion for a good many years. As a former university tutor in that subject as well as in music, I can testify that the ASE's complaint that children's entitlement to stimulating and exciting science learning has been significantly and wrongly curtailed by risk aversion is entirely justified. The link to ASE's page can be found by following the covid risk assessment of the DfE and it is worth a visit, particularly Peter Borrows' paper *We don't do that – it's not safe anymore*.[4] So, should our children not be singing because somebody thinks "it's not safe anymore?" Perhaps they are not wrong? What is the best advice? There is undoubtedly a risk in having children sing, as there is in having them travel to school. The questions are, is it an *acceptable* risk and is it a greater or lesser risk than the risk to their wellbeing and learning of having them not sing?

I have just completed an academic paper on the risks taken by choirs in Norway, Sweden, Germany, Australia and New Zealand that returned to singing last April or May, not long after the infamous "super-spreader" events of Skagit and Amsterdam created such high levels of angst in the UK and the United States. Much of the paper is taken up with analysis and critique of the risk-management process as interpreted and applied by the choirs. My aim in this article is to present the essence of that analysis in an accessible form that will empower music teachers to argue their place in the

[1] Ferguson, N., Laydon, D. et al (2020) Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. London: Imperial College Covid-19 Response Team. https://doi.org/10.25561/77482

[2] Delve Initiative, the, (2020) *Balancing the Risks of Pupils Returning to Schools*. DELVE Report no. 4, 24th July. https://rs-delve.github.io/reports/2020/07/24/balancing-the-risk-of-pupils-returning-to-schools.html

[3] https://www.tes.com/news/returning-back-to-school-september-reopening-coronavirus-things-to-know

[4] https://www.ase.org.uk/sites/default/files/Key%20Document/Key%20Document/we%20dont%20do%20that%20-%20it%27s%20not%20safe%20anymore.pdf

curriculum. I hope to show that, whilst risk cannot be eliminated, there is no unique case against class singing provided the risk is properly understood and adequately managed. I will cover three fundamental approaches to risk management that can be distinguished by the ways in which they attempt to quantify risk and the level and type of responsibility they put on school staff.

# Methods of quantifying risk

## Calculating likelihood of risk

Perhaps the two most fundamental questions we must ask are (a) whether a risk is acceptable or not and (b) whether it outweighs the alternative. So, if we say something is "high risk" are we implying that it is not acceptable, that it does not outweigh the alternative? What if we say something is "low risk" does this mean that it is also an "acceptable" risk? This is the problem of *quantification.* Much of what is being said about risk is expressed in these generalised, catch-all qualitative terms and we might pause to reflect on what they really mean. An alternative might be to quantify risk as a probability. This is commonly done on a scale of 0 – 1, where .5 would represent even chance. Sometimes percentages might be used to mean largely the same thing. I have just checked the on-line weather forecast for my area, and it tells me that the risk of rain today at lunchtime is 7%, a probability of less than 0.1. I might say this is "low risk" and lay some cement.

Suppose, though, it were not the weather that were being quantified but my chance of catching the covid virus in a singing class? As a retired person, I sometimes go into classes and take singing, but would I now, given that I am a "high risk" category on account of my age? Would I feel confident in interpreting a 0.1 probability in the same way? If the probability of a child being an asymptomatic carrier is 0.1, then we might expect that in a year assembly of 100 children, there could be ten asymptomatic carriers – children who look and feel fine but who will be the source of an onward transmission chain leading to more vulnerable members of the community. If the doors and windows are shut and the activity is a normal lesson length of, say fifty minutes, the school then becomes the source of an outbreak and I a victim. Perhaps, if we look at it like this, a probability of 0.1 is better interpreted as "high risk"?

## Considering the consequences of the risk

A further difficulty is that we do not at this stage have a complete picture of risk. A probability of 0.1 (or indeed, 0.0001) must first be calculated by a sophisticated mathematical model that is beyond the ability of any school to compute. Then it only shows what it has been designed to show, which in this case is the presence of an asymptomatic carrier in a given population. An unknown asymptomatic carrier is a *hazard,* something that "has the potential to cause harm". Missing from our assessment is any estimation (or calculation) of the consequences. If it rains on my cement, the consequence is that I will get annoyed and possibly need to repair the surface the next day. This is not catastrophic. If, however, the consequence is that I need to quarantine myself for fourteen days, it is more than a mere inconvenience. If I and several other people end up in hospital and one of those people subsequently dies, we have moved into the realms of catastrophic consequence. Risk assessment needs to identify and take account of the likelihood of many interdependent hazards *and* the consequences.

## Focusing on mitigating risk with control measures

Not all risk assessment templates do this. Some templates that are available focus simply on *control measures* – procedures that must be followed to mitigate the risk. An example would be the one

produced by the Church of England. The C of E template identifies a comprehensive range of *areas of focus*, of which 'cleaning the church before and after general use' is one. It could be the school hall or a classroom we are talking about. The template requires, amongst several things, that "if a 72- hour closure of the church is not possible then check all cleaners are not in a vulnerable group or self-isolating". Would a head teacher need to do this for a school, or could she assume that none of her cleaners will be vulnerable? Perhaps there is an implicit assumption that a church will be cleaned by elderly voluntary cleaners here? What, though, is the significance of 72 hours? Is it just an arbitrary time-period, or is it based on reliable science that has shown that the virus cannot remain viable on any surface for longer than 72 hours? The point is that this control measure is *taken on trust*. Neither schools nor churches have the mission, time or expertise to test for themselves whether viruses that adhered to the walls on Friday afternoon through the evaporation of aerosol particles will be viable the following Monday when a child touches the wall and then touches his face before visiting the toilets. So, there is quite a lot to be said for a system where the risk assessment is presented as a list of control measures or procedures that must be followed. The responsibility of the person using such a template then becomes to ensure that those measures are all followed. That person takes all these on trust and does not actually have to calculate likelihood or consequence for themselves.

## Quantifying risk using an ordinal scale

An alternative approach attempts to quantify both likelihood and consequence as a locally computed risk, and to show further mitigation of that risk by additional control measures. Unlike the C of E style template, the system allows for local adjustment and a degree of intervention by the person responsible who must do more than just compile a checklist that shows the control measures have been followed. Such a system is well-established in safety critical applications such as railway safety that must be responsive to events as they happen. Quantification in this system is by means of what is known as an ordinal scale. An ordinal scale identifies discrete categories and ascribes a number to identify these categories.[5] As such, it belongs to the second of four orders of measurement of increasing statistical power. Let us suppose that that we identify five degrees of consequence, our "C values", as follows:

> 1 = Inconvenience – absent child
> 2 = Pattern of significant absence
> 3 = All families have to quarantine for 14 days
> 4 = Several hospitalisations requiring oxygen
> 5 = Catastrophic – persons on ventilators, deaths.

The likelihood of the hazard occurring is similarly assessed on an ordinal scale:

> 1 = very unlikely
> 2 = unlikely
> 3 = fairly likely
> 4 = likely
> 5 = very likely

It would be true and useful to say that a 3 is worse than a 2. It becomes a nonsense, though, if we say that a death is five times as bad as a child off school for a couple of days. This is a misuse of

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[5] https://www.questionpro.com/blog/nominal-ordinal-interval-ratio/

statistics because we are claiming a statistical power that does not exist in the ordinal scale. We would need to use a ratio scale where the numbers are continuously variable and originating from a true zero. A simple example would be that it *is* true that a child weighing 50kg has twice the mass of one weighing 25kg. The relevance of this is that it is possible to make an error by treating numbers such as 0.2 or 0.6 probability as though they had the undisputed power of 25 and 50kg. They do not, and this is a potential drawback of the system that has been developed in the United States by the Colorado-Boulder project. This has been attempting to work with probabilities of airborne transmission generated by a complex equation known as the Wells-Riley. To put the matter simply, it is probably safest to leave such matters to the scientists and statisticians and take the control measures they derive from their calculations on trust because there are just too many confounding variables – things you forgot to include, didn't know about or that have a more complex effect than you allowed for.

Using our simpler ordinal scale, we then multiply the likelihood (L number) by the consequence (C number) and this gives us our risk as a number between 1 and 25. We interpret this number by reading off a table:



Now we have an indication of whether the particular risk is acceptable. If the number falls within the green zone, we can argue that we are justified in taking the risk, though we must continue to monitor the situation and perform another risk assessment if the situation changes. This could be because the R number in our area has changed, because an important new scientific paper has shown a hazard either more or less dangerous than first thought, or simply a localised change such as moving to a different timetable or turning the heating on for winter. If the number falls in the yellow zone, the risk is not acceptable, and we need to stop and make some changes. If it is within the red zone, it is definitely "high risk". We need to stop immediately; we shouldn't have been doing it in the first place and there's probably nothing we can do by ourselves to make it acceptable.

## Applying risk assessment to a school context

Let's look at an illustration in practice.  If a pupil is seated at a desk for any length of time, it is likely that she will cough or sneeze. Droplets of mucus will fall onto the desk where they will evaporate leaving concentrations of the virus that will remain viable on a paper surface for up to three hours or as much as three days on a plastic surface (now we see where the Church of England get their 72

hours from).[6] If we are fortunate enough to live in a region or country where the R number is very low, we can probably rate the likelihood of transmission via this fomite route as a 1 or 2, since it is highly unlikely that any pupil will have the virus. If, as in England for much of the summer, the R number is nearer 1, we are going to have to rate L somewhat higher, at least 3. We then need a consequence and we would need to choose at least 3 since we do not know who the pupils will meet outside or what they will do. Again, much depends on local circumstance, demography and housing conditions. A 4 would be justifiable caution but let us say 3. Even then, 3 x 3 = 9 and 9 is in the yellow zone. The risk is not acceptable. *Note that this has nothing to do with singing*.  It's going to happen whether the pupil is singing, answering a question, writing silently or changing for PE.

We could mitigate this risk by devising a control measure. If we said that all lessons must be in the same classroom and each pupil must have an assigned desk which only they use, the L number will fall to 1 since no other pupil will touch the surface and either the pupil already has the virus or she doesn't. It will not make any difference *for that particular hazard*. The consequence is still 3 or perhaps 4, but whether 1 x 3 = 3 or 1 x 4 = 4, the numbers are comfortably in the green zone. The risk is now acceptable. This is best expressed in tabular form as below. Note that the risk assessment is specific to location *N.* As described above it will vary according to the R number where N is located. The table assumes that R is something like .8 or .9.

| At Risk | Other pupils, their families and wider contacts in *N.* | L | C | R | Action |
|---|---|---|---|---|---|
| Hazard | Transmission of the virus via pupils' tabletops. | 3 | 3 | 9 | Unacceptable risk. Stop activity and devise control measure |
| Control | Pupils receive all teaching in the same room at individually assigned desks. | 1 | 3 | 3 | Acceptable risk. Continue the activity whilst monitoring any changes. Set review date. |

In principle, this is not complicated, though it will occupy much teacher time in working out what happens if it is impossible for pupils to receive all their lessons in the same room, and numerous other such practical complications that are doubtless already familiar to schools.

The bigger difficulty arises when we ask who has sufficient knowledge to assign a likelihood number to a given hazard. In the case of hazards that have been known about for a long time, such as falling off a ladder or contamination by cleaning agents in a school kitchen, plenty of people are competent as assessors. However, SARS-CoV-2 is a novel virus and there are hazards associated with it that challenge the most knowledgeable of scientists.[7] When scientists are uncertain, another condition arises – that of *precaution*. There is an important difference between risk and precaution. The more uncertain the science, the higher the precaution. Risk aversion is closely related to precaution and we must ask whether a control measure is the result of a risk assessment or the application of the precautionary principle. They are not the same thing.

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[6] van Doremalen, N., Bushmaker, T., Morris, D., Holbrook, M., Gamble, A., Williamson, B., Tamin, A., Harcourt, J., Thornburg, N., Gerber, S., Lloyd-Smith, J., de Wit, E., and Munster, V. (2020)  Aerosol and Surface Stability of SARS-CoV-2  as Compared with SARS-CoV-1, New England Journal of Medicine, Correspondence, April 16th.

[7] King, A et al. (2020) *COVID-19: what are the options for the UK?  Recommendations for government based on an open and transparent examination of the scientific evidence* (The independent SAGE report). London: The Independent Scientific Advisory Group for Emergencies.

## Risks of singing compared with other school activities

I have been at pains to point out that most risks associated with singing are equally risks that can be laid at the door of a mathematics lesson or a staff meeting. Music teachers should not hold back in pointing this out to colleagues and managers. Indeed, it is not hard to show how singing can be a lower risk than mathematics if, for example, the singing is from memory or the music is projected onto a whiteboard. The mathematics teacher who handles books to mark them is at a higher risk than the singing teacher by this measure. Both teachers are at equal risk from equipment in the room that any child might have touched and if children forget to social distance it matters not what the activity was. I would argue that in a well-disciplined singing session where children remain in their places and focus on a teacher giving Kodaly hand-signs, the risk of their forgetting social distancing is about as low as it could be.

Emerging understanding of the relationship between age and susceptibility to the virus allows us to argue that teenagers in a fifty-minute English lesson represent a higher risk scenario than eight-year-olds singing for ten minutes.[8] This has to do with airborne contamination. We need to be clear about why, and we must not allow singing to be demonised. It is worth pointing out that in March this year, the World Health Organisation was stating that "no airborne transmission had been reported". That carefully worded statement avoided saying there is no risk, but it justified the WHO position taken at the time that what mattered was close personal contact and surface contamination. The act of singing has popularly demonised because it was not possible to demonstrate that it was singing as opposed to shouting or talking loudly that was the unique cause of the much-publicised "super-spreader" events associated with choirs. This was a matter of precaution, not assessed risk. The knowledge to quantify the risk did not exist.

## Emerging research into singing and airborne transmission

Since then, we have become considerably more knowledgeable about the voice and airborne transmission. We have known almost since the beginning of the pandemic that the action of the vocal folds nebulises mucus (i.e creates aerosols) and that the more rigorously the folds are excited the more this happens, shouting producing up to fifty times the volume of aerosols as quiet talking.[9] This is not a matter of precaution, it is a matter of risk that can be measured. Until recently, though, there was a fear that sustained, tuned notes with exaggerated consonants and cultivated deep breathing (i.e. singing) might be even worse than shouting, but nobody had accurately measured this. So, in the realm of precaution and not quantified risk, risk-aversion dominates. Emerging work such as that recently done in the Bristol Aerosol Research Centre (fronted by Declan Costello)[10] is beginning to replace precaution with quantified risk. The result is that the Department for Culture, Media and Sport (DCMS) is now prepared to allow amateur singing to restart, though questions remain about the viral load within aerosols and the fluid dynamics of many people singing together.

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[8] Heald-Sargent, T.et al (2020) Age-related differences in nasopharyngeal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) levels in patients with mild to moderate coronavirus disease 2019. *JAMA Pediatrics* online Doi:10.1001/jamapdeiatrics.2020.3651

[9] Asadi, S. et al (2019) Aerosol emission and superemission during human speech increase with voice loudness, *Nature*, 9:2348. doi.org/10.1038/s41598-019-38808-z

[10] Gregson; Watson; Orton; Haddrell; McCarthy; Finnie; et al. (2020): Comparing the Respirable Aerosol Concentrations and Particle Size Distributions Generated by Singing, Speaking and Breathing. ChemRxiv. Preprint. https://doi.org/10.26434/chemrxiv.12789221.v1

How does the singing of schoolchildren compare with that of adult amateurs? Once again, we find we know less than we need. An expert review in the *Journal of Voice* concluded that "it is still ultimately unknown how aerosol production varies according to voice type, vocal register or vocal style (belt, growl, classical, choral, etc.)"[11] So, we need to be careful about making assumptions about how children sing but I think we can reasonably take a cue from the relaxation of the precautionary principle for adult amateurs. The Bristol study has produced evidence that quiet singing produces fewer aerosols than loud singing, so asking the children to sing quietly is another quantifiable control measure that can now be justified. The clinching factor is not the age or physical mass of the singer, or the efficiency of their technique, but the simple fact that a choral society rehearsing the Messiah would involve up to 100 or more adults, many of whom will be in high risk age categories, using all their voices simultaneously for up to 90 minutes in a poorly ventilated church hall. This probably *is* a risky behaviour unique to singing. Such confinement and constant use of voice by vulnerable groups would merit a 4 or even 5 for both likelihood and consequence, rendering a red risk.

## Reducing risk of singing in school

We have a good idea of other control measures to implement in school. We are confident that outdoor spaces are significantly lower risk than indoor spaces because moving air prevents the build-up of aerosols. If we take the children outside to sing, the likelihood is reduced to 1 or 2 at most, though additional hazards are introduced by avoidable movement around the school. If we must work indoors, as indeed we must with winter approaching, the next best thing is to reduce the number of people in the room to the lowest practicable number and change the air as frequently as we can, by such means as open doors and windows or mechanical ventilators that evenly replace but not misdirect or recirculate air.[12] Allowing a thirty-minute ventilation break when the room is vacated is another effective control measure. *All these considerations apply to all subjects.* A geography teacher talking continuously for thirty minutes with none of these control measures will generate an appreciable accumulation of aerosols. A noisy lesson with a weak supply teacher in which children call out constantly will probably generate more. I'd happily rate 15 well-behaved children in a well-ventilated classroom singing quietly and intermittently for just ten or fifteen minutes at the beginning of a music lesson as 2 x 2 and go ahead.

The bigger remaining difficulty I see is in achieving a consistent approach across the school. Music Mark have produced a risk assessment template that is an interesting hybrid of the two I have described. It suggests control measures to be taken on trust and gives a likelihood x consequence rating table that can be used to demonstrate how additional control measures devised with local knowledge have reduced the initial rating. What, though, if the science department uses a different system provided by their subject association? What if a single system is recommended for use throughout a primary school by an academy chain and this does not allow the music teacher to demonstrate how she is controlling risks specific to her subject? As always, we press our case patiently, and persistently, based on the best knowledge we can obtain.

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[11] Naunheim et al (2020) Safer Singing During the SARS-CoV-2 Pandemic: What We Know and What We Don't. Journal of Voice, https://doi.org/10.1016/j.jvoice.2020.06.028

[12]  Shao, S. et al (2020) Risk assessment of airborne transmission of COVID-19 by asymptomatic individuals under different practical settings, *arXiv preprint*, Cornell University https://arxiv.org/abs/2007.03645

**Martin Ashley** worked in a variety of school and university settings before retiring in 2013 as Head of Education Research at Edge Hill University. He has specialised in the adolescent male voice and prior to Covid-19 was working on the consequences of earlier voice change and boys' musical maturity in mixed gender choral settings. As editor-in-chief of the Association of British Choral Directors' research journal, he assembled a small team of virologists and public health professionals to produce a rapid response review of choral singing and Covid-19.

www.martin-ashley.com

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