What motivated you, Professor Jos Lelieveld, to create a publically available aerosol infection risk calculator?

We wanted to create a simple tool anyone can use to calculate their infection risk and evaluate potential safety measures' effectiveness.

How does the calculator work?

Our model determines the risk of being infected by Sars-CoV-2 via aerosol particles exhaled by patients in indoor environments. It uses parameters such as the room size, the number of people in it, and their activity to estimate both the risk of Covid-19 infection of specific persons (individual risk) and of anyone in the room. The algorithm is publicly available on our website. It calculates infection risk by small aerosol particles but not by larger droplets when safe distances are not being met.

Can you please explain the difference between small aerosol particles and larger droplets?

Breathing, talking and singing create micrometer-sized aerosol particles. These particles can stay in the air for a long time, accumulate and spread throughout the room. Many assume that such aerosol particles play an important role in the transmission of Sars-CoV-2 viruses. Indoor situations where many people are together for an extended period are particularly critical for infection with Covid-19.

Larger droplets, created, for example, from coughing or sneezing, are particularly dangerous as an individual droplet might contain many viruses. The researchers assume that the average dose for someone to become infected with Covid-19 is around 300 viruses or RNA copies per person. On a positive note, large droplets generally fall quickly to the ground over short distances. Thus, simple measures help to protect against infection. We included neither the larger droplets nor the transmission risk through infected surfaces in our model.

Can you, Dr. Kolbe please again remind us of these "simple measures" all of us should observe?

Our understanding of infection pathways shows that it is always a bundle of “simple measures,” which effectively reduces our individual risk: social distancing and wearing a mask and limited contact time to other persons. “Simple measures” mean everyone can apply them, and you do not need expert knowledge or the latest technology. Additionally, personal hygiene and a sufficient air exchange rate complete the measures.

Professor Jos Lelieveld: Does a low-risk calculated in the model mean you are safe?

The model's main aim is to roughly evaluate the potential risk situations and compare the effectiveness of possible protective measures. In general, active room ventilation and the wearing of face masks by everyone may reduce the individual infection risk by a factor of five to ten, similar to high-volume, high-efficiency particulate air filtering. A particularly effective mitigation measure is the use of high-quality masks, which can drastically reduce the indoor infection risk through aerosols.

But there is no absolute safety, and there are also uncertainties in the calculations e.g., related to assumptions such as the survival time of the Sars-CoV-2 viruses in the air and the number of viruses that an infected person gives off. 20% of the patients tested positive for SARS-CoV-2 can be classified as "highly infective", whereas 5-10% may be considered "super infective".

Therefore, even minor risks should be avoided whenever possible. But there are many instances where this may not be possible, and risk reduction is a useful strategy. We endorse the reasoning of Kai and colleagues that a "mouth-and-nose lockdown is far more sustainable than a full lockdown, from economic, social, and mental health standpoints".

Dr. Kolbe: The effectiveness of FFP2 masks was very evident in the model. By now, these masks are generally available. Do you recommend to use them generally in the laboratory? If not, in which situations do you? What is to be kept in mind?

Filtering face masks (type FFP2 or KN95) are indeed effective in avoiding inhalation of very small particles. Nevertheless, I do not recommend them as standard equipment. Personal protective equipment always demands careful use and understanding of the proper application. Due to the mask's material, breathing is really exhausting especially if you wear it for longer time (e.g. > 30 minutes) or you do hard manual work.

Apply the "simples measures" at any time and use FFP2/KN95 masks as a backup if closer contact or longer contact time to other persons is probable. Please use only masks without ventilation valve to ensure that exhaling and inhaling air is free of particles (= viruses). So you protect yourself and your lab mates!

Dr. Kolbe: What did you find particularly noteworthy while calculating the risks for the typical situations at work? And which recommendations might be derived from them?

The calculations visualize very clear the effectiveness of the bundle of measures.

One result is that safe working conditions during the pandemic are still possible, but you should invest some time to check it out by using the model! The other is, it demonstrates how difficult it is to keep a low infection risk if you try to ignore one of the measures. That means, if you do not use a mask you only have very short contact time or if you do not reduce the number of contacts to other people only a FFP2 mask ensures low infection risk. The model shows that a single measure is never enough.

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and

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were interviewed in December 2020 by

Dr. Tobias Rasse on behalf of the Max Planck BioImaging Core Unit Network

for more information we refer to:

https://www.bioimagingnet.mpg.de/covid19resources