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Implications of respiratory pathogen transmission dynamics on prevention and testing

The COVID-19 pandemic provides an important reminder on the importance of understanding respiratory pathogen transmission dynamics to support evidence-based practices and recommendations for prevention. The study of respiratory pathogen transmission dynamics is nothing new; previous studies have clearly shown that large droplets can travel more than 6 m away in a sneeze, 2 m away in a cough and nothing new, previous studies have clearly shown that large droplets prevent. The study of respiratory pathogen transmission dynamics is important reminder on the theoretical rationale for the possible limited benefit of some current public health prevention recommendations on physical distancing and masking as explained in this article.

Currently, the World Health Organization (2020) and other governmental bodies such as the US Center for Disease Control (2020) recommend around 1–2 m for physical distancing. However, as a recent laboratory experiment has showed that COVID-19 droplets can travel up to 7–8 m and that turbulent gas clouds can extend aerosolized droplet life by up to 1000 times from seconds into minutes (Bourouiba, 2020). It has been supported by a separate laboratory study which showed that aerosolized SARS-CoV-2 particles remain viable for up to 3 hours (van Doremalen et al., 2020). It must be noted as later explained, the controlled setting of these laboratory experiments reduces the generalizability of these results in the community.

Furthermore, another laboratory experiment by Anfinrud et al. (2020) using laser light scattering to visualize speech-generated oral fluid droplets showed the emission of numerous droplets ranging from 20 to 500 μm. This supports the results of an earlier experiment in Hongkong which showed that in seasonal coronavirus patients, viral RNA can be detected even in exhaled breath and not only when patients cough (Leung et al., 2020).

While these findings raise questions regarding our current understanding of COVID-19 being mainly transmitted through respiratory droplets, the R-0 of around 2.3 does not indicate such a high potential for aerosol transmission as depicted (Zhang et al., 2020). Furthermore, a recent small study in Singapore showed that despite extensive environment contamination air samples remain negative for SARS-CoV-2 (Ong et al., 2020). There is certainly a need for more evidence on COVID-19 transmission dynamics especially in the community, in asymptomatic and pre-symptomatic individuals following these findings as they are all done under laboratory conditions where the impacts of heat, humidity and airflow are under control unlike in the population setting.

Broader Testing Criteria Needed

Even so, the implications from these studies goes beyond current physical distancing guidelines. It showed the potential for substantial transmission beyond the current criteria of close contact which within less than 2 m and for more than 15 minutes in several guidelines such as by the US CDC (2020) and European CDC (2020). Hence, broader testing beyond this criterion would be required to detect asymptomatic or pre-symptomatic cases which potentially has similar transmissibility to those symptomatic.

More Stringent Public Prevention Measures Required

This study further supports the value of lockdowns to limit transmission. However, lockdowns are not possible everywhere especially in low middle-income countries where it may lead to chaos as shown in India (Pandey, 2020). Furthermore, countries that have been able to contain its spread with lockdowns like Germany and China cannot sustain them for too long. Universal masking in public maybe an alternative in such situations and areas of high local transmission such as New York.

While there is modest evidence supporting universal masking in public, this is not evidence of ineffectiveness (Greenhalgh et al., 2020). Universal masking using medical masks that has been shown to be effective in reducing respiratory droplet transmission is certainly ideal. (Leung et al., 2020). Even so, any masks even homemade masks when utilized properly can help reduce transmission compared to no mask at all as reported in several studies (Ma et al., 2020; van der Sande et al., 2008). A qualitative small laboratory study has even showed that using a cloth to cover one's mouth during speaking reduces emission of droplets (Anfinrud et al., 2020). It is important to note that for an effective implement the public needs to be educated on its proper use and that it is not a replacement, but must be done in synergy with intensifying other prevention practices such as frequent handwashing and more extensive physical distancing measures.

Masking may also confer benefits outside of droplet protection. A recent ecological study by Martelletti and Martelletti (2020) in Italy has shown potential links between higher levels of air pollution and COVID-19 prevalence which was similar to the result of ecologic studies in China during the SARS-CoV-1 outbreak (Cui et al., 2003). It was hypothesized in these studies that high level of air particulates reduces host immunity and more importantly may become carriers of viral particles helping in its transmission. If this is confirmed, despite limited evidence of the effectiveness of masking against pollution with studies reporting an effectiveness of between 32% and 97%, it may result in an additional layer of benefit outside droplet reduction (Cherrie et al., 2018).

Like using parachutes when jumping out of airplanes, in these times of pandemic recommending universal masking in public with proper education is unlikely to cause harm and has potential to substantially mitigate the COVID-19 respiratory transmission dynamics as discussed above which goes far beyond current recommendations.

Disclosures

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Anthony Paulo Sunjaya
Respiratory Division, The George Institute for Global Health, UNSW Sydney,
1 King Street, Newtown, Sydney, 2042, Australia
E-mail address: a.sunjaya@unsw.edu.au.