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Centralized air-conditioning and transmission of novel coronavirus

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There has been an alarming increase in the death toll due to Coronavirus Disease 2019 (COVID-19), i.e., over 2.7 million confirmed cases and approaching 200,000 associated deaths as of 24 April 2020 [1]. It is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and it has been suggested widely that the approaching warmer weather may slow or even stop the spread of this devastating disease. This conclusion is drawn based on SARS-CoV-2's similarity with the common flu in the symptoms it causes and its transmission [2];, however, the transmissibility and severity of the virus are far greater than the climate-sensitive flu virus. Hence, it is unclear whether SARS-CoV-2 will be affected by seasonal temperature variation. Moreover, we hypothesize that SARS-CoV-2 can take refuge inside ubiquitous and environmentally hardy *Acanthamoeba* (the trojan horse of the microbial world) [3], allowing its persistence in the environment, and in particular, in centralized air-conditioning systems. This is not surprising as several microbial pathogens are well documented to take refuge inside hardy amoebae cysts, a property that allows them to survive and spread under hostile environments.

At present, a common understanding is that microbial pathogens such as coronaviruses and bacteria survive better in the cold with reduced ultraviolet light. However, here we hypothesize that SARS-CoV-2 may have the capability to act as a hyperparasite, i.e., a parasite within another parasite, as well as that centralized air-conditioning systems can allow the virus' viability and its continued persistence during the summer months. In support of this hypothesis, recent reports suggest that SARS-CoV-2 could be spread by air-conditioning, after discovering viral particles in a restaurant in Ghangzhou, China, hospital air-ducts, as well as cruise ships, and therefore may be more contagious than previously thought [4,5]. Moreover, at present, there is only elementary knowledge of several aspects of how this infection spreads and whether the virus is airborne. It is certainly possible that the SARS-CoV-2 can be airborne similar to its closely related predecessor, SARS-CoV-1. This was supported by numerous studies that retrospectively revealed the pathway of SARS-CoV-1 transmission in Hong Kong's Prince of Wales Hospital [6]. If this is true, it will be an alarming development that can aggravate SARS-CoV-2 transmission further in the summer months. Such a situation would be particularly relevant to warmer countries such as those within South East Asia and the Middle East and North Africa (MENA) region. There is an urgent need to determine the effects of increased temperature and humidity on the novel coronavirus. Notably, in summer, (i) people spend more time indoors in air-conditioning leading to reduced levels of vitamin D and melatonin, which can affect the performance of their immune system, (ii) and while in closer proximity with other people, could increase opportunities for novel pathogens such as SARS-CoV-2 to spread to other individuals. Hence, there is an urgent need to determine the prevalence of SARS-CoV-2 in air-conditioning systems in public schools, hospitals, shopping malls, mosques, public places, etc. If we know what is out there ahead of time, we will have the opportunity to enhance our capacity for the rational development of diagnosis and therapeutic interventions, preventative measures, as well as the improvement of the air-conditioning systems.

Contributors and sources

RS (BSc, MRes, PhD) has over 15 years of experience in the field of infectious diseases. Both NAK and RS have a lifelong interest in the field of medical microbiology and became interested in hyperparasites in the spread of infectious agents. All authors contributed equally to the manuscript and will act as guarantors.

Disclosure statement

The authors declare (1) no financial support for the submitted work from anyone other than their employer; (2) no financial relationships with commercial entities that might

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