Personal respirators for population level control of the COVID19 pandemic

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Dear editor,

Since the readers of this Journal were first alerted to the emerging problem of COVID-19 (1) the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus is causing a global pandemic (2-4), resulting in more than two million confirmed cases and almost 140 000 deaths to mid-April (5). SARS-CoV-2 is transmitted by aerosol droplets or facial touching (6), and fatalities are usually due to respiratory complications. The primary control measure is social distancing, but maintaining such controls will be challenging.

Traditional control measures from an infectious disease include personal hygiene, vaccination, vector control, environmental controls, prophylaxis and quarantine. For example, vaccinia virus eradicated smallpox, bed nets control malaria and condoms reduce HIV transmission. As SARS-CoV-2 transmits to the face or mouth, an alternative would be to protect these areas, which can be achieved by a

personal respirator. Widespread use of personal respirators has not been possible to date due to their complexity and limited supply. We have developed a simple personal respirator in Southampton (PeRSo), made from cheap, mass-produced components (7, 8). The motor unit fan pulls air through a high efficiency filter, powered by rechargeable batteries. The clear air is delivered into a hood with a clear plastic visor, and passes standard sniff and bacterial tests (Figure 1). We have initiated manufacture locally and are aiming to roll out widely in the United Kingdom, and are investigating components suitable for local production in the developing world (PeRSo-DW).

Figure 1. PeRSo prototype

However, in addition to protecting healthcare staff as per the original design intention, PeRSos could potentially be used for wider control of SARS-CoV-2. Whilst this may seem fanciful, if one had proposed in December 2019 that one third of the world would be under lockdown three months later, this would have seemed ridiculous. Wearing PeRSos outside the house would allow society to return to productivity, with industries and business re-enabled, and individuals able to meet face-to-face.

Evidently, implementation challenges exist, but the alternative of waiting for a vaccine indefinitely seem worse in terms of economic impact. As a control strategy, PeRSo use outside the house would be compulsory in areas with active transmission. Once the cycle of transmission is broken, respirator use would be optional. Strengthened public health screening would be required to identify breakdown areas, leading to travel restrictions and return to compulsory PeRSo use. Humans would all look highly unusual, but SARS-CoV-2 would be controlled and this would act as a bridge to a new vaccine or drug therapy. Whilst the costs may seem high, compared to the economic costs of a prolonged lock-down, this is trivial.

We propose the PeRSos should be mass produced and deployed to healthcare workers in areas of SARS-CoV-2 transmission urgently. Later, wider use could be considered, such as in roles involving frequent interpersonal contact. Ultimately, this will permit a return to normal vaccine becomes available, just as a bed net protects in malarial regions. Public health interventions of increased surveillance and compliance with regular hand hygiene, in particular before and after removing the

PeRSo, will also be needed. The return to a semblance of global "normality", and the upswing economic productivity, will reduce the impact of the pandemic on the poorest in the world.

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