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Facepiece filtering respirators with exhalation valve should not be used in the community to limit SARS-CoV-2 diffusion

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To the Editor—From the first identified cases of COVID-19 onward, the pandemic spread of COVID-19 has presented difficult challenges for the scientific community. Many countries have already experienced periods of social lockdown, with the aim of containing the virus but with dramatic economic consequences. To balance health and economic and social needs in the long term, de-escalation of quarantine restrictions has been proposed in many countries.

During normal speech, a huge number of droplets are produced, and face covering may be effective in limiting the distance reached by the droplets, potentially reducing the transmission of the virus from individuals who are unaware that they are infected.[1]

Face covering with masks or tissue has been widely recommended as a complementary measure to reduce the infection rate in the community by limiting the excretion of droplets from asymptomatic or presymptomatic individuals.[2] In this context, some governments are ordering face covering, especially during activities when social distancing is impossible or difficult (eg, using public transportation and visiting grocery stores or supermarkets, etc).[2,3]

Such measures should be intended as a protection towards the community and not as self-protection. A distorted comprehension of the real aim and a scarce knowledge of the differences among protective devices, has led many people to start using facepiece filtering respirators (FFRs) instead of the suggested nonmedical or medical masks, which are the most appropriate devices for source control, especially in the context of a pandemic.

FFRs are disposable filtering media, designed to provide the wearer an inward protection from inhaling contaminants conveyed by respiratory droplets or aerosols.[4] On one hand, this 'panic buying' of FFRs may have contributed to the lack of supplies available for those employed in risky settings, such as healthcare workers frequently exposed to aerosol generating procedures, and it has also likely encourages counterfeiting.[5] On the other hand, the uncontrolled sale of FFRs to people who are unaware of their specific features and are untrained in their use can create additional risks: incorrect doffing procedures can increase cross contamination; a false perception of safety can reduce the compliance to other measures (ie, hand hygiene, respiratory etiquette, social distancing); and even worse, the use of FFRs with exhalation valves in the community may be an additional and underrecognized transmission source.

The risks related to the presence of an exhalation valve are not intuitive for the general population and should not be silenced by institutions and governments. FFRs endowed with exhalation valves are meant for prolonged use, such as during extended work shifts when the wearer may experience discomfort and heat due to high resistance during exhalation. The valve opens only during the expiration, lowering resistance encountered during expiration. At lower inward pressures than those created by the expiratory airflow, the valve closes and, despite minimal inward leakage, filtering occurs during inspiration, together with a more comfortable expiration.[6]

The functioning of exhalation valves poses major concerns about outward protection, which is reasonably diminished by FFRs. Several institutions have already expressed concerns about their use outside the recommended context. The European Centres for Disease Prevention and Control (ECDC) and Africa Centre for Disease Prevention and Control have provided clear statements against their use in the community setting.[7,8] The US Centers for Disease Prevention and Control (CDC) recommended against their use in healthcare settings where a sterile field must be maintained, thus implying that the outward protection is not provided by FFRs.[9] Recently, the City and County of San Francisco explicitly listed respirators with one-way valves among those forbidden for use in the community, clarifying that they 'allow droplets out of the mask, putting others nearby at risk,' thus not complying with the face-covering order.[10]

Communication campaigns should aim to promote the wearing of masks as a source control measure and to increase awareness that FFR supplies are already insufficient to protect highly exposed

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workers. Indeed, institutions and governments should consider preventing free marketing of FFR with valves, given that their indiscriminate use in the community setting can determine an additional and under tracked risk for the population.

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Aerosol distribution in the cabin and cockpit of an ambulance helicopter

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To the Editor—Even before the COVID-19 pandemic, when our study was planned, the question of potential spread of droplets or airborne particles from the patient in the cabin of an air ambulance helicopter into the cockpit was eminent. Transportation of patients with aerogenously transmitted diseases in helicopters is increasingly required, and personal protective equipment cannot be worn by the pilot to the same degree as the medical crew. Also, disinfection of aeronautic equipment in the cockpit is cumbersome.[1] Therefore, we developed an experimental model to simulate aerosol distribution within the helicopter on the ground and in flight with a worst-case "airborne spread" scenario and a clinically relevant "short, intermittent droplet spread" scenario.

Material and Methods

The project was approved by the Wissenschaftlicher Arbeitskreis der DRF Stiftung Luftrettung gemeinnützige AG, WAK-ID 24 (Scientific Review Committee). A Cirrus 2 nebulizer (Intersurgical GmbH, Siegburger Str. 39, 53757 Sankt Augustin, Germany) was filled with a fluorescent marker fluid (UV-Tinte 4887, Flockenhaus GmbH KG, Frankfurter Str 536124 Eichenzell–Fulda, Germany) and positioned at the head of the patient stretcher, which was positioned at a 30° angle. For the worst-case scenario, aerosol was produced for 60 seconds with a flow of 8 L per minute every 5 minutes during flight or on the ground for 30 minutes and for 10 seconds in the short, intermittent scenario on 5 occasions with EC 135 and H 145 Airbus helicopters (Industriestrasse 4, 86609 Donauwörth, Germany) with and without a curtain separating the cockpit from the cabin. In the ground simulation, a test scenario with open aft doors and wind (simulated by a fan) directed into the cabin was added. Aerosol distribution was visualized with ultraviolet light, and the experiment was videotaped. The surface sedimentation was documented using serial photographs.

Results

Figure 1 gives an impression of the turbulent, undirected distribution of the aerosol. The aerosol filled the cabin on the ground and in flight, independent of helicopter type, ventilation settings, and flight maneuvers, resulting in sedimentation on all surfaces around the patient in the worst-case scenario. Without a curtain,

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