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The Next Breath

Scientists Urge Action to Clean the Air Children Breathe

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Kids are going back to school — but not really. Since the start of the COVID-19 pandemic over 1 billion children of the world's 1.6 billion school-age children have fallen behind in school (1). Respiratory disease, already the leading cause of death in low-income countries (2), has not just robbed children of their education; it has pushed an estimated 150 million children into multi-dimensional poverty (3). Today around 750 million children are threatened with lack of access to some combination of education, healthcare, water, sanitation, and nutrition (4).

While COVID-19 has posed an unprecedented threat to childhood health and learning, this threat may pale in comparison to the growing threat shaped by the climate crisis. Atmospheric black carbon and other short-lived climate pollutants (SLCPs), which today account for roughly half of global warming, worsen the

severity of every facet of multidimensional poverty.

Poor air quality increases the childhood burden of respiratory disease. Exacerbated by the burning of fossil fuels, and more frequent wildfires, asthma has become the most prevalent chronic disease of children in low-income regions of the world (5), where pneumonia is now the number one killer of children less than five (6), and where annual cases of influenza among children in this same group surpass those of all older ages combined (7).

Breathing cleaner air will ultimately require better cookstove technologies and cleaner cooking fuels to reduce indoor air pollution; it will require displacing fossil fuels from the transportation, electricity and industrial sectors, the dominant sources of air pollution in our cities. Clean energy technology is moving fast, but not fast enough to meet the health and learning needs of the hundreds of millions of children breathing poor quality air today.

Scientific advances in non-therapeutic approaches to combat COVID-19, many disease-agnostic and easily implemented, can help reduce the threat of respiratory disease to childhood health and learning. Recent innovations in air quality control, point-of-contact disease detection, and human hygiene can be integrated into childhood learning environments around the world, help open safer schools, and help keep kids breathing cleaner air.

Owing to pandemic science we understand better today how to protect:

Our Air. HEPA filters, which have proven effective against airborne SARS-CoV-2 (8), can clean the air of the hundreds of millions to tens of billions of fine particles (PM2.5) inhaled by people every day and that directly correlate to respiratory diseases ranging from asthma (10) to COVID-19 (11). Far-UVC light and ultraviolet germicidal (UVG) radiation, effective for disinfecting the air of SARS-CoV (12, 13), and can help counter the more general airborne infection dangers of increased use of closed-system air conditioning units (14). Growing evidence that the very dry air of winter contributes to the seasonality of airborne infectious diseases such as COVID-19 (15) suggests that maintaining moderate moisture levels in the air may help diminish risk of lower respiratory tract disease (16).

Our Airways. The wearing of face masks reduces the risk of cold, flu, and COVID-19 infection alike (17, 18). Advances in mask design (19), recognition that the effectiveness of even cotton face masks at reducing the threat of COVID-19 may significantly owe to the humidification of the upper airways (20, 21), and the discovery that nasally-administered airway hygiene mists of salty water enriched with calcium effectively clean the nose and upper airways of the tiny respiratory droplets masks are ineffective at filtering (22, 23) — all point to simple new ways to reduce exposure of the lower airways and surrounding environment to pathogenic substances, particularly beneficial in polluted air settings (24).

Our Human Airspace. The ability to detect risk of pathogenic exposure by new point-of-contact disease diagnostics (24, 25) is improving the ability to minimize risk of airborne disease exposure in social

circumstances, and advances in architecture driven by the challenge to social gathering posed by the COVID-19 pandemic (26) may revolutionize the design of safe living, working and learning environments.

Pandemic science innovations in the cleaning of the air our children breathe may reach children unequally. Children in affluent schools are most likely to benefit by sophisticated technologies of air quality control and disease detection, while for the 750 million school-age children who now live in multidimensional poverty and are at greatest risk of respiratory disease, hygiene innovations may be fastest to rescue.

The wearing of even simple cotton face coverings, which can moisturize the upper airways, and the daily nasal mist administration of calcium-enriched physiological salts, which further bolster mucus clearance of inhaled airborne contaminants, are among actions that can be quickly adopted in low income learning settings — and add to effective actions already recommended in the course of the COVID-19 pandemic (28).

It is imperative that we all work together to clean the air that children and the rest of us breathe to assure that the next breath is always a better one.

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