

# Letters

## RESEARCH LETTER

### Peripheral Oxygen Saturation in Older Persons Wearing Nonmedical Face Masks in Community Settings

Based on the evidence that nonmedical face masks prevent the spread of severe acute respiratory syndrome coronavirus 2,<sup>1,2</sup> many governments are mandating the wearing of masks in the community. However, fueled partly by claims on social media that masks can cause hypoxia and are therefore dangerous,<sup>3</sup> concerns have emerged about the safety of wearing face masks. We examined whether wearing nonmedical face masks was associated with a change in oxygen saturation.

**Methods** | This was a crossover study in which participants self-measured peripheral oxygen saturation (SpO<sub>2</sub>) before, while, and after wearing a mask. The study protocol was approved by the Hamilton Integrated Research Ethics Board. We included individuals aged 65 years or older and excluded those who had comorbid cardiac or respiratory conditions that could lead to dyspnea or hypoxia at rest or who were unable to remove the mask without assistance.<sup>4</sup> Participants were prospectively recruited from a retirement condominium in Ontario between July 27 and August 10, 2020, following approval from the condominium's board of directors. Residents were contacted by email, and those who were interested were approached to obtain (verbal or written) informed consent.

To minimize variability, we provided participants with a 3-layer plane-shaped disposable nonmedical face mask with ear loops (Boomcare DY95 model, Deyce Leather Co Ltd) and a portable pulse oximeter (HOMIEE). Instructions on how to correctly wear the mask (to ensure adequate nose and mouth coverage) and measure SpO<sub>2</sub> were provided. Participants were instructed to self-monitor and record SpO<sub>2</sub> 3 times 20 minutes apart for 1 hour before, 1 hour while, and 1 hour after wearing the mask while they were at rest or performing usual activities of daily living at home. Participants were offered opportunities to clarify these instructions.

We determined whether wearing a face mask would be associated with a decrease of 2% or more in SpO<sub>2</sub>. A decrease in SpO<sub>2</sub> of 3% or more has been previously considered clinically important,<sup>5</sup> and for this study, a value of 2% was chosen because older people have lower baseline SpO<sub>2</sub>.<sup>6</sup> For a 2% decrease in SpO<sub>2</sub>, a standard deviation of 3, a of 5%, and power of 90%, a sample size of 27 participants was required (see the eAppendix in the Supplement for the sample size calculation). For each participant, we calculated the mean of the 3 SpO<sub>2</sub> readings for each period (before, while, and after wearing the mask). Pairwise comparisons of these values (while vs before, and while vs after) for each

Table 1. Baseline Characteristics of Participants

| Characteristics           | No. (%) of participants (n = 25) |
|---------------------------|----------------------------------|
| Age, mean (SD), y         | 76.5 (6.1)                       |
| Sex                       |                                  |
| Men                       | 13 (52)                          |
| Women                     | 12 (48)                          |
| Medical conditions        |                                  |
| Hypertension              | 6 (24.0)                         |
| Respiratory               | 3 (12)                           |
| Bronchitis                | 1 (4)                            |
| Interstitial lung disease | 1 (4)                            |
| Asthma                    | 1 (4)                            |
| Cardiac surgery           | 2 (8)                            |
| Diabetes                  | 2 (8)                            |
| Smoking                   | 1 (4)                            |
| Medications               |                                  |
| Statins                   | 12 (48)                          |
| ACEI or ARB               | 10 (40)                          |
| Diuretics                 | 8 (24)                           |
| Calcium channel blocker   | 4 (16)                           |
| Anticoagulants            | 4 (16)                           |
| β-Blockers                | 4 (16)                           |
| Acetylsalicylic acid      | 2 (8)                            |
| Oral hypoglycemic agents  | 2 (8)                            |
| Prednisone                | 1 (4)                            |

Abbreviations: ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers.

participant were performed, and the paired mean differences (95% CIs) in SpO<sub>2</sub> were calculated using GraphPad Prism for Windows (GraphPad Software). The pooled mean SpO<sub>2</sub> (95% CI) for all participants was also calculated for each period.

**Results** | Twenty-eight people were approached, 3 declined participation, and 25 participants (mean age, 76.5 years [SD, 6.1 years]; 12 women [48%]) were enrolled. Nine participants (36%) had at least 1 medical comorbidity (Table 1). The pooled mean SpO<sub>2</sub> was 96.1% before, 96.5% while, and 96.3% after wearing the mask (Table 2). None of the participants' SpO<sub>2</sub> fell below 92% while wearing masks. The paired mean differences in SpO<sub>2</sub> while wearing the mask were minimal when compared with the value before they wore the mask (0.46% [95% CI, 0.06% to 0.87%]) and the value after wearing the mask (0.21% [95% CI, -0.07% to 0.50%]), with both 95% CIs excluding a 2% or more decline in SpO<sub>2</sub>.

**Discussion** | In this small crossover study, wearing a 3-layer nonmedical face mask was not associated with a decline in oxygen saturation in older participants. Limitations included

**Table 2. Oxygen Saturation Before, While, and After Wearing Nonmedical Face Masks**

|  | SpO <sub>2</sub> mean (SD), % |
|--|-------------------------------|
| No. of participants                                    | 25                            |
| Before mask wearing, SpO <sub>2</sub> reading          |                               |
| 1  | 96.1 (1.3)                    |
| 2  | 95.8 (2.1)                    |
| 3  | 96.3 (1.6)                    |
| Pooled mean SpO <sub>2</sub> , % (95% CI) <sup>a</sup> | 96.1 (95.5-96.7)              |
| While mask wearing, SpO <sub>2</sub> reading           |                               |
| 1  | 96.4 (1.2)                    |
| 2  | 96.5 (1.3)                    |
| 3  | 96.7 (1.1)                    |
| Pooled mean SpO <sub>2</sub> , % (95% CI) <sup>a</sup> | 96.5 (96.1-97.0)              |
| After mask wearing, SpO <sub>2</sub> reading           |                               |
| 1  | 96.4 (1.3)                    |
| 2  | 96.4 (1.4)                    |
| 3  | 96.2 (1.4)                    |
| Pooled mean SpO <sub>2</sub> , % (95% CI) <sup>a</sup> | 96.3 (95.8-96.8)              |

Abbreviation: SpO<sub>2</sub>, oxygen saturation measured using a portable oximeter.

<sup>a</sup> 95% CIs are 2-sided.

the exclusion of patients who were unable to wear a mask for medical reasons, investigation of 1 type of mask only, SpO<sub>2</sub> measurements during minimal physical activity, and a small sample size. These results do not support claims that wearing nonmedical face masks in community settings is unsafe.

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*Concept and design:* Chan, Hirsh.

*Acquisition, analysis, or interpretation of data:* All authors.

*Drafting of the manuscript:* Chan, Hirsh.

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*Statistical analysis:* Chan, Li.

*Administrative, technical, or material support:* Chan, Li.

*Supervision:* Chan, Hirsh.

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