

A pediatric pulmonologist’s cumulative risk of acquiring Covid-19 in outpatient practice

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Abstract

Pediatric pulmonologists, and, indeed, general pediatricians, are exposed to the causative virus of Covid-19 , SARS-CoV2, in their daily outpatient practices from both symptomatic and asymptomatic patients. This risk naturally increases with multiple exposures over time. We have developed a simple equation to calculate the probability of a practitioner remaining Covid free over a specified time interval, given the local population prevalence of virus, the transmissibility of the organism or “attack rate,” the mitigating effects of personal protective equipment (PPE), and the number of patients seen over the time interval. The equation can be used to construct a Kaplan Meier -like plot for remaining Covid free. Since studies of transmission of SARS-CoV2 suggest a spectrum between droplet and aerosol spread, even in asymptomatic patients and absence of aerosol generating procedures, the type of masks protection worn by medical practitioners may mitigate risk to different degrees. Eye protection may mitigate the risk further. While the risk of acquiring Covid-19 in a year of practice is low, it is not negligible. However it can be minimized. These considerations may be helpful in deciding local risk to the practitioner according to practice volume and in choosing the level of PPE that would result in minimizing that risk.

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Running Title: Cumulative risk of acquiring Covid-19

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To the Editor:

Pediatric pulmonologists, and, indeed, general pediatricians, are exposed to the causative virus of Covid-19, SARS-CoV2, in their daily outpatient practices from both symptomatic and asymptomatic patients. This risk naturally increases with multiple exposures over time. To describe how risk could be affected by disease prevalence, transmissibility, patient volume, and personal protective equipment (PPE), we have developed a simple equation for the probability of a practitioner remaining Covid free over a specified time interval. We were unable to find similar calculations in the literature, although analogous concepts have been explored in considering communicable disease risk to *patients* from multiple exposures to practitioners and other patients in healthcare settings (1).

In our analysis, we assume that R, the risk of each patient encounter = average prevalence in population (P) x transmission rate/encounter (T) x PPE mitigation factor (M).

If $1-R$ = probability of remaining Covid- free after one encounter, and total encounters (E) over one year = encounters/day x patient days/week x weeks/year, then to calculate **Cumulative Covid-free probability (CFP_c)** :

$$CFP_c = (1-R)^E$$

$$CFP_c = (1-PTM)^E$$

For example, if one makes the following assumptions for the clinical practice of one practitioner over a year:

Daily population prevalence (P) of 2% over the exposure period = 0.02 (2)

Transmission rate (T) of 1 in every 100 close encounters = 0.01 (3)

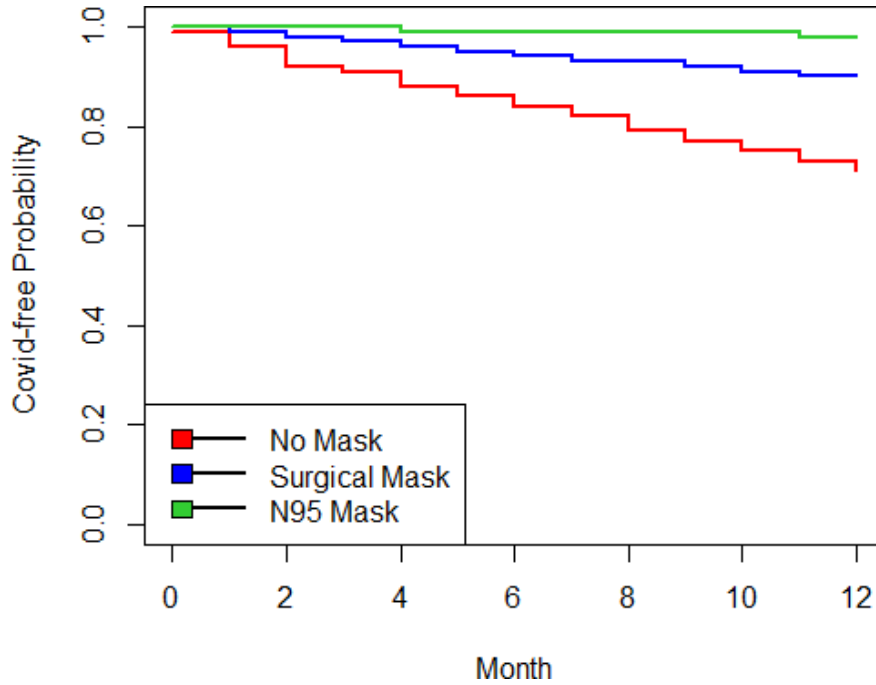
PPE mitigation factor (M) = 1.0 for no mask, 0.33 for a surgical mask, and 0.04 for an N95 mask (4)

Encounters/year (E) = 12 patients seen/day x 3 Patient days/week x 46 Patient Weeks/year = 1656

then, the probability of remaining Covid free for a year if the practitioner wears a surgical mask can be calculated as

$$CFP_c = (1 - 0.02 \times 0.01 \times 0.33)^{1656} = 0.99993^{1656} = 0.89, \text{ or } 89\%.$$

Similarly, the probability is 72% with no mask, and 98% with an N95 mask. The equation can be used to construct a Kaplan Meier -like plot for remaining Covid free (Figure)



Studies of transmission of SARS-CoV2 suggest a spectrum between droplet and aerosol spread, even in asymptomatic patients and absence of aerosol generating procedures (5). Thus the type of masks worn by medical practitioners may mitigate risk to different degrees. Our equation is modifiable, according to local prevalence, transmission efficiency, number of patients seen per year by the provider, and quality of mask mitigation. Eyewear may further mitigate this risk (4). The figure shows that while the risk of acquiring Covid-19 in a year of practice is low, it is not negligible. However it can be minimized. These considerations may be helpful in deciding local risk to the practitioner according to practice volume and in choosing the level of PPE that would result in minimizing that risk.

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