

Importance of Proper Ventilation for Risk Mitigation due to Airborne Diseases

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Abstract: This paper analyzes the potential impact of the return to the so called “new normal”, specifically in terms of eliminating the use of masks in closed spaces and the lack of proper ventilation and/or filtration. First, the paper examines the potential risks associated with lack of proper ventilation in closed spaces, specifically in classrooms. A brief summary of studies related to COVID-19 and classrooms is presented. To illustrate the concept of risk of transmission, a non-representative example was selected, based on observations done in the Autonomous University of Queretaro. We conclude that in the absence of filtration systems, natural ventilation is a requisite, otherwise ambient saturation can happen very fast.

Keywords: COVID-19, monitoring, ventilation.

Abbreviations: PPM: Particles per million, HEPA: High efficiency particulate air

1. INTRODUCTION

The COVID-19 pandemic has highlighted the importance of proper ventilation in crowded spaces, particularly in classrooms. Poor ventilation in classrooms can have a significant impact on the spread of the virus, while good ventilation can help mitigate the risk of transmission (Chen, Chen, Chen, & Su, 2021).

Poor ventilation in a classroom can lead to a buildup of airborne particles, including the virus that causes COVID-19. When a person with the virus speaks, coughs, or sneezes, their respiratory droplets can linger in the air for an extended period of time, putting others at risk of infection. In poorly ventilated classrooms, these droplets may not be able to dissipate quickly, increasing the chances that others will inhale them and become infected.

In contrast, good ventilation in a classroom can help to reduce the spread of the virus. This can be achieved through a variety of means, such as opening windows, using fans, or installing air filters. These methods can help to circulate fresh air and remove contaminated air from the room, reducing the concentration of airborne particles and the risk of infection (Berry, Parsons, Morgan, Rickert, & Cho, 2022).

Another way to improve ventilation in classrooms is to use portable air cleaners with high-efficiency particulate air (HEPA) filters. These filters can remove 99.97% of particles, including the virus that causes COVID-19, from the air.

In addition, it is also important to consider the air flow patterns in a room and how they can be used to reduce the spread of the virus. For example, using directional air flow to create a barrier between students and teachers, or using natural ventilation to remove contaminated air from the room.

The use of masks in closed spaces, specifically classrooms, has become a crucial measure in preventing the spread of COVID-19. However, not using masks in these spaces can have severe consequences on the health and safety of students, teachers, and staff.

One of the main effects of not using masks in closed spaces such as classrooms is the increased risk of transmission of the virus. When a person with COVID-19 speaks, coughs, or sneezes, their respiratory droplets can spread the virus to others. Masks can help to prevent the spread of these droplets by trapping them before they can reach other people. Without masks, the droplets can easily travel through the air and infect others.

Furthermore, not using masks in classrooms can also lead to a higher rate of absenteeism due to illness (Bartolucci, Templeton, & Bernardini, 2022). Without the added protection of masks, students and teachers may be more likely to become infected and have to stay home for an extended period of time. This can have a negative impact on the continuity of learning and the overall functioning of the school.

Another effect of not using masks in closed spaces is the psychological impact on students, teachers, and staff. The use of masks has become a symbol of the ongoing pandemic and the measures taken to keep us safe. Not using masks in classrooms can create a sense of normalcy that can lead to complacency and a false sense of security, making people less likely to adhere to other safety measures (Savona, 2021).

It is important to note that mask use alone is not enough to prevent the spread of the virus and it should be combined with other measures such as physical distancing, good ventilation, and frequent hand hygiene.

2. DEVELOPMENT

The rate of respiratory infection in closed classrooms without air filters can be alarmingly high, particularly during the COVID-19 pandemic. This is due to a number of factors, including poor ventilation, the close proximity of students and teachers, and the lack of protective measures such as air filters.

Poor ventilation in a closed classroom can lead to a buildup of airborne particles, including the virus that causes COVID-19. When a person with the virus speaks, coughs, or sneezes, their respiratory droplets can linger in the air for an extended period of time, putting others at risk of infection. In poorly ventilated classrooms, these droplets may not be able to dissipate quickly, increasing the chances that others will inhale them and become infected.

Furthermore, closed classrooms without air filters can also trap contaminated air inside the room, increasing the concentration of airborne particles and the risk of infection. This can be particularly dangerous in spaces where people are in close proximity to one another, such as in a classroom setting (Bartolucci et al., 2022).

According to recent studies, the lack of proper ventilation and air filtration in classrooms can lead to a higher rate of respiratory infection. A study published in the journal "International Journal of Risk Reduction" found that classrooms with poor ventilation had a higher rate of absenteeism due to respiratory illness, compared to classrooms with good ventilation (Bartolucci et al., 2022).

It is important to note that even with air filters, it is crucial to maintain a proper ventilation system that circulates fresh air and removes contaminated air from the room (Li et al., 2022).

3. FINDINGS AND CONCLUSIONS

During the second semester of 2022, daily readings were taken from different classrooms with different characteristics but roughly the same number of students, for this paper only one of said classrooms will be presented, the average number of students present at all times were 35, with less than half a meter of distance between rows of students and no distance at all to the sides, the number of windows in the classroom were 4 medium windows located at the top part of 2 walls and a door that remained open at all times, the classroom was located at a second floor, with a relatively good flow of air.

At the beginning of the semester, around 90% of the students wore a mask at all times, the quality of the masks varied greatly, from KN95 to surgery or cloth masks, with the windows open at all times and two ceiling fans turned on during the duration of the class, during this period the average reading in the carbon dioxide monitor was 520 PPM.

By the end of the semester, almost 90% of the students were not wearing any kind of masks, the weather was colder so the ceiling fans were turned off all the time and the windows were closed, the readings at this point got as high as 2,945 PPM, however just with a few minutes of opening two out of the 4 windows the readings would drop to around 1,600 or even close to 600 if the students could be convinced to keep all windows open.

Another point, which is merely anecdotal since there's no actual proof of correlation, as the masks dropped and the ventilation diminished, the number of sick students rose, this observation would be in pair with other studies.

In conclusion, not using masks in closed spaces such as classrooms can have severe consequences on the health and safety of students, teachers, and staff. Masks can help to prevent the spread of the virus, reduce absenteeism due to illness, and promote a sense of safety and security. It is essential for schools and other educational institutions to implement and enforce mask use in their classrooms to protect the health and safety of everyone involved, closed classrooms without air filters can have a high rate of respiratory infection, particularly during the COVID-19 pandemic. Poor ventilation and the lack of protective measures such as air filters can lead to a buildup of airborne particles and an increased risk of infection. It is essential for schools and other educational institutions to take steps to improve ventilation and install air filters in their classrooms to protect the health and safety of students and teachers.

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