Title: Efficacy of powered air purifying respirators (PAPRs) as source control devices for simulated respiratory aerosols—Dataset description

Dataset Number:

Introduction

Background

Powered air purifying respirators (PAPRs) are a popular alternative to the use of filtering facepiece respirators by healthcare workers. Although PAPRs protect the wearer from aerosol particles, their ability to block infectious aerosol particles exhaled by the wearer from being released into the environment (called source control) is unclear.

Methods

The source control performance of five PAPR loose-fitting facepieces were tested using a manikin that exhales aerosol particles. The facepieces were tested by themselves and in combination with a surgical mask or N95® respirator.

Results

Four of the facepieces did not significantly reduce the release of exhaled aerosols into the environment. One facepiece with a HEPA filtration panel did provide effective source control of the exhaled aerosols. Wearing a mask or respirator under the facepiece significantly improved the source control performance.

Conclusions

Most PAPR facepieces do not block aerosols exhaled by the wearer. Facepieces designed to filter exhaled particles can prevent aerosols from being released into the environment. Wearing a surgical mask or a filtering facepiece respirator under the facepiece can also provide source control, but PAPRs are not typically certified for use with masks and respirators.

Data Collection Methods

1. Aerosol Particle Generation
    a. 5% w/v KCl aerosolized via single jet Collison nebulizer, dried, and neutralized.
2. Airflows
    a. Cyclic breathing at 15 L/min
3. Aerosol Particle Measurement
    a. The collection chamber was purged of aerosol particles before starting the experiments.
    b. An optical particle spectrometer (OPS; Model 3330, TSI) at the outlet of the collection chamber measured the aerosol concentration by continuously drawing an aerosol sample at 1 L/min.
    c. The OPS reported the aerosol particle number concentration (# particles/cm^3) at 1 Hz in 16 logarithmically spaced size bins from 0.3 to 10 µm.
    d. The control experiments with no source control device indicated that the aerosol concentration reached a steady-state in 10 minutes or less.

e. The steady-state concentration was calculated based on the average concentration during the second 10 minutes of operation minus the background concentration measured after the system was purged and before aerosol generation and breathing began.
f. The particle concentration data was checked to verify that the chamber aerosol concentration did not exceed 3000 particles/cm3, which is the upper concentration limit for the OPS.

Citation

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