Real-Time Fit of a Respirator during Simulated Healthcare Tasks

Jessica Hauge[1], Marc Roe[2], Lisa Brosseau[1], and Craig Colton[2]

[1]University of Minnesota School of Public Health, Division of Environmental Health Sciences, Minneapolis, Minnesota, USA
[2]3M Company, Occupational Health and Safety Division, St. Paul, Minnesota, USA

Background: Fit is an important but difficult to predict feature of respirator performance. This study examined a new approach to measuring respirator performance using two continuous direct-reading particle-counting instruments in a simulated health care workplace.

Methods and Approach: A pilot test was conducted with eight experienced health care professionals who passed a traditional quantitative fit test before performing three randomized 10-min health care scenarios (patient assessment [PA], IV treatment [IV], and wound care [WC]). Two TSI Portacount Plus (Model 8020) with N95 Companion (Model 8095) instruments were used to continuously measure 1-sec ambient particle concentrations inside and outside the respirator facepiece. A simulated workplace protection factor (SWPF) was calculated by dividing outside by inside concentrations. Data were log transformed and examined using analysis of variance (ANOVA) between subjects, scenario types, and scenario order. The GM SWPF for the eight subjects, three scenarios per subject, ranged from 172 to 1073 (GSD 1.7 to 3.5) and was significantly different for each subject.

Results and Discussion: A multi-way analysis of variance showed no difference among the three scenario types (PA, IV, WC). There were differences by the order in which scenarios were performed: the third scenario SWPF was significantly different and higher than that of the first and second scenarios. All subjects passed the initial quantitative fit test with a fit factor of at least 100. Five subjects had fit factors greater than 200 and GM scenario SWPFs greater than 400. Three participants with initial fit factors less than 200 had GM scenario SWPFs ranging from 132 to 326.

Conclusions: This pilot test demonstrates that it is possible to evaluate instantaneous respirator fit using two quantitative fit test instruments in a simulated health care environment. Results suggest that an initial fit test may be predictive of fit during simulated tasks and that one scenario may be adequate for measuring a simulated workplace protection factor.