Podium Session 125: Health Care Industries

Papers 185-192

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Efficacy of Surgical Masks to Suppress Aerosol Generation during Simulated Cough

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The intended use of a surgical or procedure mask is to capture large particles (e.g., spit, mucus) expelled by the wearer. For example, the World Health Organization recommends using surgical masks on patients with probable SARS, to minimize dispersal of droplets during patient transport. They are designed to loosely cover the mouth and nose and are not sized for individual fit. While test methods exist to assess the filtration efficiency of surgical mask materials, few studies have characterized the ability of a surgical mask to capture aerosol generated during a cough or sneeze. A test method was developed to assess the efficacy of surgical masks to suppress aerosol generated during a simulated cough. The surgical mask was placed onto a head form connected to a breathing machine that simulated the cough. The aerosol was introduced into the cough prior to exhalation from the mouth of the head form. The resulting airborne aerosol was characterized to determine the particle size distribution and source term reduction. Both flat and cone shaped surgical masks were evaluated. The effects of the cough profile (i.e., waveform shape and peak velocity) and humidity (e.g., mask preconditioning) on the measured efficacy will be discussed.

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Risk Assessment for Respirator Selection to Minimize Exposure to Infectious Agents

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The selection of the proper respirator protection is a vital part of respiratory protection for employees. The usual method is to compare the workplace exposure to a regulatory standard or recommendation in developing a hazard ratio. The hazard ratio is compared to the assigned protection factor in deciding the style of respirator to select. For infectious agents there are no recommended exposure limits and no reliable means to monitor worker exposure. A risk assessment can be developed for workers who must enter infectious patient rooms by using data on (1) the quantity of infectious particles generated by an infectious person, (2) the probability of being infected in specific work situations, and (3) the exposure reduction of the different types of respiratory protection. This assessment can be used to determine the appropriate respirator for a specific situation.

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Application of Novel Local Exhaust Ventilation Devices to Control Bioaerosols in Chest Clinics and During Patient Transport

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In the wake of SARS and the emerging threat of avian influenza, a number of local exhaust ventilation (LEV) devices have been developed for controlling respiratory pathogens in various clinical settings. The concept is to capture and contain, at the source, bioaerosols generated from patients, remove them by high-efficiency particulate air (HEPA) filtration, and release clean air back to the immediate environment. With assistance from front-line health care workers, a couple of LEV devices have been built and tested in respiratory outpatient care facilities and during patient transport. Although the LEV concept is commonplace in industrial settings, it has not been applied widely to the clinical environment for infection control. Successful introduction of these devices depends not only on physical performance of the units but also their acceptance by clinical staff and patients. Besides, the introduction of a physical barrier, in the form of a booth or tent, to contain bioaerosols potentially increases the risk of contact transmission through surface contamination. This presentation reports findings of field trials of these devices, which include (1) performance checks based on a set of validation protocols, (2) surveys of patients and clinical workers who have used the prototypes, and (3) surface disinfection of containment booth employing ultraviolet-C irradiation, and verification by replicate organism detection and counting (RODAC) plate technique. Results indicate the devices can effectively control bioaerosols in clinical environments to reduce the risk of transmission. They also highlight the potential for further collaboration between occupational hygiene and infection control professionals to enhance protection of clinical workers and the public.

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Exposure to Nitrous Oxide At Delivery Suites in Six Swedish Hospitals

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This study explores occupational peak and average exposures to nitrous oxide in delivery suites in six Swedish hospitals and evaluates different scavenging techniques. Exposure measurements based on 2-hr samples (n=111) were used to calculate 8-hr time-weighted averages (TWAs) for 36 midwives and assistant midwives. Short-term samples to study peak exposure were also included in the monitoring program. Diffusive samplers were used for monitoring and were analyzed by thermal desorption and gas chromatography-mass spectrometry. The effect on exposure using different types of scavenging systems was studied by mixed-model analysis. The 8-hr TWA (n=36) nitrous oxide concentrations varied between 2.6 and 320 mg/m^3. The arithmetic mean for all the 8-hr TWAs was 17 mg/m^3 for the midwives and 44 mg/m^3 for the assistant midviwes. About 25% of all the 8-hr TWAs exceeded the ACGIH threshold limit value (TLV-TWA) of 90 mg/m^3 (50 ppm); the corresponding figures for midwives and assistant midwives were 11 and 14 %, respectively. For the short-term samples (n=29), the nitrous oxide levels varied between 19-4200 mg/m^3, and 14 % exceeded the Swedish occupational exposure ceiling limit value (OEL-C) of 900 mg/m^3. The exposure levels for short-term samples were found to be significantly higher when using the nonventilated simple mask compared with the double mask (p=0.006, ß=2.5). A trend (not statistically significant) was also seen for using the mask with a valve to ventilate exhaled air (p=0.0805 ß =1.27). A

large number of TWAs exceeded the ACGIH TLV for midwives during delivery. Using a mask connected to scavenging systems during nitrous oxide distribution significantly reduced the midwives' and assistant midwives' exposure. Furthermore, using forced general air ventilation system in addition to improved work and delivery routines for the staff and the mother-to-be substantially improved the air quality in the delivery suites, enabling compliance with occupational hygiene standards.

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Risk Coding: Risk-Based Exposure Control at the Mayo Clinic

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The Mayo Clinic has constructed a model to evaluate the storage and use of chemicals within the institution. The model assesses risk by evaluating chemical hazard parameters based on standards/guidelines published by regulatory bodies, guideline-producing organizations, and health care industry-specific accreditation bodies. The Mayo Clinic is a complicated facility for chemical management with approximately 30,000 employees and 75 buildings. There are two hospitals and numerous high-rise buildings that house clinicians and researchers using hazardous chemicals/pharmaceuticals for medical treatment and research. The clinic has the largest inventory of varied chemicals in Minnesota. This, along with the multistory construction of the hospitals, clinics, and research facilities, poses a challenging chemical management scenario. The Mayo-developed model weights exposures to chemicals based on standard/guideline information to establish a risk code for each chemical. Each new material acquired is reviewed and assigned an appropriate risk code. These risk codes can be used to assess the proper use, handling, and storage of chemicals on campus. The risk coding program is part of Mayo's more global safety and security chemical risk assessment program and strategic planning initiative. This presentation describes the background and methodology for the Mayo Clinic's risk coding system and its fit into the institution's chemical risk assessment and management program.

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Why Are Blood and Bodily Fluid Incidents in British Columbia Health Care Underreported? A Structural Equation Model

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Unbiased reporting of needlestick and other blood and bodily fluid (BBF) incidents is necessary to effectively monitor exposures and prevention strategies. We sought to document the magnitude of underreporting of BBF exposures and to investigate factors associated with reporting behavior. During 2004-2005, 916 health care workers (HCWs) at two tertiary care hospitals were recruited from departments at high risk of BBF exposure to complete a self-administered questionnaire. A structural equation model (SEM) approach was used to investigate association between personal, occupational, and environmental factors and subjects' reporting of BBF exposure incidents. Of the total HCWs surveyed, 309 (33.7%) acknowledged having at least one needlestick or BBF-related exposure in the previous 12 months. Of the estimated 1016 incidents in this period, only 174 (17%) were reported to an occupational health department.

Employees who handled needles and sharps more frequently indicated a greater intention to report BBF incidents, as did those who perceived the consequences of infection as being more severe. Additionally, HCW perceptions of a positive workplace safety culture were related to their acknowledgment of a sound safety policy as well as their awareness at their workplace of personal protective equipment and safe work procedures. Multivariate analysis indicated that the joint positive influence of intention of reporting and perception of a safety culture lead to safer behavior, as demonstrated by the likelihood of reporting BBF exposure incidents. Moreover, the combined effects of intention and safety culture have a stronger positive influence on the reporting of BBF incidents than does the influence on reporting by a positive safety culture alone. The results suggest that underreporting of BBF incidents may be reduced by addressing external workplace factors (influenced by safety policy and the availability of exposure control measures) and personal factors (influenced by comfort with procedures and perceptions of personal risk).

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Case Study: Teaming Up to Reduce Patient Handling Injuries at UNIVERSITY OF CONNECTICUT Health Center

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At the University of Connecticut Health Center's hospital, the rates and costs of nursing staff injuries from patient handling tasks were rising significantly. Four percent of employees reported a back injury in one year; half were associated with patient moving or lifting. Workers' compensation costs associated with injuries involving "another person" reached $500,000 per year. Informal surveys revealed that basic equipment on hospital units was not used. A participatory ergonomic intervention was proposed to decrease injuries by expanding the inventory of lifting equipment and its usage by staff. Management approval was obtained when funding became available from the State of Connecticut. A cross-functional, worker-management core team was formed. Initial steps included equipment reviews, site visits, and information gathering from national and state safe-patient-handling resources. The program was phased in over several years with systematic deployment of employee involvement, continuing education, and policy. The major program elements responsible for its success included management support, employee participation, communication, publicity, and accountability. User education was core and included patient assessment techniques, equipment competency, team-building, and other activities to build commitment. Data collection and analysis included employee surveys and focus groups conducted pre- and post-implementation. With some variations among hospital units, there was an overall decrease in the rate of lost-time injury, severity, and costs. Employee survey and focus group results show a range of employee acceptance and use of equipment. Self-assessment by the committee yielded areas of program weaknesses and strengths. The lessons learned provide important insights for future deployment in other hospital departments and ambulatory clinics. These lessons also help maintain program focus on employee safety, patient safety, and the mission and vision of our hospital.

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Are All No-lift Policies the Same?

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Health care workers (HCWs) have a significant risk of developing low back pain (LBP), and safety devices such as mechanical lifts could reduce that risk. What is needed is a program that promotes using mechanical lifts and discourages manual lifting of nursing home residents. However, simply having a no-lift policy that is not rigorously enforced may not be adequate. This presentation describes the results of a cross-sectional study of lifting patterns at two nursing homes in central Illinois. Site 1 had a no-lift policy, but it covered only totally dependent residents. Site 2 had a corporatewide, enforced no-lift policy covering all resident lifts. Information was collected using self-administered questionnaires. Our hypothesis was that personnel at site 2 would perform fewer manual lifts than at site 1. The prevalence of LBP was 50% at site 1 and was 41% at site 2. The odds of having LBP were 2.7 greater in those HCWs who did not use the lifts. Those who manually lifted fallen residents from the floor had a 3.8 greater risk of LBP. Also, the health care providers at site 2 performed significantly fewer manual lifts of residents than site 1. In terms of psychological stress measures, personnel at site 1 scored higher in perceived physical demand, but they also scored higher in supervisor social support. These results support the effectiveness of using mechanical devices to lift nursing home residents. This is particularly true of lifting a fallen resident, the most hazardous type of lift. The results also support rigorous enforcement of a no-lift policy that covers all resident lifts. This study has important implications because HCWs are at risk of disabling LBP, and LBP is one of the most costly occupational problems in the United States.