P.1.06 EFFECTS OF CIGARETTE SMOKING ON HEARING LOSS IN WORKERS WITH NOISE EXPOSURE

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10.1136/OEM-2019-EPI.212

Objectives Previous studies found that noise and cigarette smoking are risk factors of hearing loss. This study aimed to investigate effects of cigarette smoking and other factors on hearing loss.
Methods This was a cross-sectional study of 95 machine maintenance workers with noise exposure in an electronics industry. The databases of health examination and environmental monitoring were used, and the information on demographics, years of employment, habit of cigarette smoking, hearing levels of pure tone audiometry, and levels of personal noise exposure monitoring (TWA) were assessed. There were two definitions of hearing levels, which were the mean level (mean of bilateral 3K, 4K, 6 K Hz) and the maximal level (maximum of bilateral 3K, 4K, 6 K Hz). Linear regression was applied to explore the association.
Results 60.0%, 14.7%, and 25.3% workers were never smokers, ever smokers who had quit, and current smokers, respectively. The multivariable linear regression showed that current smokers had higher mean hearing level than never smokers (β=4.54, 95% CI=−0.10–9.19); age was associated with the mean hearing level (β=0.52, 95% CI=0.25–0.79). In additions, another multivariable model showed that current smokers had higher maximal hearing level than never smokers (β=8.36, 95% CI=0.28–16.43); age was associated with the maximal hearing level (β=0.91, 95% CI=0.45–1.38). Years of employment and noise exposure levels were not associated with hearing levels. Concerning workers aged 36 years or older, subgroup analysis found that the maximal hearing levels were 25 dB (never smokers), ever smokers who had quit (30 dB), and current smokers (45 dB), which had statistical significant (p=0.048).
Conclusions The findings suggest that old age and current smoking were risk factors of hearing loss, and also call attention to the importance of preventing hearing loss including quitting smoking for noise exposure workers.

P.1.07 A STUDY OF BLOOD MULTI-ELEMENT CONCENTRATIONS IN LEAD-EXPOSED AND NON-EXPOSED WORKERS

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10.1136/OEM-2019-EPI.213

Objectives Although the leaded gasoline has been phased out, lead (Pb) continues to be a public health concern due to its widely industrial uses. During the lead industrial processes, these workers exposed to the other non-essential elements, which can induce adverse effects including the imbalance of essential elements. The aim of this study is to compare with Pb, cadmium (Cd), arsenic (As), selenium (Se), cobalt (Co), copper (Cu), zinc (Zn) in human whole blood between lead-exposed and non-exposed workers.
Method There were 109 lead workers and 329 individuals of non-exposed group, received the health examination in Kaohsiung Medical University Hospital, Taiwan. The whole blood concentration of Pb was determined by graphite atomic absorption spectrometer (AAS), while the others (Cd, As, Se, Co, Cu and Zn) were determined by inductively coupled plasma mass spectrometer (ICPMS). We analyzed the associations between the seven elements and the worker health examination data. Finally, multiple linear regressions were used to analyze interaction between elements.
Results For all workers, the average of age was 40.13 years and mean BMI was 24.81. The other health examination results showed the well status of health and nutrition. Mean concentrations of seven blood elements in Pb-exposed workers were Pb=143.5, Cd=1.28, As=9.45, Se=251.46, Co=0.57, Cu=1044.4, and Zn=9706.92 (ug/L). On the other hand, the blood concentrations of these elements in non-exposed workers were Pb=26.18, Cd=0.98, As=5.28, Se=255.40, Co=0.42, Cu=880.07, and Zn=6891.52 (ug/L). Using the interaction variables, the results showed that there were interactions between Cd and As, As and Co, As and Cu.
Conclusions The positive effect of essential elements to health examination values were not clear, little does the influence to the other non-essential elements. However, the damage from occupational non-essential elements exposure still needs to be concerned. Interaction to multi-elements also needs further research.

P.1.08 CONNECTING CONTRACTOR SAFETY MANAGEMENT PROGRAMS AND WORKER PERCEIVED SAFETY CLIMATE IN COMMERCIAL CONSTRUCTION PROJECTS

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10.1136/OEM-2019-EPI.214

Background Leading indicators are preferred to identify injuries and fatalities in construction industry. Safety climate is a leading indicator of construction injuries yet it is not known how workers' safety climate scores relate to safety programs of different maturity levels.
Methods This study examined the relationship between safety program scores based on documents and contractor reported activities and project leading indicators of contractor safety climate, safety behaviors of workers and crews, and safety attitudes of coworkers from employee surveys. Hierarchical linear regression models accounted for contractor size and number of workers, nested in contractors within projects. Separate models examined the relationships between safety program scores and 1) contractor safety climate; 2) coworker attitude scores, 3) employees' own behavior score, and 4) crew behavior scores.
Results 446 employees of 40 contractors from three commercial construction projects participated. Many contractors (n=16) had good safety programs with 15 or more safety activities (out of 17) from organizational management, worker participation, hazard identification, and training domains. Stronger safety programs had higher safety climate scores (5.15 point difference on a 100 point scale, p=0.05), better coworker safety attitudes (6.69 points, p=0.01), better crew safety behaviors (5.34 points, p=0.02) and higher self-rated behaviors (5.14 points, p=0.02) compared to safety programs with fewer safety items.
Conclusions Contractors with more comprehensive safety programs were perceived to have stronger safety climate. Better

safety programs were also associated with better self-reported safety performance of coworkers, crews, and individual workers. Stronger safety programs incorporated activities from all four domains Safety programs that include activities that cover safety of management and worker influence safety performance and safety climate as perceived by the workers.

P.1.09 RISK ASSESSMENT OF EXPOSURE TO FORMALDEHYDE IN UNIVERSITY LABORATORIES

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10.1136/OEM-2019-EPI.215

Objective Formaldehyde is a commonly used chemical in laboratories and has been regarded as a potential hazard to health. Researchers and students who work in medical laboratories have potentially a higher risk of exposure to Formaldehyde. The aim of this study was to determine the risk of exposure to formaldehyde and its health effects in laboratories.
Methods In a cross-sectional survey air samples were collected with charcoal tubes from 23 anatomy, pathology and histopathology laboratories. Personal and time weighted exposures of 102 samples were sampled and analyzed using OSHA method. A questionnaire was distributed to 83 participants engaged in laboratory activities to examine the adverse health effects of formaldehyde.
Results Overall, 92.3% of the personal exposure levels were higher than the occupational exposure limit. The area concentrations ranged between 0.234 ppm and 3.45 ppm (mean=1.43 ppm, SD=0.45). Individual exposure levels in respiratory zone ranged 0.219 ppm and 1.96 ppm (mean=0.573 ppm, SD=0.39). The risk of Formaldehyde exposure levels were higher for researchers and technicians compared to students with a factor of two or three. Participants with a duration of exposure more than 2 years had an increased risk of health symptoms (Hazard ratio=1.4; Confidence Interval=0.8–3.7). Laboratory personnel reported physical fatigue (39.1%), headache (32.7%), breathing problems (21.1%), noise irritation (17.4%), and eye irritation (14.9%).
Conclusion The concentration levels of Formaldehyde vapor in laboratory indoor air were higher compared to individual exposure levels. Work in laboratories is associated with exposure levels exceeding the recommended exposure limit and an increased risk of health complaints. Preventive measures are required to reduce the emission of airborne formaldehyde and prevalent health-related symptoms in academic medical laboratories.

P.1.11 'CREATION OF CLASSIFICATION MODEL USING MACHINE LEARNING; TO DETECT DYSPHONIA WORK-RELATED'

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10.1136/OEM-2019-EPI.216

The underdiagnosis of occupational disease causes severe damage to the health system. The classification of a disease as a professional is based on the decision on whether the present labor factors are sufficient for the generation of the disease, and this function is carried out by a qualified professional or committee.

Occupational dysphonia is one of the 5 most frequent occupational diseases in Chile, whose condition impact on the labor productivity and the quality of life of the patient. Today there are no unified criteria among the occupational qualification decisión makers to decide on the sufficient of laboral factors of occupational dysphonia disease.

Computerized systems have been developed to support clinical diagnosis decision-making process; among these, Machine Learning methods have been used to simulate the reasoning of the expert from the analysis and identification of complex patterns in large databases, so in this study it is suggested that the creation of a dysphonia classification model is possible employing Machine Learning tools. For this purpose, 103 cases obtained from patients with qualification results cause by dysphonia was analize in relation to the number of variables studied and their distribution for the observation of the characteristics that give identity to the groups studied. Subsequently, different classification models were developed using Machine Learning and the one that presented the best performance was chosen.

Statistical analyzes show that of the 6 models of Machine Learning elaborated, Random Forest was the one that presented the best performance (accuracity=0.83 and Kappa value=0.61), variables that manage to establish identity to each group represent 26.5% of the total of studied variables. The results in this work show the potential of the use of computer tools can be useful as a support tool for diagnosis of occupational disease.

P.1.12 PARTICULATE MATTER MEASUREMENT SYSTEM USING LOW COST SENSOR AND INTERNET OF THINGS

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10.1136/OEM-2019-EPI.217

The Internet of Things (IoT) is an important keyword in the Fourth Industrial Revolution. IoT is expected to have a massive impact for human being, but these are still early days. IoT enables these objects to collect and exchange data through the wireless network, such as devices, vehicles, buildings, and other items that include electronic devices, software, sensors, and network connections. IoT is a technology that can be used and expanded in various applications such as industrial, manufacturing, medical and consumer products and so on. This research focuses specifically on the development of measurement systems for particulate matter using IoT technology for occupational as well as environmental settings. Currently, the government is providing the concentration of particulate matter (PM2.5/10) hourly. However, it is difficult to reflect personal exposure because it is installed on the top of a building. Therefore, this study shows development of the particulate matter measuring system using IoT and obtains the personal measurement data of the particulate matter. Also, to provide a further insight, we will also present how particulate matter measurement system works by showing some measurements collected with an experimental testbed deployed in our research group. Still, it is necessary to improve the quality of system and the convergence between pollutant measurement including particulate matter and IoT can provide new