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# Číslo 3


**Michelle Cardoso, Fred Fulton, Colin McKinnon, Jack P. Callaghan, Michel J. Johnson & Wayne J. Albert. *Ergonomic evaluation of a new truck seat design: a field study*. Pages: 331-343.**

A postural evaluation of commercial licensed truck drivers was conducted to determine the ergonomic benefits of a truck seat prototype in comparison with an industry standard seat. Twenty commercially licensed truck drivers were recruited to perform a 90-min driving task. Postures were assessed using accelerometers and a backrest and seat pan pressure mapping system. Subjective discomfort measurements were monitored using two questionnaires: ratings of perceived discomfort (RPD) and the automotive seating discomfort questionnaire (ASDQ). Participants reported significantly higher discomfort scores when sitting in the industry standard seat. Participants sat with more lumbar lordosis and assumed a more extended thoracic posture when seated in the prototype. Pairing the gluteal backrest panel with the adjustable seat pan also helped reduce the average sitting pressure on both the seat pan and the backrest. The prototype provided several postural benefits for commercially certified truck drivers, as it did for a young and healthy population.

- **Keywords:** ergonomic evaluation, ergonomic design, posture, discomfort

**Michelle Cardoso, Fred Fulton, Jack P. Callaghan, Michel Johnson & Wayne J. Albert. *A pre/post evaluation of fatigue, stress and vigilance amongst commercially licensed truck drivers performing a prolonged driving task*. Pages: 344-354.**

*Purpose*. The main purpose of this research study was to evaluate changes in fatigue, stress and vigilance amongst commercially licensed truck drivers involved in a prolonged driving task. The secondary purpose was to determine whether a new ergonomic seat could help reduce both physical and cognitive fatigue during a prolonged driving task. Two different truck seats were evaluated: an industrial standard seat and a new truck seat prototype. *Methods*. Twenty male truck drivers were recruited to attend two testing sessions, on two separate days, with each session randomized for seat design. During each session, participants performed two 10-min simulated driving tasks. Between simulated sessions, participants drove a long-haul truck for 90 min. Fatigue and stress were quantified using a series of questionnaires whereas vigilance was measured using a standardized computer test. *Results*. Seat interactions had a significant effect on fatigue

patterns. *Conclusion.* The new ergonomic seat design holds potential in improving road safety and vehicle accidents due to fatigue-related accidents.


- **Keywords:** driving, stress, vigilance, fatigue, cognitive ergonomics


**Omran Ahmadi, Seyed Bagher Mortazavi, Ali Khavanin & Hamidreza Mokarami. *Validity and consistency assessment of accident analysis methods in the petroleum industry*. Pages: 355-361.**


*Background*. Accident analysis is the main aspect of accident investigation. It includes the method of connecting different causes in a procedural way. Therefore, it is important to use valid and reliable methods for the investigation of different causal factors of accidents, especially the noteworthy ones. *Objective*. This study aimed to prominently assess the accuracy (sensitivity index [*SI*]) and consistency of the six most commonly used accident analysis methods in the petroleum industry. *Methods*. In order to evaluate the methods of accident analysis, two real case studies (process safety and personal accident) from the petroleum industry were analyzed by 10 assessors. The accuracy and consistency of these methods were then evaluated. The assessors were trained in the workshop of accident analysis methods. *Results*. The systematic cause analysis technique and bowtie methods gained the greatest *SI* scores for both personal and process safety accidents, respectively. The best average results of the consistency in a single method (based on 10 independent assessors) were in the region of 70%. *Conclusion*. This study confirmed that the application of methods with pre-defined causes and a logic tree could enhance the sensitivity and consistency of accident analysis.



- **Keywords:** accident analysis, accuracy, consistency, sensitivity index, petroleum industry


**Yanqing Wang, Heap-Yih Chong, Pin-Chao Liao & Hantao Ren. *Interactive mechanism of working environments and construction behaviors with cognitive work analysis: an elevator installation case study*. Pages: 362-376.**


Unsafe behavior is a leading factor in accidents, and the working environment significantly affects behaviors. However, few studies have focused on detailed mechanisms for addressing unsafe behaviors resulting from environmental constraints. This study aims to delineate these mechanisms using cognitive work analysis (CWA) for an elevator installation case study. Elevator installation was selected for study because it involves operations at heights: falls from heights remain a major cause of construction worker mortality. This study adopts a mixed research approach based on three research methodology stages. This research deconstructs the details of the working environment, the workers' decision-making processes, the strategies chosen given environmental conditions and the conceptual model for workers' behaviors, which jointly depict environment–behavior mechanisms at length. By applying CWA to the construction industry, environmental constraints can easily be identified, and targeted engineering suggestions can be generated.



- **Keywords:** cognitive work analysis, elevator installation, unsafe behavior, working environment, construction industry


**Christer Ahlström, Maria Gink Lövgren, Mats Nilsson, Tania Dukic Willstrand & Anna Anund. *The effect of an active steering system on city bus drivers' muscle activity*. Pages: 377-385.**


City bus drivers spend hours driving under time pressure, in congested traffic and in a monotonous sitting position. This leads to unhealthy working conditions, especially in

terms of physical and psychological stress. The aim of this study is to investigate whether an active steering system can alleviate the musculoskeletal stress involved in manoeuvring a bus. Twenty bus drivers drove a city bus equipped with the Volvo dynamic steering (VDS) support system in real traffic. Steering effort was evaluated with electromyography and with a questionnaire. Compared to baseline, VDS significantly reduced the required muscle activity by on average 15–25% while turning, and up to 68% in the part of the manoeuvre requiring maximum effort. The bus drivers believed that VDS will help reduce neck and shoulder problems, and they expressed a desire to have VDS installed in their own bus.


- **Keywords:** active steering, electromyography, city bus driver


**Iman Dianat, Soudabeh Asadollahi & Moein Nedaei. *Evaluation of design alternatives for sewing scissors with respect to hand performance, discomfort and usability*. Pages: 386-393.**

The effects of three re-designed models of sewing scissors on hand performance measures, discomfort and usability were investigated, and the results were compared with those of conventional scissors. Adjustments were made to the scissors handle with emphasis on more neutral wrist postures (bent handle - model A), correction of the thumb's position and movements (model B) and reducing hand/finger discomfort (model C) while working with the tool. The results showed some improvements in hand performance, muscular effort, usability and discomfort with model B compared to the conventional model. Better hand performance and usability and lower discomfort were recorded with model C compared to the conventional model. The results suggest that the correction of the thumb's position and movement (model B) or even reduced hand/finger discomfort (model C) are perhaps more important considerations in scissors design than improved wrist posture (model A) for improving users' performance and usability of the tool.


- **Keywords:** hand tool design, tool handle, handle shape, muscular effort, bent handle, fabric cutting scissors


**Almas Hamid, Wajeeha Saleem, Ghazala Yaqub & Moin ud din Ghauri. *Comparative assessment of respiratory and other occupational health effects among elementary workers*. Pages: 394-401.**

*Objective*. This study was conducted to assess hazards faced by elementary workers. *Methods*. A questionnaire survey and a respiratory function test (spirometry) were carried out on 150 respondents. *Results*. Major hazards identified related to sharp objects, heavy weight lifting, thermally harsh conditions, working at height, whole body vibration, chemicals, pathogens, increased noise levels and confined space entry. Workers suffered from upper and lower respiratory disorder symptoms, digestive problems, optical and musculoskeletal issues, etc. Spirometric measurement showed obstructive lung disorders to be highest among construction workers (CW) (48%) followed by sanitation workers (SW) (32%) and solid waste pickers (SWP) (28%). Restrictive lung pattern was dominant among SW (56%) followed by SWP (46%) and CW (42%). The observed $FEV_1/FVC$ in diseased SWP, SW and CW ranged from 51 to 96%, from 52 to 98% and from 31 to 99% respectively while observed mean $FEV_1$ was 2.15, 1.79 and 1.70 L, respectively. *Conclusion*. The study findings show that occupational exposure can significantly influence respiratory system impairment and contribute to other ailments among elementary workers. The study recommends use of appropriate protective equipment and regular medical examination for early recognition of any health risk so that timely interventions for effective management may be undertaken.


- **Keywords:** construction workers, occupational hazards, sanitary workers, solid waste pickers, spirometry¨

**Ananth Vijendren, Gavin Devereux, Bruno Kenway, Kathy Duffield, Vincent Van Rompaey, Paul van de Heyning & Matthew Yung. *Effects of prolonged microscopic work on neck and back strain amongst male ENT clinicians and the benefits of a prototype postural support chair*. Pages: 402-411.**

Musculoskeletal pain is a common occupational hazard experienced by surgeons. Ear, nose and throat (ENT) surgeons are predisposed to neck and back pain due to regular prolonged microscopic work. We conducted a prospective pilot study to investigate the effects of sustained microscopic work on the neck and back, its correlation to surgical experience and to assess the benefits of a prototype postural support chair (PSC) amongst 10 male, ENT clinicians. We used a subjective measure of time to fatigue and pain for the neck and back as well as objective readings from a surface electromyogram (sEMG). We found that an increase in surgical experience correlated with the time taken to experience fatigue and pain in the neck and back. This was corroborated by our sEMG findings. The PSC significantly delayed the sensations in the neck and also eliminated the difference seen amongst the varying seniority of clinicians.

- **Keywords:** posture, musculoskeletal pain, otological surgical procedures, otolaryngology

**Erna von Heimburg, Mariann Sandsund, Tone Pedersen Rangul & Randi Eidsmo Reinertsen. *Physiological and perceptual strain of firefighters during graded exercise to exhaustion at 40 and 10 °C*. Pages: 412-422.**

*Purpose*. To study whether perceptual identification should be included as a measure to evaluate physiological stress. *Methods*. Physiological variables oxygen uptake ($V_{O2}$), ventilation, heart rate, blood lactate concentration, rectal temperature ($T_{rec}$) and mean skin temperature, and perceptual variables rate of perceived exertion, thermal sensation and time to exhaustion, were measured at submaximal and maximal intensities during graded exercise on a treadmill to exhaustion in 12 firefighters wearing protective clothing and extra mass at 40 and 10 °C. Physiological strain index (P*h*SI) and perceptual strain index (P*e*SI) were calculated. *Results*. Apart from $T_{rec}$, all physiological and perceptual variables were higher at submaximal intensities of 40 °C. Time to exhaustion was 16% shorter and the corresponding $V_{O2}$ was reduced by 7% in the heat. A high correlation ($r = 89$) between P*h*SI and P*e*SI was found at both temperatures. P*e*SI scores were equal to P*h*SI at both ambient temperatures, except at the two highest intensities in the heat, where P*e*SI was higher. *Conclusions*. These findings support use of perceptual identification to evaluate physiological stress. However, at very high intensities under hot conditions the perceptual strain was estimated higher than the physiological strain. More precise indexes are needed to include perceptual measures in safety standard.

- **Keywords:** firefighters, physiological strain index, perceptual strain index, ambient conditions, body temperature

**Iva Japundžić & Liborija Lugović-Mihić. *Skin reactions to latex in dental professionals – first Croatian data*. Pages: 423-428.**

*Purpose*. To determine the prevalence of undesirable skin reactions to latex in dental professionals and students of the School of Dental Medicine in Zagreb, Croatia. *Methods*. Our research included 444 participants, of which 200 agreed to undergo a skin prick test (SPT). All participants answered a questionnaire in which we asked about incidence of skin lesions, duration of occupational exposure to latex, localization of skin lesions and symptoms. Statistical analysis of the questionnaire and test results was then carried out. *Results*. Of the total 444 participants surveyed, 249 (56.1%) reported lesions on their skin (professionals 64.8%, students 6.1–58.5%). From the questionnaire, 239

(96.0%) respondents reported lesions on the hands and fingers, mostly in the form of erythema (37.0%) and occasional dryness of skin (29.0%). Positive SPT results were found in 14 (7.0%) out of the 200 respondents who underwent the test. *Conclusions*. While a large number of subjects (56.1%) reported skin lesions when using latex products at their workplace, the SPT test was positive only in 7.0%. The results show that the prevalence of self-reported skin lesions was significantly related to the length of occupational exposure, with a substantial effect size ($p < 0.001$; $V = 0.334$).

- **Keywords:** latex, gloves, dentists, skin reactions, dermatitis, occupational diseases, skin prick test, students

**Maxime Norval, Mohsen Zare, René Brunet, Fabien Coutarel & Yves Roquelaure. *Operational leeway in work situations: do ergonomic risk assessment tools consider operational leeway for job analysis?* Pages: 429-442.**

Our study shows that information on operational leeway is limited in the originator articles of the ergonomic risk assessment tools for prevention of musculoskeletal disorders (MSDs). The tools' underlying theoretical models do not consider the indicators of operational leeway, and they cannot determine the sufficiency of the situational operational leeway in a work situation. Consequently, regulation of the activity, which ensures the performance goals and the individual's health, has been overlooked. The lack of literature on indicators of situational operational leeway is one of the reasons for this deficit. Defining the indicators for this concept would be an innovation in the approach of MSD risk prevention. Developing empirically the concept of situational operational leeway in risk assessment tools would help to progress the current approach of MSD prevention. This study therefore proposes indicators of situational operational leeway to increase the representativeness and reliability of the risk assessment tools for MSDs.

- **Keywords:** operational leeway, risk assessment tools, musculoskeletal disorders, job analysis

**Gültekin Çoşkun, Gencay Sarıışık & Ali Sarıışık. *Slip safety risk analysis of surface properties using the coefficients of friction of rocks*. Pages: 443-457.**

This study was conducted to determine the most appropriate surface processing techniques (SPT), environmental conditions (EC) and surface roughness (SR) to minimize the risk of slipping when pedestrians walk on a floor covering of rocks barefoot and with shoes. Coefficients of friction (COFs) and values of SR were found using five different types of rocks, four SPT and two (ramp and pendulum) tests. Results indicate that the parameters which affect the COF values of rocks include SR, EC and SPT. Simple linear regression was performed to examine the relationship between the values of the COF and the SR. The value of the COF was identified as $R2 \geq 0.864$. Statistical results, which are based on experimental measurements, show that rocks are classified according to their safe use areas depending on their COF and SR values.

- **Keywords:** rock, coefficient of friction, floor surface, surface roughness, slip safety

**Phayong Thepaksorn, Akio Koizumi, Kouji Harada, Wattasit Siriwong & Richard L Neitzel. *Occupational noise exposure and hearing defects among sawmill workers in the south of Thailand*. Pages: 458-466.**

The aim of this study was to investigate occupational noise exposure and hearing defects among sawmill workers in the south of Thailand. Seven hundred sawmill workers

participated, of which 335 (47.9%) were male. The mean age of the sawmill workers was 33.5 years (SD 10.2), and more than 60% were <35 years old; 75.1% of the workers had less than 5 years of work experience. Only about one in four workers (25%) had been trained in use of personal protective equipment (PPE), and half of the participants never or rarely wore PPE while working. The prevalence rate of noise-induced hearing loss (NIHL) was 22.8% (N = 42). Male workers had significantly higher risk than female workers (odds ratio [OR] = 2.21). Workers aged older than 25 years had significantly higher risks for NIHL (OR = 3.51–12.42) than workers younger than 25 years. Sawing workers had higher risk for NIHL than office workers (OR = 3.07).


- **Keywords:** occupational noise, noise-induced hearing loss, occupational health, sawmills


## Rachel Morrow & Paula Brough. *It's off to work we go!' Person–environment fit and turnover intentions in managerial and administrative mining personnel*. Pages: 467-475.

*Purpose*. Person–environment fit asserts that incompatibility between an employee and aspects of their work environment is more likely to lead to occupational stress. The aim of this study was to investigate the impact that varying levels of person–environment fit had on key criterion outcomes including work engagement, work-related wellbeing and turnover intentions in a unique sample of managerial and administrative mining personnel. *Method*. An online self-report survey was distributed to an Australian mining organization by the company's Chief Executive Officer. Anonymous survey links were sent to staff, of which 118 participants responded. The survey consisted of previously validated measures. *Results*. Hierarchical multiple regression analyses revealed significant relationships between abilities–demand fit, needs–supply fit and work engagement. Additionally, work-related wellbeing was significantly associated with increased person–organization fit and needs–supply fit. However, only needs–supply fit had a significant negative relationship with turnover intentions. Needs–supply fit significantly predicted all criterion variables. *Conclusions*. This study found that personal need fulfilment through work-related activities had the most significant impact on work-related wellbeing and work engagement. Personal need fulfilment through work also produced the most significant negative relationship with turnover intentions.


- **Keywords:** mining, person–environment fit, work engagement, wellbeing, turnover intentions, occupational stress


## Shengyuan Yan, Cong Chi Tran, Yingying Wei & Jean Luc Habiyaremye. *Driver's mental workload prediction model based on physiological indices*. Pages: 476-484.

Developing an early warning model to predict the driver's mental workload (MWL) is critical and helpful, especially for new or less experienced drivers. The present study aims to investigate the correlation between new drivers' MWL and their work performance, regarding the number of errors. Additionally, the group method of data handling is used to establish the driver's MWL predictive model based on subjective rating (NASA task load index [NASA-TLX]) and six physiological indices. The results indicate that the NASA-TLX and the number of errors are positively correlated, and the predictive model shows the validity of the proposed model with an R2 value of 0.745. The proposed model is expected to provide a reference value for the new drivers of their MWL by providing the physiological indices, and the driving lesson plans can be proposed to sustain an appropriate MWL as well as improve the driver's work performance.


- **Keywords:** driving simulator, mental workload, predictive model, work performance

**Gaëlle Encrenaz, Sonia Laberon, Christine Lagabrielle, Gautier Debruyne, Jacques Pouyaud & Nicole Rascle. *Psychosocial risks in small enterprises: the mediating role of perceived working conditions in the relationship between enterprise size and workers' anxious or depressive episodes*. Pages: 485-494.**

*Purpose*. The relationship between enterprise size and psychosocial working conditions has received little attention so far but some findings suggest that conditions are more favorable in small enterprises. This could have a positive impact on workers' mental health. The objective of this study was to test the mediating effect of perceived working conditions in the relationship between enterprise size and anxious or depressive episodes. *Methods*. Data from the 2010 SUMER – Surveillance Médicale des Expositions aux Risques professionnels (French periodical cross-sectional survey) were analyzed; $N = 31{,}420$ for the present study. Anxious or depressive episodes were measured with the hospital anxiety and depression scale and the perceived working conditions were psychological demand, decision latitude and social support as assessed with Karasek's job content questionnaire. The indirect effect was tested according to the method proposed by Preacher and Hayes. *Results*. In a multivariate logistic regression, the risk of anxious or depressive episodes was found to be lower in micro enterprises (2–9 employees). Formal tests pointed to a significant indirect effect of enterprise size on mental health through perceived working conditions, with a larger effect for psychological demand. *Conclusion*. This study highlights perceived working conditions as an explanation of the effects of enterprise size.

- **Keywords:** psychosocial factors, private enterprises, occupational health, mental health, psychological stress, cross-sectional studies