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Riaan Dirkse van Schalkwyk & Rigard J. Steenkamp. *A review and exploration of sociotechnical ergonomics.* Pages: 297-306.

A holistic review of ergonomic history shows that science remains important for general occupational health and safety (OSH), the broad society, culture, politics and the design of everyday things. Science provides an unconventional and multifaceted viewpoint exploring ergonomics from a social, corporate and OSH perspective. Ergonomic solutions from this mindset may redefine the science, and it will change with companies that change within this socially hyper-connected world. Authentic corporate social responsibility will counter 'misleadership' by not approaching ergonomics with an afterthought. The review concludes that ergonomics will be stronger with social respect and ergonomic thinking based on the optimisation of anthropometric data, digital human models, computer-aided tools, self-empowerment, job enrichment, work enlargement, physiology, industrial psychology, cybernetic ergonomics, operations design, ergonomic-friendly process technologies, ergonomic empowerment, behaviour-based safety, outcome-based employee wellness and fatigue risk management solutions, to mention a few.

- **Keywords:** social respect, sociotechnical system, ergonomics, occupational health and safety, quality of work life, work enrichment

Myriam Martinez-Fiestas, Ignacio Rodríguez-Garzón, Antonio Delgado-Padial & Valeriano Lucas-Ruiz. *Analysis of perceived risk among construction workers: a cross-cultural study and reflection on the Hofstede model.* Pages: 307-317.

This article presents a cross-cultural study on perceived risk in the construction industry. Worker samples from three different countries were studied: Spain, Peru and Nicaragua. The main goal was to explain how construction workers perceive their occupational hazard and to analyze how this is related to their national culture. The model used to measure perceived risk was the psychometric paradigm. The results show three very similar profiles, indicating that risk perception is independent of nationality. A cultural analysis was conducted using the Hofstede model. The results of this analysis and the relation to perceived risk showed that risk perception in construction is independent of national culture. Finally, a multiple lineal regression analysis was conducted to determine what qualitative attributes could predict the global quantitative size of risk perception. All

of the findings have important implications regarding the management of safety in the workplace.

- **Keywords:** perceived risk, risk analysis, Hofstede, safety management, psychometric paradigm

Krystian Skubacz, Łukasz Wojtecki & Paweł Urban. *Aerosol concentration and particle size distributions in underground excavations of a hard coal mine.* Pages: 318-327.

Deposition of aerosols in the respiratory system depends inter alia on their size and the respiratory tract deposition is appreciable for nanometer-sized particles. This article presents the results of measurements of size distributions of aerosols in the range of several nanometers up to about 20 µm in the underground mine excavations of an active hard coal mine. The study included practically all particles of a respirable fraction. The results showed that a high concentration of fine and ultrafine aerosols occurs in key underground workplaces especially during mining machine operations, although their contribution to total mass concentration is usually negligible.

- **Keywords:** hard coal mine, particle size distribution, ultrafine particles, fine particles, coarse particles, statistical parameters

Ali Kemal Çelik, Erkan Oktay & Kübranur Çebi. *Analysing workplace violence towards health care staff in public hospitals using alternative ordered response models: the case of north-eastern Turkey.* Pages: 328-339.

The main objective of this article is to determine key factors that may have a significant effect on the verbal abuse, emotional abuse and physical assault of health care workers in north-eastern Turkey. A self-administered survey was completed by 450 health care workers in three well-established hospitals in Erzurum, Turkey. Because of the discrete and ordered nature of the dependent variable of the survey, the data were analysed using four distinctive ordered response models. Results revealed that several key variables were found to be a significant determinant of workplace violence, such as the type of health institution, occupational position, weekly working hours, weekly shift hours, number of daily patient contacts, age group of the respondents, experience in the health sector, training against workplace violence and current policies of the hospitals and the Turkish Ministry of Health.

- **Keywords:** workplace, violence, health care, ordered response model, hospital

Myoung Hwan Park & Byung Yong Jeong. *Occupational injuries and sick leaves in household moving works.* Pages: 340-346.

Background. This study is concerned with household moving works and the characteristics of occupational injuries and sick leaves in each step of the moving process. **Methods.** Accident data for 392 occupational accidents were categorized by the moving processes in which the accidents occurred, and possible incidents and sick leaves were assessed for each moving process and hazard factor. **Results.** Accidents occurring during specific moving processes showed different characteristics depending on the type of accident and agency of accidents. The most critical form in the level of risk management was falls from a height in the 'lifting by ladder truck' process. Incidents ranked as a 'High' level of risk management were in the forms of slips, being struck by objects and musculoskeletal disorders in the 'manual materials handling' process. Also, falls in 'loading/unloading', being struck by objects during 'lifting by ladder truck' and driving accidents in the process of 'transport' were ranked 'High'. **Conclusion.** The

findings of this study can be used to develop more effective accident prevention policy reflecting different circumstances and conditions to reduce occupational accidents in household moving works.

- **Keywords:** accident analysis, household mover, moving process, occupational injury

Sıdıka Bulduk, Emre Özgür Bulduk & Tufan Süren. *Reduction of work-related musculoskeletal risk factors following ergonomics education of sewing machine operators.* Pages: 347-352.

Work-related musculoskeletal disorders (WMSDs) are a major hazard for sewing machine operators. Ergonomics education is recommended for reducing musculoskeletal disorders at workstations. This study aimed to evaluate the effect of an ergonomics education in reducing the exposure to risk factors for WMSDs among sewing machine operators. In this study of 278 workers, their exposure to the risk of WMSDs was assessed using the quick exposure check scale prior to them attending an ergonomics education programme and then again 3 months after the programme. The scores for risk exposure before the education programme were moderate for back (static) and back (dynamic), high for shoulder/arm and very high for wrist/hand and neck. The results obtained 3 months later were low for back (static) and shoulder/arm, and moderate for back (dynamic), wrist/hand and neck. Based on our results, ergonomics education can reduce the exposure to risk factors for WMSDs in the workplace.

- **Keywords:** ergonomics education, sewing machine operators, quick exposure check, musculoskeletal disorders

Murat Gunduz & Heikki Laitinen. *A 10-step safety management framework for construction small and medium-sized enterprises.* Pages: 353-359.

It is of great importance to develop an occupational health and safety management system (OHS MS) to form a systemized approach to improve health and safety. It is a known fact that thousands of accidents and injuries occur in the construction industry. Most of these accidents occur in small and medium-sized enterprises (SMEs). This article provides a 10-step user-friendly OHS MS for the construction industry. A quantitative OHS MS indexing method is also introduced in the article. The practical application of the system to real SMEs and its promising results are also presented.

- **Keywords:** safety management, construction industry, management system

Detlef Mewes & Christian Adler. *Safety of stationary grinding machines – impact resistance of work zone enclosures.* Pages: 360-365.

Guards on machine tools are intended to protect persons from being injured by parts ejected with high kinetic energy from the work zone of the machine. Stationary grinding machines are a typical example. Generally such machines are provided with abrasive product guards closely enveloping the grinding wheel. However, many machining tasks do not allow the use of abrasive product guards. In such cases, the work zone enclosure has to be dimensioned so that, in case of failure, grinding wheel fragments remain inside the machine's working zone. To obtain data for the dimensioning of work zone enclosures on stationary grinding machines, which must be operated without an abrasive product guard, burst tests were conducted with vitrified grinding wheels. The studies show that, contrary to widely held opinion, narrower grinding wheels can be more critical concerning the impact resistance than wider wheels although their fragment energy is smaller.

- **Keywords:** stationary grinding machine, guards, work zone enclosures, impact resistance, burst test, grinding wheels

Yousuf Al-Wardi. *Arabian, Asian, western: a cross-cultural comparison of aircraft accidents from human factor perspectives.* Pages: 366-373.

Introduction. Rates of aviation accident differ in different regions; and national culture has been implicated as a factor. This invites a discussion about the role of national culture in aviation accidents. This study makes a cross-cultural comparison between Oman, Taiwan and the USA. **Method.** A cross-cultural comparison was acquired using data from three studies, including this study, by applying the Human Factors Analysis and Classification System (HFACS) framework. The Taiwan study presented 523 mishaps with 1762 occurrences of human error obtained from the Republic of China Air Force. The study from the USA carried out for commercial aviation had 119 accidents with 245 instances of human error. This study carried out in Oman had a total of 40 aircraft accidents with 129 incidences. **Results.** Variations were found between Oman, Taiwan and the USA at the levels of organisational influence and unsafe supervision. Seven HFACS categories showed significant differences between the three countries ($p < 0.05$). **Conclusion.** Although not given much consideration, national culture can have an impact on aviation safety. This study revealed that national culture plays a role in aircraft accidents related to human factors that cannot be disregarded.

- **Keywords:** cross-culture, human error, accident investigation

Hamidreza Mokarami, Seyed Bagher Mortazavi, Ali Asgari, Alireza Choobineh & Lorann Stallones. *Multiple dimensions of work-related risk factors and their relationship to work ability among industrial workers in Iran.* Pages: 374-379.

Objectives. The present study was designed to investigate the simultaneous effects of physical, psychosocial and other work-related risk factors on the work ability index (WAI) score among industrial workers. **Methods.** This study used a cross-sectional design with a questionnaire survey. A total of 280 workers were included in the study. Data were collected using three questionnaires including the Persian version of the WAI, the Persian version of the job content questionnaire and an author-developed measure (to assess work-related factors, health-related factors and socio-demographic characteristics). **Results.** The majority of the participants were young, but they had poor WAI scores (mean 37.3 ± 6.4) and 44.3% of them had poor or moderate work ability. Occupational accidents and injuries were found to be the strongest predictors of WAI scores. Additionally, there was a strong association between WAI scores and supervisor support, skill discretion, occupational training, sleep quality, work nature and educational level. **Conclusions.** Intervention programs should focus on improving supervisor support, sleep quality, job skills and knowledge and on decreasing physical and mental work demands. Additionally, implementing a comprehensive occupational health and ergonomics program for controlling and reducing hazardous working environments and occupational injury rates should be considered.

- **Keywords:** work ability index, job content questionnaire, psychosocial factors, work-related risk factors, industrial workers

Fereydoon Laal, Ramazan Mirzaei, Mina Sadat Behdani, Mahdi Mohammadi & Khatereh Khodami. *Evaluation of the influence of ergonomic intervention on the musculoskeletal disorders of Zahedan tailors.* Pages: 380-385.

Work-related musculoskeletal disorders are among the major health problems of tailors. This study was conducted with the aim of evaluating posture type, assessment of pain in body parts and the impact of education on the frequency of such injuries in tailors. This interventional study was performed in two groups of male tailors (45 cases, 45 controls) using Quick Exposure Checklist (QEC) software and the Nordic musculoskeletal questionnaire. The relationship between the qualitative variables was examined by χ^2 test. Three months after the educational course, there was a significant decrease in the frequency of pain in most of the body parts ($p < 0.05$); mean of the QEC scores before the intervention was 79.04 ± 80.02 compared with 70.4 ± 8.3 after the intervention. It is suggested to hold cyclical educational courses along with other intervention programs for reducing the risks and dangers in the tailors.

- **Keywords:** musculoskeletal disorders, Quick Exposure Checklist, ergonomic intervention, tailors

Milad Abbasi, Abolfazl Zakerian, Ahmad Mehri, Mohsen Poursadeghiyan, Nader Dinarvand, Arash Akbarzadeh & Mohammad Hossein Ebrahimi. *Investigation into effects of work-related quality of life and some related factors on cognitive failures among nurses. Pages: 386-392.*

Objective. Cognitive failure is one of the factors which can be influenced by personal and professional characteristics. This research was carried out to study the effect of work-related quality of life (WRQoL) and some related factors on cognitive failures (CF) among nurses. **Methods.** This cross-sectional study was conducted among nurses working in intensive care units, critical care units and emergency units in 2014. **Results.** In total, 750 nurses participated in the study. The mean \pm SD for the total CF and WRQoL was 40.5 ± 12.7 and 75.8 ± 13.7 respectively. The results show that CF have a statistically significant difference among the age groups, experience groups and working units. Multiple regression tests show that age, income and WRQoL have a significant effect on CF. Based on the results, for a unit increase in WRQoL we expect a 0.26 unit decrease in CF. Analysis of variance results show that the emergency ward had changed the overall effect of WRQoL on CF, after the effect of WRQoL was controlled. **Conclusions.** Overall results from the present research indicated that, despite the high level of WRQoL among the studied nurses, the rate of CF was not at an appropriate level. Development of supportive and interventional strategies is highly recommended.

Hilma Raimona Zadry, Lusi Susanti & Dina Rahmayanti. *Ergonomics intervention on an alternative design of a spinal board. Pages: 393-403.*

A spinal board is the evacuation tool of first aid to help the injured spinal cord. The existing spinal board has several weaknesses, both in terms of user comfort and the effectiveness and efficiency of the evacuation process. This study designs an ergonomic spinal board using the quality function deployment approach. A preliminary survey was conducted through direct observation and interviews with volunteers from the Indonesian Red Cross. Data gathered were translated into a questionnaire and answered by 47 participants in West Sumatra. The results indicate that the selection of materials, the application of strap systems as well as the addition of features are very important in designing an ergonomic spinal board. The data were used in designing an ergonomic spinal board. The use of anthropometric data ensures that this product can accommodate safety and comfort when immobilized, as well as the flexibility and speed of the rescue evacuation process.

- **Keywords:** spinal board, ergonomics, quality function deployment, product design

Ukachukwu Okoroafor Abaraogu, Charles Ikechukwu Ezema & Chinenye Kosisochukwu Nwosu. *Job stress dimension and work-related musculoskeletal disorders among southeast Nigerian physiotherapists.* Pages: 404-409.

Background. Although publications describe physical demands of the job in the physiotherapy profession, there is a dearth of literature on job stress dimensions (JSDs), and their relationship to work-related musculoskeletal disorders (WMSDs). Objective. To investigate JSDs and their relationship to WMSDs among physiotherapists currently practicing in southeast Nigeria. Method. A cross-sectional study using items related to the Job Content Questionnaire and the Nordic musculoskeletal questionnaire. Data were summarized with descriptive statistics, and the relationship between WMSDs and JSDs was analyzed with the Mann–Whitney U test. Results. A total of 126 physiotherapists responded. There were high levels of stress in most of the job dimensions investigated: 82.1% and 22.8% of the physiotherapists had WMSDs in at least one body region in the last 12 months and the last 7 days respectively. The lower back was the most commonly affected in both periods. No specific domain was related to development of WMSDs. Conclusion. Over 80% of physiotherapists in southeast Nigeria have WMSDs. However, despite high levels of physical demands on the job, physiotherapists have job control and good social support. Intervention programs aimed at reducing WMSDs in physiotherapists should focus on risk factors that target the physical demands of the job.

- **Keywords:** job stress, physiotherapists, work-related musculoskeletal disorders, Nigeria

Tzu-Hsien Lee. *The effects of arm posture and holding time on holding capability and muscle activity.* Pages: 410-414.

The aim of this study was to examine the effects of arm posture and holding time on human holding capability and resulting muscle activity. Fifteen healthy young males were recruited as participants. Maximum holding capacity was examined at 0 (degrees of shoulder forward flexion angle)/90 (degrees of elbow angle), 30/120 and 90/180 arm postures. Maximum acceptable weight of holding was evaluated in three arm postures (0/90, 30/120, 90/180) by three holding times (10 s, 20 s, 30 s). The greatest and lowest maximum holding capacity or maximum acceptable weight of holding occurred at 0/90 and 90/180 arm postures, respectively. Maximum acceptable weight of holding decreased with increasing holding time. While holding maximum acceptable weights, the % of maximum voluntary contraction of brachioradialis, biceps brachii and erector spinae ranged from 14 to 44%, from 14 to 53% and from 25 to 36%, respectively.

- **Keywords:** psychophysical, manual materials handling, musculoskeletal injury

Tomasz Hermann & Marian Witalis Dobry. *Energy evaluation of protection effectiveness of anti-vibration gloves.* Pages: 415-423.

This article describes an energy method of assessing protection effectiveness of anti-vibration gloves on the human dynamic structure. The study uses dynamic models of the human and the glove specified in Standard No. ISO 10068:2012. The physical models of human–tool systems were developed by combining human physical models with a power tool model. The combined human–tool models were then transformed into mathematical models from which energy models were finally derived. Comparative energy analysis was conducted in the domain of rms powers. The energy models of the human–tool systems were solved using numerical simulation implemented in the MATLAB/Simulink environment. The simulation procedure demonstrated the effectiveness of the anti-vibration glove as a method of protecting human operators of hand-held power tools

against vibration. The desirable effect is achieved by lowering the flow of energy in the human–tool system when the anti-vibration glove is employed.

- **Keywords:** local vibrations, biomechanical system, anti-vibration gloves

Qinghui Suo & Daming Zhang. *Investigation and identification of factors affecting migrating peasant workers' usage of safety footwear in the Chinese construction industry. Pages: 424-430.*

A sample of 300 migrating peasant workers from 15 Chinese building construction sites completed a demographic questionnaire to investigate the usage of safety footwear. The survey form was constructed based on the theory of planned behaviour, and a total of 12 questions focusing on the workers' past experience, attitudes, subjective norms and perceived behavioural control were included in the survey. It was found that 92% of the participants did not wear safety footwear while working on construction sites, although more than 91% of them believed that safety footwear would protect the foot from injury; none of the participants had been provided free safety footwear by their employer. Regression analysis shows that employers' attitude is the most important factor affecting their usage of safety footwear, 'providing free safety footwear' and 'comfortability of the safety footwear' ranking second and third respectively.

- **Keywords:** migrating peasant worker, safety footwear, construction site, theory of planned behaviour

Adel Mazlomi, Farideh Golbabaie, Somayeh Farhang Dehghan, Marzieh Abbasinia, Somayeh Mahmoud Khani, Mohammad Ansari & Mostafa Hosseini. *The influence of occupational heat exposure on cognitive performance and blood level of stress hormones: a field study report. Pages: 431-439.*

Introduction. This article aimed to investigate the effect of heat stress on cognitive performance and the blood concentration of stress hormones among workers of a foundry plant. **Methods.** Seventy workers within the exposed (35 people) and unexposed (35 people) groups were studied. The wet bulb globe temperature (WBGT) index was measured for heat stress assessment. The cognitive performance tests were conducted using the Stroop color word test (SCWT) before and during working hours. For the assessment of the serum level of cortisol and the plasma level of adrenaline and noradrenaline, blood samples were taken during working hours from both groups. **Results.** Only for SCWT III was there a significant relationship between heat stress and test duration, error rate and reaction time. The laboratory test results revealed significantly higher concentrations of cortisol, adrenaline and noradrenaline in the exposed subjects than in the unexposed group. There existed a positive correlation between cortisol, adrenaline, noradrenaline and WBGT index and also test duration and reaction time of SCWT III, and number of errors of SCWT I, SCWT II and SCWT III during work. **Conclusion.** Heat stress can lead to an increase in the blood level of stress hormones, resulting in cognitive performance impairment.

- **Keywords:** heat stress, cognitive performance, stress hormones, foundry industry

Adam Pościk & Marcin Jachowicz. *Mechanical properties of protective spectacles fitted with corrective lenses. Pages: 440-446.*

The majority of commercially available corrective spectacles used by workers do not provide effective eye protection against mechanical hazards in the workplace. One of the risks commonly occurring during work is hitting the head on some protruding elements,

such as components of machines, buildings or tree branches in a forest. Because of the considerable weight of the human head and the speed of movement during impact, this type of accident may be very serious. This article presents a method of testing the mechanical strength of corrective lenses, simulating the results of an impact of the head on elements of workplaces. The results of tests of commercially available materials used for the construction of corrective and protective spectacles are also presented and discussed.

- **Keywords:** safety spectacles, corrective spectacles, presbyopia, impact resistance