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Sangbok Lee, Myoung Hwan Park & Byung Yong Jeong. *Gender differences in public office workers' satisfaction, subjective symptoms and musculoskeletal complaints in workplace and office environments.* Pages: 165-170.

This study investigates differences between male and female public office workers' satisfaction levels, sick building syndrome (SBS) symptoms and musculoskeletal disorder (MSD) complaints in workplace and office environments. Questionnaire surveys were performed in 30 offices from 15 public institutions. Male and female workers of the same age were coupled and selected from each office, gathering a total of 120 male and 120 female subjects. The results show that differences exist between genders in noise and lighting satisfaction levels, SBS-related symptoms (eye, nose, skin) and MSD complaints of hand/wrist/finger, while there is no difference in overall satisfaction level of office environments. The study also suggests that office design for public office workers should take into account gender differences in preventing MSDs and also SBS. The findings of this study are expected to serve as basic data for designing effective public office environments.

- **Keywords:** office worker, gender difference, sick building syndrome, indoor environmental quality, musculoskeletal disorders

Krzysztof Baszczyński. *Effects of falling weight impact on industrial safety helmets used in conjunction with eye and face protection devices.* Pages: 171-180.

Industrial workplaces pose concurrent hazards to the upper part of the head and the eyes. Under the circumstances, workers may use protective helmets in conjunction with protective goggles or spectacles. In order to assess the compatibility of this equipment, a method and a test stand for evaluating the behavior of safety helmets and protective goggles/spectacles upon the impact of a falling weight were designed. The results of tests concerning the displacement and deformation of helmets and spectacles/goggles, the forces acting on the helmets, as well as the forces exerted by the spectacles/goggles on the headform upon falling weight impact are presented. The results revealed the ways in which the tested equipment interacted with each other. The influence of equipment construction on the test results was analyzed and inferences concerning the safety of the

studied protective devices were made. Some general construction guidelines were formulated for the compatibility of the equipment.

- **Keywords:** safety, mechanical testing, simulation tests, impact energy

Cibele Satuf, Samuel Monteiro, Henrique Pereira, Graça Esgalhado, Rosa Marina Afonso & Manuel Loureiro. *The protective effect of job satisfaction in health, happiness, well-being and self-esteem.* Pages: 181-189.

The purpose of this article is to analyze the possible effects of job satisfaction on mental and physical health, happiness, subjective well-being and self-esteem. A total of 971 Portuguese-speaking adults participated in this study. Most participants reported high rates of satisfaction with their colleagues, the nature of their work and leadership, while reporting dissatisfaction with regard to salaries and promotions. Results indicated the existence of the protector effect of job satisfaction for health, happiness, subjective well-being and self-esteem, in addition to reinforcing the importance of maintaining a positive evaluation of one's work. As a practical implication, the results may suggest that the effects of personnel management policies which emphasize job satisfaction could potentially lead to improvements in levels of health, happiness, subjective well-being and workers' self-esteem, all of which are factors that can potentially improve organizational performance. The study also considered its limitations and the possibility for future investigation.

- **Keywords:** job satisfaction, health, happiness, subjective well-being, self-esteem

Yun Su, Jun Li & Guowen Song. *The effect of moisture content within multilayer protective clothing on protection from radiation and steam.* Pages: 190-199.

The moisture from skin sweat and atmospheric water affects the thermal protective performance provided by multilayer protective clothing. Four levels of moisture content were selected to evaluate the impact of moisture on thermal protection under dry (thermal radiation) and wet (thermal radiation and low-pressure steam) heat exposure. Also, the role of moisture and its relationship with exposure time were analyzed based on skin heat flux and Henriques integral value. The addition of moisture to a fabric system was found to result in differences in second-degree and third-degree skin burn times. When moisture is added to a fabric system, it both acts as a thermal conductor to present a negative effect and provides a positive effect owing to thermal storage of water and evaporative heat loss. The positive or negative effects of moisture are mainly dependent on the thermal exposure time, the moisture content and the presence of hot steam.

- **Keywords:** skin sweat, hot steam, skin burn, protective clothing, thermal protective performance

Danuta Roman-Liu & Paweł Bartuzi. *Influence of type of MVC test on electromyography measures of biceps brachii and triceps brachii.* Pages: 200-206.

Objective. This study aimed to investigate the amplitude and frequency measures of the electromyography (EMG) signal in agonistic and antagonistic muscles (biceps brachii, triceps brachii). *Methods.* Fifteen males (22.9 ± 2.1 years old) took three isometric maximum voluntary contraction (MVC) tests. Two tests were typical MVC tests for biceps brachii and triceps brachii. The third was a test often used to obtain MVC for forearm muscles (arm and forearm hanging down). The EMG signal was recorded during three

isometric MVC muscle contractions and during a relaxation test. *Results.* There were no differences in amplitude between relaxation and MVC antagonist in static contraction, with higher values for frequency measures in relaxation. When biceps brachii and triceps brachii act as antagonists in an MVC test, frequency measures present lower values than when the muscles act as agonists. Biceps brachii shows much lower amplitude than during an agonist MVC contraction with similar spectral measures. Triceps brachii presents much higher values of spectral measures than during an agonist MVC test. *Conclusion.* The type of exerted force, i.e., if a muscle acted as an agonist, antagonist or stabilizer, affects the relationship between the time and frequency domain measures.

- **Keywords:** maximum force capabilities, muscle relaxation, peak frequency, power spectrum, time and frequency domain

Anamai Thetkathuek & Parvena Meepradit. *Work-related musculoskeletal disorders among workers in an MDF furniture factory in eastern Thailand.* Pages: 207-217.

The purpose of this study was to analyze the factors contributing to musculoskeletal disorders (MSDs) among 439 workers in an MDF furniture factory using questionnaires and the risk assessment form of the Ergonomic Assessment Tool for Arthritis technique to assess aspects of the workstations and working postures of jobs. With regard to factors that affected MSDs, it was found that workers older than 50 years were having knee symptoms: their adjusted odds ratio (aOR) was 18.49, 95% confidence interval (CI) [1.51, 226.40]. Those who had been working for 1–2 years were having neck pain symptoms: aOR 12.01, 95% CI [1.82, 79.43]. The recommendation of this study is that health monitoring should be provided for workers who have pain in various parts of their bodies, especially those who have been working for 6–10 years, and those who are over 50 years old with knee pain.

- **Keywords:** musculoskeletal disorder, furniture factory, Thailand

Yong-Ku Kong, Sung-yong Lee, Kyung-Suk Lee & Dae-Min Kim. *Comparisons of ergonomic evaluation tools (ALLA, RULA, REBA and OWAS) for farm work.* Pages: 218-223.

Introduction. The purpose of this study was to validate the agricultural lower limb assessment (ALLA) ergonomic checklist, which was developed for various agricultural tasks in Korea. *Methods.* One hundred and ninety-six working postures were selected from the real agricultural tasks to verify ALLA, a lower limb body posture assessment tool, and then evaluated by 16 ergonomic experts. Hit rate, quadratic weighted κ , one-way analysis of variance and *t*-test analyses were applied to compare ALLA with other assessment tools. *Results.* ALLA analysis had a superior hit rate with ergonomic expert assessment compared with other assessment tools. Quadratic weighted κ analysis also showed that ALLA provided superior estimates of risk levels for farm working postures. *Discussion.* ALLA would be an appropriate assessment tool to estimate risk factors for various lower limb body postures which frequently occur in agricultural tasks in Korea. ALLA is a simple and accurate risk assessment tool that could be usefully applied to identify and mitigate risk factors and work-related musculoskeletal disorders in agricultural tasks, and also to evaluate the effects of control and intervention for working conditions.

- **Keywords:** ergonomic risk assessment tools, agricultural lower limb assessment, rapid entire body assessment, rapid upper limb assessment, Ovako working posture analysis system

Hamidreza Heidari, Farideh Golbabaei, Aliakbar Shamsipour, Abbas Rahimi Forushani & Abbasali Gaeini. *The cut-off point for tympanic temperature as a heat strain index for evaluation of outdoor workers: a field study.* Pages: 224-232.

Objectives. The aims of this study were (a) to assess the agreement coefficient between tympanic temperatures and the most popular and valid heat stress index, wet bulb globe temperature (WBGT), in outdoor environments; (b) to determine a cut-off point for tympanic temperature as a heat strain index for evaluation of outdoor workers. *Methods.* 1452 measurements of WBGT index and tympanic temperature were recorded for outdoor workers from nine different climatic regions. Consistency of the WBGT and tympanic temperature were tested. The cut-off point for tympanic temperature in outdoor environments regarding WBGT evaluation was suggested based on obtained sensitivity and specificity from a receiver operating characteristic curve. *Results.* The results showed that there were numerous situations in which WBGT exceeded the reference value, whilst the measured values of tympanic temperature rarely reached a permissible value for core temperature (38 °C). Therefore, appropriate consistency of results between the heat stress and strain indices was not achieved. *Conclusion.* The criterion of tympanic temperature equaling 37 °C was suggested as a cut-off point for tympanic temperature as a heat strain index for outdoor environment evaluation.

- **Keywords:** tympanic temperature, outdoor environment, heat stress, cut-off point

Norintan Ab-Murat, Lydia Mason, Rahimah Abdul Kadir & Noriah Yusoff. *Self-perceived mental well-being amongst Malaysian dentists.* Pages: 233-239.

Purpose. To assess Malaysian dentists' perceptions of their mental well-being. *Methods.* A self-administered questionnaire was developed based on a conceptual framework of mental health and well-being model. Two aspects were assessed, namely the physiological (two domains) and the psychological (six domains). Participants were asked to rate their experiences of the aforementioned aspects using a 5-point Likert scale ranging from *all the time* to *never*. *Results.* The response rate was 81%. Most of the dentists (61.7%) perceived having positive mental well-being. Under the physiological aspect, most respondents reported that they were 'generally happy' (93.3%), but about 30% stated they were 'stressed physically and emotionally'. Of the six domains under the psychological aspect, positive well-being was observed in the 'sense of coherence' and 'behavioural stress' domains. Participants who were above 40 years old, married and had children reported having a more positive mental well-being when compared with their counterparts. *Conclusion.* Overall, most Malaysian dentists perceived having a positive mental well-being. It is crucial, however, to closely monitor and initiate early interventions for those with negative symptoms to ensure the safe practice of dentistry.

- **Keywords:** mental health, mental well-being, dentists, stress, burnout

Ishfaq Ahmed, Muhammad Zeeshan Shaukat, Ahmad Usman, Muhammad Musarrat Nawaz & Mian Sajid Nazir. *Occupational health and safety issues in the informal economic segment of Pakistan: a survey of construction sites.* Pages: 240-250.

This research covers the current status of occupational health and safety (OHS)-related practices in the informal construction segment of Pakistan. Data were collected, through interviews, from 316 construction sites employing 3577 workers. The results of the study reveal that both employers and workers lack knowledge of OHS laws/standards and no practices of this nature are enacted at these construction sites. Alarming, work-related

accidents, whenever they happen, are not given due attention and there is no formal injury-report system. The informal construction industry employs a huge portion of the informal workforce, and lack of OHS happens at tremendous human cost. These research findings may thus play their role in strengthening the case for reforms in the sector. This study, if properly utilized, may also enable employers of the sector by increasing their knowledge about OHS practices and, as a result, trying to offer safer environments for their workers.

- **Keywords:** occupational health and safety, informal sector, attitudes, perceptions, construction, Pakistan

Montakarn Chaikumarn, Nuttika Nakphet & Prawit Janwantanakul. *Impact of rest-break interventions on the neck and shoulder posture of symptomatic VDU operators during prolonged computer work.* Pages: 251-259.

There is limited research on the effects of different types of rest-break interventions for visual display unit (VDU) operators on neck and shoulder postures. This study examined the effect of rest-break interventions on the neck and shoulder postures of symptomatic VDU operators during prolonged computer work. Thirty subjects were randomly and equally assigned to breaks with stretching, breaks with dynamic movement and passive breaks. Subjects performed the typing task for 60 min and received 3-min breaks after 20 min of work. The craniovertebral and forward shoulder angles were obtained from a 3D motion analysis system. Results showed that there were no significant differences in the craniovertebral and forward shoulder angles among any types of rest breaks. It can be concluded that the three types of rest-break interventions had positive effects on neck and shoulder posture during prolonged computer terminal work.

- **Keywords:** symptomatic VDU operators, rest break, neck and shoulder postures

Vivian Farahte Giangardi, Sandra Regina Alouche, Sandra Maria Sbeghen Ferreira de Freitas, Raquel Simoni Pires & Rosimeire Simprini Padula. *The influence of a real job on upper limb performance in motor skill tests: which abilities are transferred?* Pages: 260-267.

To investigate whether the specificities of real jobs create distinctions in the performance of workers in different motor tests for the upper limbs, 24 participants were divided into two groups according to their specific job: fine and repetitive tasks and general tasks. Both groups reproduced tasks related to aiming movements, handling and strength of the upper limbs. There were no significant differences between groups in the dexterity and performance of aiming movements. However, the general tasks group had higher grip strength than the repetitive tasks group, demonstrating differences according to job specificity. The results suggest that a particular motor skill in a specific job cannot improve performance in other tasks with the same motor requirements. The transfer of the fine and gross motor skills from previous experience in a job-specific task is the basis for allocating training and guidance to workers.

- **Keywords:** motor learning, skill acquisition, health and safety, injury risks

Baisheng Nie, Xin Huang, Fei Xue, Jiang Chen, Xiaobing Liu, Yangyang Meng & Jinxin Huang. *A comparative study of vocational education and occupational safety and health training in China and the UK.* Pages: 268-277.

In order to enhance Chinese workers' occupational safety awareness, it is essential to learn from developed countries' experiences. This article investigates thoroughly

occupational safety and health (OSH) in China and the UK; moreover, the article performs a comparison of Chinese and British OSH training-related laws, regulations and education system. The following conclusions are drawn: China's work safety continues to improve, but there is still a large gap compared with the UK. In China a relatively complete vocational education and training (VET) system has been established. However, there exist some defects in OSH. In the UK, the employer will not only pay attention to employees' physiological health, but also to their mental health. The UK's VET is characterized by classification and grading management, which helps integrate OSH into the whole education system. China can learn from the UK in the development of policies, VET and OSH training.

- **Keywords:** work safety status, vocational education and training, safety and health training, education system

Shankar Subramaniam, Naveenkumar Raju, Karthick Jeganathan & Mohankumar Periyasamy. Evaluation of vibrant muscles over the shoulder region among workers of the hand screen printing industry. Pages: 278-285.

This study focuses on evaluation of the muscle activities associated with shoulder pain among workers of the hand screen printing (HSP) industry. Activities of three major muscles which showed higher muscle activity for a HSP job were observed for fatigue using surface electromyography (SEMG). The anatomical sites were chosen on the basis of a statistical survey and a visual inspection conducted before the experiment. Activities of the deltoid, teres major and infraspinatus were recorded using SEMG and the nature of muscle activities was studied for about 50 m of cloth printing. Data collected were processed using LabVIEW 2014 and the activities were analyzed using statistical tests and regression analyses. The results showed an increased risk of shoulder disorders with an increase in working time. Some of the risks which might cause disorders were predicted from the results; inspection and possible mitigations were suggested.

- **Keywords:** electromyography analysis, shoulder, hand screen printing, repeated measures, working hours

Erman Çakıt. Ergonomic assessment of airport shuttle driver tasks using an ergonomic analysis toolset. Pages: 286-293.

This study aimed to (a) evaluate strength requirements and lower back stresses during lifting and baggage handling tasks with the 3D Static Strength Prediction Program (3DSSPP) and (b) provide additional analyses using rapid entire body assessment (REBA) and the NASA task load index (TLX) to assess the risks associated with the tasks. Four healthy female shuttle drivers of good health aged between 55 and 60 years were observed and interviewed in an effort to determine the tasks required of their occupations. The results indicated that lifting bags and placing them in a shuttle were high risk for injury and possible changes should be further investigated. The study concluded there was a potential for injury associated with baggage storing and retrieval tasks of a shuttle driver.

- **Keywords:** ergonomics assessment, lower back pain, postural, occupational stressors

Kai Way Li, Caijun Zhao, Lu Peng & Ai-qun Liu. Subjective assessments of floor slipperiness before and after walk under two lighting conditions. Pages: 294-302.

A gait experiment was performed. The participants were tested under shoes, floors, surface and lighting conditions. They gave floor slipperiness ratings before and after a gait trial. The perceived sense of slip (PSOS) was collected. It was found that the perceived floor slipperiness (PFS) before walking was affected significantly by the lighting, floor and surface conditions. Relative low PFS values were recorded under wet and detergent-contaminated conditions in the normal daylight condition as compared with those in the dimmed condition. The PFS after the gait was significantly affected by the floor and surface conditions. The PSOS was highly correlated with the PFS after trial. The regression analyses results indicated that both the coefficient of friction (COF) of the floor and lighting were primary predictors of the PFS before a gait. The COF and walking speed were the primary predictors of the PFS after a gait.

- **Keywords:** slip and fall, gait, floor slipperiness, subjective rating, lighting

Fakhradin Ghasemi, Omid Kalatpour, Abbas Moghimbeigi & Iraj Mohhammadfam. *A path analysis model for explaining unsafe behavior in workplaces: the effect of perceived work pressure.* Pages: 303-310.

Background. Unsafe behavior is closely related to occupational accidents. Work pressure is one the main factors affecting employees' behavior. The aim of the present study was to provide a path analysis model for explaining how work pressure affects safety behavior. *Methods.* Using a self-administered questionnaire, six variables supposed to affect safety employees' behavior were measured. The path analysis model was constructed based on several hypotheses. The goodness of fit of the model was assessed using both absolute and comparative fit indices. *Results.* Work pressure was determined not to influence safety behavior directly. However, it negatively influenced other variables. Group attitude and personal attitude toward safety were the main factors mediating the effect of work pressure on safety behavior. Among the variables investigated in the present study, group attitude, personal attitude and work pressure had the strongest effects on safety behavior. *Conclusion.* Managers should consider that in order to improve employees' safety behavior, work pressure should be reduced to a reasonable level, and concurrently a supportive environment, which ensures a positive group attitude toward safety, should be provided. Replication of the study is recommended.

- **Keywords:** safety behavior, group attitude, accident prevention, perceived hazard

Guilherme da Silva Bertolaccini, Idinei Francisco Pires de Carvalho Filho, Gustavo Christofoletti, Luis Carlos Paschoarelli & Fausto Orsi Medola. *The influence of axle position and the use of accessories on the activity of upper limb muscles during manual wheelchair propulsion.* Pages: 311-315.

Introduction. Wheelchair configuration is an important factor influencing the ergonomics of the user-device interface and, from a biomechanical point of view, small changes in chair setup may have a positive influence on the demand on the upper limbs during manual propulsion. This study aimed to investigate the influence of the position of the rear wheels' axle and the use of accessories on the activity of upper limb muscles during manual wheelchair propulsion. *Methods.* Electromyography signals of the biceps, triceps, anterior deltoids and pectoralis major were collected for 11 able-bodied subjects in a wheelchair propulsion protocol with four different wheelchair configurations (differing in axle position and the use of accessories) on a straightforward sprint and a slalom course. *Results.* With accessories, moving the axle forward led to a decrease in the activity of all muscles in both the straightforward sprint (significant differences in triceps, anterior deltoids and biceps) and the slalom course (significant difference in anterior

deltoids and biceps). However, when propelling the chair without accessories, no difference was found related to axle position. *Conclusion.* Changes in wheelchair configuration can influence the ergonomics of manual wheelchair propulsion. Reducing the biomechanical loads may benefit users' mobility, independence and social participation.

- **Keywords:** wheelchairs, biomechanics, manual propulsion, ergonomics, assistive technologies

Patricia Blanco-Piñeiro, M. Pino Díaz-Pereira & Aurora Martínez Vidal. *Variation in posture quality across musical instruments and its impact during performances.* Pages: 316-323.

Objective. Bad posture increases the risk that a musician may suffer from musculoskeletal disorders. This study compared posture quality required by different instruments or families of instruments. *Methods.* Using an ad-hoc postural observation instrument embracing 11 postural variables, four experts evaluated the postures of 100 students attending a Spanish higher conservatory of music. *Results.* The agreement of the experts' evaluations was statistically confirmed by a Cohen's κ value between 0.855 and 1.000 and a Kendall value between 0.709 and 1.000 ($p < 0.001$ in all cases). Moreover, χ^2 tests revealed significant association between instrument families and seated posture with respect to pelvic attitude, dorsal curvature and head alignment in both sagittal and frontal planes. This analysis also showed an association between instrument families and standing posture with respect to the frontal plane of the axis of gravity, pelvic attitude, head alignment in the frontal plane, the sagittal plane of the shoulders and overall posture. *Conclusions.* While certain postural defects appear to be common to all families of instruments, others are more characteristic of some families than others. The instrument associated with the best posture quality was the bagpipe, followed by percussion and strings.

- **Keywords:** music students, instrument, posture, evaluation

Pierre Nanyan & Mondher Ben Charrada. *Effect of restaurant types on compensation claims for work-related musculoskeletal disorders in France.* Pages: 324-328.

Objectives. The economic burden of work-related musculoskeletal disorders (WMSDs) is industry specific. The objective was to analyse compensation claims for WMSDs among restaurant workers in France taking into account the type of restaurant. *Methods.* Data for 2014 were obtained from the French National Health Insurance Fund for Salaried Workers. A chi-square test was used to compare claims, incapacity and lost work day rates in different types of restaurant. *Results.* Prevalence for WMSDs differed significantly by the type of kitchen: collective restaurant (7.2/1000 workers), traditional restaurant (1.7/1000), and fast food restaurant (1.0/1000). There were more male claimants in traditional restaurant workers (51.0%) than in collective restaurant workers (40.1%) but more female claimants in collective restaurant workers (50.1%) than in traditional restaurant workers (39.4%). Permanent incapacity was significantly more prevalent in collective restaurant workers (49.6%), than in traditional (41.9%) and fast food (8.5%) restaurant workers. In collective restaurant workers, as a percentage, claims, permanent incapacity and lost work days increased with age range or work experience. *Conclusions.* Prevalence for WMSDs and therefore incapacity and lost work days are different according to the type of restaurant. Preventive strategies should take these differences into consideration.

- **Keywords:** lost work days, permanent incapacity, work experience, work-related musculoskeletal disorders, restaurant workers