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Samira Bahrampour , Jalil Nazari , Iman Dianat , Mohammad Asghari Jafarabadi & Ahmad Bazazan. *Determining optimum seat depth using comfort and discomfort assessments.* Pages: 429-435.

The aim of this study was to determine optimum seat depth using subjective assessments. Comfort and discomfort evaluation, as an ergonomic subjective method, was used to find the optimum seat depth. A total of 36 university students rated the comfort and discomfort of six different seat depths (including 32.0, 37.0, 42.0, 47.0 and 52.0 cm which covered the buttock–popliteal length [BPL] range as well as 40.2 cm representing the 5th percentile of the BPL) during a 90-min period using a chair evaluation checklist. The results showed that a seat depth of 40.2 cm (equivalent to the 5th percentile of the BPL) was more comfortable and caused less discomfort ratings after 90 min compared to other experimental seat depths. The findings suggest that an appropriate seat depth for the studied population can be recommended based on the 5th percentile of the BPL as an anthropometric criterion.

- **Keywords:** anthropometric criteria, seat design, subjective methods, university students

Ehsanollah Habibi , Mina Salehi , Ghasem Yadegarfar & Ali Taheri. *Optimization of the ANFIS using a genetic algorithm for physical work rate classification.* Pages: 436-443.

Purpose. Recently, a new method was proposed for physical work rate classification based on an adaptive neuro-fuzzy inference system (ANFIS). This study aims to present a genetic algorithm (GA)-optimized ANFIS model for a highly accurate classification of physical work rate. *Methods.* Thirty healthy men participated in this study. Directly measured heart rate and oxygen consumption of the participants in the laboratory were used for training the ANFIS classifier model in MATLAB version 8.0.0 using a hybrid algorithm. A similar process was done using the GA as an optimization technique. *Results.* The accuracy, sensitivity and specificity of the ANFIS classifier model were increased successfully. The mean accuracy of the model was increased from 92.95 to 97.92%. Also, the calculated root mean square error of the model was reduced from 5.4186 to 3.1882. The maximum estimation error of the optimized ANFIS during the network testing process was $\pm 5\%$. *Conclusion.* The GA can be effectively used for ANFIS optimization and leads to an accurate classification of physical work rate. In addition to

high accuracy, simple implementation and inter-individual variability consideration are two other advantages of the presented model.

- **Keywords:** physical work rate, classification, optimization, adaptive neuro-fuzzy inference system

Maryam Jamshidzad , Maryam Maghsoudipour , Seyed Abolfazl Zakerian , Enayatollah Bakhshi & Paul Coh. *Impact of music type on motor coordination task performance among introverted and extroverted students.* Pages: 444-449.

Purpose. People are interested in music. In this study, we assessed the impact of music type on objective performance. *Materials and methods.* We distributed 64 medical science students in Tehran into four groups: Iranian pop music, traditional music, Mozart's classical music and control groups. All participants performed the two-arm coordination test once without music and once with music (except for the control group), with an interval of 1 week. In the music groups, music was playing during the performance of the test. Participants were categorized as either introverted or extroverted and were distributed equally in the groups. *Results.* There was a significant decrease of test time in the second trial, observed in all music groups, and no significant difference identified in the control group. The traditional music group had less difference of mean time compared to the pop music group. The differences in the traditional and classical groups were not significantly different. In the music groups, both extroverted and introverted students decreased their test time significantly after music intervention, but extroverted students decreased more. *Conclusion.* Listening to music would enhance the speed of performance. Music with a higher tempo, such as pop music, increased the speed more.

- **Keywords:** music, objective performance, introverted, extroverted

Kadri Cemil Akyuz , Ibrahim Yildirim & Celal Gungor. *Validation of a pre-existing safety climate scale for the Turkish furniture manufacturing industry.* Pages: 450-458.

Understanding the safety climate level is essential to implement a proactive safety program. The objective of this study is to explore the possibility of having a safety climate scale for the Turkish furniture manufacturing industry since there has not been any scale available. The questionnaire recruited 783 subjects. Confirmatory factor analysis (CFA) tested a pre-existing safety scale's fit to the industry. The CFA indicated that the structures of the model present a non-satisfactory fit with the data ($\chi^2 = 2033.4$, $df = 314$, $p \leq 0.001$; root mean square error of approximation = 0.08, normed fit index = 0.65, Tucker-Lewis index = 0.65, comparative fit index = 0.69, parsimony goodness-of-fit index = 0.68). The results suggest that a new scale should be developed and validated to measure the safety climate level in the Turkish furniture manufacturing industry. Due to the hierarchical structure of organizations, future studies should consider a multilevel approach in their exploratory factor analyses while developing a new scale.

- **Keywords:** safety climate, safety culture, furniture manufacturing industry, safety management

Ishak Altinpinar & Ersan Basar. *Comparison of the safety cultures of Turkish aviation and maritime transportation workers.* Pages: 459-468.

Given the needs of the growing world population, the importance of the transportation sector has steadily increased. Maritime and aviation fields are considered two crucial

parts of this sector. Transportation accidents must be minimized in order to ensure timely delivery of natural resources, sustainable production and safety of life and property. Human error plays an important role in transportation accidents and is the cause of 70–90% of all aviation and maritime accidents. These errors can be minimized by enhancing the perception of safety culture for individuals, corporations and nations. In this study, a questionnaire survey was conducted among 318 Turkish people who work in different positions in the aviation and maritime industries. The perceptions of safety culture within different occupations and occupational groups were compared. Statistically significant differences were found between the aviation and maritime sectors.

- **Keywords:** safety culture, maritime, aviation

Huakang Liang , Shoujian Zhang & Yikun Su. *The structure and emerging trends of construction safety management research: a bibliometric review.* Pages: 469-488.

Recently, construction safety management (CSM) practices and systems have become important topics for stakeholders to take care of human resources. However, few studies have attempted to map the global research on CSM. A comprehensive bibliometric review was conducted in this study based on multiple methods. In total, 1172 CSM-related papers from the Web of Science Core Collection database were examined. The analyses focused on publication year, country–institute, publication source, author and research topics. The results indicated that the USA, China, Australia and the UK took leading positions in CSM research. Two branches of journals were identified, namely the branch of engineering science and that of safety science and social science. Additionally, seven themes together with 28 specific topics were detected to allow researchers to track the main structure and temporal evolution of CSM research. Finally, the main research trends and potential research directions were discussed to guide the future research.

- **Keywords:** construction safety management, bibliometric review, CiteSpace, emerging trends

Ahmet Yıldız, Sıdıka Kaya , Mesut Teleş & Cahit Korku. *The effect of nurses' empowerment perceptions on job safety behaviours: a research study in Turkey.* Pages: 489-496.

Objective. This study aimed to investigate the effect of nurses' empowerment perceptions on job safety behaviours. *Methods.* A survey of 377 nurses working in five hospitals in Turkey was conducted using the conditions of work effectiveness questionnaire, psychological empowerment instrument, universal precautions compliance scale and occupational health and safety obligations compliance scale. Relations between variables were tested using Pearson's correlation and path analysis. *Results.* There was a moderate and statistically significant relationship between psychological and structural empowerment and complying with universal safety measures and meeting occupational health and safety obligations. Also, an increase of 1 unit on the level of psychological empowerment was found to correspond to an increase of 0.37 units on the level of universal precautions compliance and to an increase of 0.46 units on the level of occupational health and safety obligations compliance. As such, an increase of 1 unit in structural empowerment corresponds to an increase of 0.53 units on the level of universal precautions compliance and to an increase of 0.36 units (total effect) on the level of occupational health and safety obligations compliance. *Conclusions.* The findings reveal that empowerment is a valuable tool for nurses' positive job safety behaviours.

- **Keywords:** nurses, empowerment, job safety, job safety behaviours

Jun Sik Kim & Byung Yong Jeong. *Human errors and occupational injuries of older female workers in residential healthcare facilities for the elderly.* Pages: 497-506.

This study aimed to describe the characteristics of occupational injuries of female workers in residential healthcare facilities for the elderly, and to analyze human errors as causes of accidents. From the national industrial accident compensation data, 506 female injuries were analyzed by age and occupation. The results showed that medical service worker was the most prevalent (54.1%), followed by social welfare worker (20.4%). Among injuries, 55.7% had <1 year of work experience and 37.9% were aged ≥ 60 years. Slips/falls were the most common type of accident (42.7%), and the proportion injured by slips/falls increases with age. Among human errors, action errors were the primary reasons, followed by perception errors and cognition errors. In addition, the ratios of injuries by perception errors and action errors increase with age. The findings of this study suggest that there is a need to design workplaces that accommodate the characteristics of older female workers.

- **Keywords:** occupational injury, human error, older female, residential healthcare facility

Iwan Muhamad Ramdan , Krishna Purnawan Candra & Alfiani Rahma Fitri. *Factors affecting musculoskeletal disorder prevalence among women weavers working with handlooms in Samarinda, Indonesia.* Pages: 507-513.

A cross-sectional study was conducted on 40 women weavers of Samarinda sarongs to identify the prevalence and risk factors of musculoskeletal disorders (MSDs). A Nordic body map, rapid upper limb assessment and anthropometric tools were used to plot the MSD severity, work posture and anthropometric dimensions of the weavers, respectively. The age, education background, working period and prolonged sitting position distributions of the weavers were collected by direct interview. Pearson's product-moment correlation was applied to identify correlations between the MSD prevalence and other parameters. An MSD prevalence of 80.5% was found among the women weavers, with the MSDs categorized as low, moderate and high in 15.0, 75.0 and 7.5% of the respondents, respectively. The MSD prevalence was significantly correlated with education background ($p = 0.025$), working period ($p = 0.015$), prolonged sitting hours ($p = 0.032$), work posture ($p < 0.001$) and weavers' anthropometry ($p < 0.001$).

- **Keywords:** Samarinda sarong, traditional loom, gedokan , work posture, working period, prolonged sitting hours, anthropometry, ergonomic

Katarzyna Misiurek & Bartosz Misiurek. *Improvement of the safety and quality of a workplace in the area of the construction industry with use of the 6S system.* Pages: 514-520.

This article presents the development of a standard approach to the improvement of workplace quality (5S system) with an additional 'S – Safety' step, creating an approach called the 6S system. The article describes a literature survey on the use of the standard 5S system in the construction sector and the 6S system in the manufacturing industry. On the basis of the performed analysis, the method of implementing the 6S system in the construction sector was proposed, while indicating how an additional 'S – Safety' step should be implemented. The method, which is presented in the article, was based on the Plan–Do–Check–Act cycle. In addition, the article also describes questionnaires for supporting the successful implementation of the 'S – Safety' step in the construction industry.

- **Keywords:** 6S system, 5S system, construction site, job safety, Lean Management, occupational safety

M. Hafizul Hilmi M. Noor & Raja Ariffin Raja Ghazilla. *Physical ergonomics awareness in an offshore processing platform among Malaysian oil and gas workers. Pages: 521-537.*

Introduction. The reliability of offshore oil and gas (O&G) facilities depends on the operation and maintenance activities, where human physical intervention is involved. Workers are often exposed to ergonomics hazards due to inefficient workplace design. Ergonomics awareness among workers is a crucial factor in mitigating such hazards. *Objectives.* This study intends to evaluate the state of physical ergonomics awareness among Malaysian O&G workers and to assess their perception toward the criticality of physical ergonomics issues within an offshore processing facility. *Methods.* Data were collected through online questionnaire distribution. The respondents were required to evaluate three sections of the questionnaire to reflect their state of physical ergonomics awareness: design criteria in an offshore workplace that are related to physical ergonomics; effects of physical ergonomics implementation in design; criticality of physical ergonomics issues. *Results.* The results showed a good level of physical ergonomics awareness among respondents without them being influenced by dissimilar experiences (engineering design and operation/maintenance) and the range of experience in an offshore workplace. *Conclusion.* This study provides an overview of Malaysian O&G workers' outlook toward the physical ergonomics issues in an offshore workplace. These data could be further analyzed in future as relevant aspects of designing an offshore facility.

- **Keywords:** oil and gas, offshore, processing equipment, physical ergonomics, ergonomics awareness, Malaysia

Xing Pan & Zekun Wu. *Performance shaping factors in the human error probability modification of human reliability analysis. Pages: 538-550.*

Human-induced accidents indicate the importance of human reliability analysis (HRA) in reducing and eliminating human errors, thus improving the reliability of human-machine systems. HRA takes both qualitative and quantitative approaches to determine the error of the operators and the contexts in which tasks are performed. To ensure that HRA results can objectively evaluate human error behaviors, the quantification of human error probability (HEP) is typically based on the qualitative analysis of human factors and task contexts and is further refined by performance shaping factors (PSFs). A good HEP process development includes the selection of PSFs, the evaluation of PSFs and the quantification strategy of HEP. A variety of HEP quantification analyses based on PSFs has been widely adopted in contemporary HRA studies. This work reviews three major quantification strategies used in HRA methods. Additionally, we generalize the modification of HEP with PSFs into a paradigm.

- **Keywords:** human error probability, human reliability analysis, task context, performance shaping factors

Zhongxiang Feng , Jingjing Zhan , Chuanlian Wang , Changxi Ma & Zhipeng Huang. *The association between musculoskeletal disorders and driver behaviors among professional drivers in China. Pages: 551-561.*

The main objective of this study is to explore correlations between the severity of musculoskeletal disorders (MSDs) and aberrant driving behaviors among professional taxi drivers. Questionnaires were administered to 162 taxi drivers in a Chinese city. Drivers with more severe MSDs reported more general and dangerous error behaviors and

negative moods. Interestingly, MSDs affect drivers' error behaviors through negative moods. The study also examined the effects of age, driving experience, traffic accidents, mood states, safety awareness and driving skills on aberrant driving behaviors. The results showed that age and driving experience were significant predictors of aberrant driving behaviors. Anger was a significant predictor of aggressive violations and dangerous errors. Additionally, drivers who reported higher levels of safety awareness also reported fewer aggressive violations, and drivers with higher levels of driving skills reported fewer dangerous error behaviors.

- **Keywords:** professional taxi drivers, musculoskeletal disorders, driver behaviors, driver skills, Roland–Morris disability questionnaire, profile of mood states

Syed Jamal Shah, Li Zhang, Salim Khan, Syed Asad Ali Shah, Dilawar Khan Durrani, Liaqat Ali & Bandana Das. *Terrorism vulnerability: organizations' ambiguous expectations and employees' conflicting priorities.* Pages: 562-572.

This study demonstrates how field employees' perceived threat of terrorism (PTT) is magnified by the incompatibility between role demand (travel and work outdoors) and resources (terrorism-endangered environment). With a foundation in the conservation of resources perspective and transactional theory of stress, a theoretical framework was proposed to test the mediating effect of role ambiguity (RA) and role conflict (RC) in the relationship between PTT and emotional exhaustion (EE). An approach involving confirmatory factor analysis and the structural equation was used for analysis. Data from 432 pharmaceutical sales representatives indicate a significant positive relationship between PTT and EE, while RA and RC significantly mediated the relationship. The findings are potentially useful for employers in charge of field employees in high-risk regions by explaining how such groups can be provided with support to reduce their role stress and exhaustion, leading ultimately to increased satisfaction.

- **Keywords:** emotional exhaustion, perceived threat of terrorism, role ambiguity, role conflict

Burak Efe, Mustafa Kurt & Ömer Faruk Efe. *Hazard analysis using a Bayesian network and linear programming.* Pages: 573-588.

In order to make a system safer, it is necessary to determine which hazard should be removed by considering the interactions of all hazards in the process. In this study, the influence of the hazards related to iron works in a construction firm is examined by Bayesian network approach. If only the most important hazard is identified and removed from the work environment, it may be erroneous to comment on the levels of the remaining hazards. A Bayesian network is proposed to remove this problem. If there is more time and budget than planned for a process, these capacities will have to be reduced in other processes. Linear programming is proposed to remove this problem. A strong decision support system has been established by combining a Bayesian network and linear programming. A construction firm application has been demonstrated using the proposed method.

- **Keywords:** Bayesian network, linear programming, hazard analysis, construction, occupational health and safety

Byungjoon B. J. Kim & Sunghan Kim. *Adaptation of perturbation to postural control in individuals with diabetic peripheral neuropathy.* Pages: 589-594.

Loss of sensation in the feet due to diabetic peripheral neuropathy can cause deterioration of postural control and result in higher risk of trips, slips or falls. In the literature, many studies have reported that people with diabetic peripheral neuropathy tend to show greater displacement of body sway than normal people when the base of support is disrupted. But not much is known about postural characteristics of diabetics with peripheral neuropathy at the moment of postural stability disruptions and during the time span for recovering stability. The objective of this study was to analyze differences of postural characteristics between diabetics with peripheral neuropathy and diabetics without peripheral neuropathy. A learning effect of perturbation was found for the diabetic peripheral neuropathy group in the posterior direction of perturbation during the first phase, which may indicate that it could be possible to design a postural control program for those people.

- **Keywords:** diabetic, peripheral neuropathy, posture control

Camilla Dahlqvist , Henrik Enquist , Lotta Löfqvist & Catarina Nordander. *The effect of two types of maximal voluntary contraction and two electrode positions in field recordings of forearm extensor muscle activity during hotel room cleaning.* Pages: 595-602.

Purpose. This study aimed to investigate the effects of using hand grip or resisted wrist extension as the reference contraction, and two electrode positions, on field recordings of forearm extensor muscle activity. *Materials and methods.* Right forearm extensor muscle activity was recorded using two electrode pairs (over the most prominent part (position 2) and proximal to that (position 1)) during one working day in 13 female hotel housekeepers. Each subject performed the two maximal voluntary contractions (MVCs), and the electrical activity obtained during these (maximal voluntary electrical activity (MVE)) was used for normalization. Each set of recordings was analysed twice, once using hand grip as the MVC and once using resisted wrist extension. *Results.* Resisted wrist extension showed a higher group mean MVE than hand grip. Position 2 had higher correlation between MVE and force during the MVCs. The workload during cleaning was lower when using resisted wrist extension as reference than when using hand grip (24%MVE vs 46%MVE; $p = 0.002$ at position 2) for the 90th percentile. The workload (99th percentile) was overestimated in two subjects when using hand grip as reference. *Conclusions.* Problems associated with poorly activated forearm extensors can be overcome by using resisted wrist extension as reference.

- **Keywords:** hand grip, power grip, resisted wrist extension, maximal voluntary contraction, maximal voluntary electrical activity, electromyography amplitude

Katarzyna Durniat. *Development and psychometric properties of the Polish basic version of the SDM questionnaire for measuring bullying.* Pages: 603-616.

Aim. This article presents the construction, validation and psychometric properties of the Polish basic version of a workplace bullying questionnaire (called the SDM questionnaire). *Method.* The tool was developed in phases, with reference to the international bullying literature and Polish socio-organizational background. The study from 2005/2006 ($N = 347$) established the structure of the scales' reliability, while the questionnaire's convergent validity was tested in 2018 ($N = 500$). Among the main statistical methods used were exploratory factor analyses, estimation of internal consistency with Cronbach's α and correlations analyses. *Results.* The main version of the SDM questionnaire comprises two consistent, correlating scales: the main behavioural scale (SDM-IDM scale, 43 items; Cronbach's $\alpha = 0.96$) used for diagnosing exposure to bullying behaviours; and an auxiliary emotional-cognitive scale (SDM-ODC scale, 21 items; Cronbach's $\alpha = 0.97$), which completes the psychological picture of bullying

interaction. Each of these scales may be divided into three, more specific, subscales. All of the SDM questionnaire scales positively correlate with the negative acts questionnaire – revised and with three self-report measures of job stressors. *Conclusion.* The SDM questionnaire is an accurate and reliable psychometric tool for measuring workplace bullying in Polish conditions.

- **Keywords:** workplace bullying/workplace mobbing, measurement methods, negative acts questionnaire – revised, SDM questionnaire, factorial structure, validity, reliability

Marcin Jachowicz & Grzegorz Owczarek. *Analysis of selected mechanical parameters for foamed materials with non-Newtonian liquid characteristics in terms of their use in aspects of protective helmets.* Pages: 617-623.

This article presents the results of measurements of mechanical parameters for foamed materials with non-Newtonian liquid characteristics (energy suppressed in the sample, force transferred to the anvil during the dynamic tests). In dynamic studies, the following characteristics were determined: the pressure forces exerted on the anvil as a function of the sample deflection during the impact, the energy suppressed in the sample depending on the temperature and the energy suppressed in the sample depending on the sample density. Foamed materials with non-Newtonian characteristics are currently used as elements protecting against impacts. Such materials have been used for the first time in protective helmets, and in particular in those designed for workplace applications.

- **Keywords:** foamed materials with non-Newtonian liquid characteristics, head protection, protective helmets

Rajitha Kawshalya Mailan Arachchige Don , Joon-Sig Jung , Yun-Jin Lee & Seung-Cheol Hong. *ELF-MF occupational exposure in die-casting and electroplating workers in Korea.* Pages: 624-631.

A 24-h exposure assessment was performed in two groups of blue-collar workers from a die-casting plant and an electroplating plant to investigate levels of exposure to extremely low-frequency magnetic fields (ELF-MFs), using an EMDEX Lite (Enertech, USA) dosimeter. ELF-MF exposure of workers from the die-casting plant (arithmetic $M \pm SD$ $0.649 \pm 1.343 \mu T$) is higher than in electroplating workers ($0.138 \pm 0.045 \mu T$). Higher ELF-MF exposure occurred among workers living in the same building as their workplace compared with that among other workers. This study suggests that ELF-MF exposure levels should be taken into consideration when providing dormitories for workers to minimize levels of residential ELF-MF exposure due to emissions from industrial plants. The study recommends that blue-collar workers should be made aware of measures to minimize their exposure to environmental agents such as ELF-MFs and electromagnetic fields during work, such as maintaining a safe distance between machines and avoiding undesirable behavior with equipment.

- **Keywords:** blue-collar workers, extremely low-frequency magnetic fields, industrial exposure assessment, residential exposure

Alireza Besharati, Hadi Daneshmandi, Khodabakhsh Zareh, Anahita Fakherpour & Mojgan Zoaktafi. *Work-related musculoskeletal problems and associated factors among office workers.* Pages: 632-638.

Purpose. The aim of this study was to investigate musculoskeletal disorders (MSDs) and associated factors among Iranian office personnel. *Materials and methods.* In this cross-sectional study, 359 Iranian office workers were included. Data were gathered using a

demographic questionnaire, the Nordic musculoskeletal questionnaire, the numeric rating scale, rapid office strain assessment (ROSA) and the NASA task load index (NASA-TLX). *Results.* Our findings showed that the highest prevalence rate of MSDs within the last 12 months and the highest pain/discomfort severity were related to the participants' necks. The mean performance, mental demand and effort subscale scores of the NASA-TLX were higher than other subscales (physical demand, temporal demand and frustration level). ROSA scores showed that 53.8% of the participants were in action level 1 (low MSD risk) and the rest (46.2%) were in action level 2 (high MSD risk). The pain/discomfort severity in the shoulders, elbows, wrists/hands, thighs and ankles/feet was correlated to the final ROSA score. Age, gender, body mass index and some NASA-TLX subscales (effort, mental demand and performance) were associated with symptoms of MSDs in different body regions. *Conclusions.* Improving workplace conditions (both mentally and physically) is suggested for reducing and eliminating musculoskeletal problems among office workers.

- **Keywords:** musculoskeletal disorders, NASA task load index, office workers, pain, rapid office strain assessment