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Dae-Min Kim & Yong-Ku Kong. *Evaluation of pliers' grip spans in the maximum gripping task and sub-maximum cutting task.* Pages 449-456.

A total of 25 males participated to investigate the effects of the grip spans of pliers on the total grip force, individual finger forces and muscle activities in the maximum gripping task and wire-cutting tasks. In the maximum gripping task, results showed that the 50-mm grip span had significantly higher total grip strength than the other grip spans. In the cutting task, the 50-mm grip span also showed significantly higher grip strength than the 65-mm and 80-mm grip spans, whereas the muscle activities showed a higher value at 80-mm grip span. The ratios of cutting force to maximum grip strength were also investigated. Ratios of 30.3%, 31.3% and 41.3% were obtained by grip spans of 50-mm, 65-mm, and 80-mm, respectively. Thus, the 50-mm grip span for pliers might be recommended to provide maximum exertion in gripping tasks, as well as lower maximum-cutting force ratios in the cutting tasks.

- **Keywords:** grip span, two-handle type hand tools, maximum gripping task, cutting task

Alpaslan Turkkan & Kayihan Pala. *Trends in occupational injuries and fatality in Turkey.* Pages 457-462.

Introduction. The aim of this study was to evaluate the trend of occupational injuries in Turkey using epidemiologic criteria such as incidence mortality and fatality/all injuries recorded – rates. **Materials and methods.** Safety and health data were obtained from the Annual Statistic Books of the Social Insurance Institution (1988–2006) and Social Security Institution (2007–2011) of Turkey. **Results.** The results from the official data showed that although total employment is increasing the number of occupational injuries and incidence and mortality rates are decreasing. The results also demonstrate that occupational fatality/all injuries recorded – rate is increasing. The fatality/all injuries recorded – rate per 1000 injuries increased to 25.5 in 2011 from 8.6 in 1988. Each work day an average of five people died because of occupational injuries. **Discussion and conclusions.** The fatality/all injuries recorded – rate (the number of fatal cases per 1000 occupational injuries) is an important indicator of the injury rate for a country. Systems of occupational injury and illness surveillance constitute a critical resource for the management and reduction of occupational injuries and illness.

- **Keywords:** occupational injuries, occupational accidents, mortality, fatality, safety and health at work

Tomasz Tokarski & Danuta Roman-Liu. *Influence of disability type on upper-limb motor skills*. Pages 463-472.

This study was carried out in order to determine the effect of physical disability (paraplegia) and sensory disability (deafness) on motor skills of the upper limbs. Studies were distinguished by two parameters: the nature of the control curve (sine or random) and the magnitude of the isometric force exerted on the lever (10 N, 20 N, 40 N, 80 N). A comparison of the quality of manual force control in a visual detection task among groups of people with sensory disability (deaf), people with physical disability (paraplegic) and people without disability showed differences among those groups. Values of force above 20 N create conditions of lower quality of control and of direction of force exertion outside the body. At the same time, the study proved that people with some types of disability can perform certain work tasks as effectively as people without disability.

- **Keywords:** accuracy, precision, steering, disabled, deaf, paraplegic

Javid Manzoor, Mamta, Rayavarapu Jaganadha Rao & Khursheed Ahmad Wani. *Health impact and noise exposure assessment in the cricket bat industry of Kashmir, India*. Pages 473-478.

Aim. The aim of the present study was to identify and evaluate predominant noise sources in the cricket bat industry of Kashmir, India. **Methods.** Sound levels were measured at operator's ear level in the working zone of the workers of seven cricket bat factories. The impact assessment was made through personal interviews with each worker separately during their period of rest. **Results.** On average, 62.5% of the workers reported difficulty in hearing and 24.1% of the workers have become patients for hypertension. Only 58.1% of the workers complained of headache due to high noise level. **Conclusions.** The workers engaged in the cricket bat industry of Kashmir are exposed to high noise levels. It is suggested that personal protective equipment like ear plugs and ear muffs be used by these workers as a protection against this hazard.

- **Keywords:** noise, workers, health, protection, Kashmir

Dejan Bogdanović, Vladimir Stanković, Snežana Urošević & Miloš Stojanović. *Multicriteria ranking of workplaces regarding working conditions in a mining company*. Pages 479-486.

Ranking of workplaces with respect to working conditions is very significant for each company. It indicates the positions where employees are most exposed to adverse effects resulting from the working environment, which endangers their health. This article presents the results obtained for 12 different production workplaces in the copper mining and smelting complex RTB Bor - 'Veliki Krivelj' open pit, based on six parameters measured regularly which defined the following working environment conditions: air temperature, light, noise, dustiness, chemical hazards and vibrations. The ranking of workplaces has been performed by PROMETHEE/GAIA. Additional optimization of workplaces is done by PROMETHEE V with the given limits related to maximum permitted values for working environment parameters. The obtained results indicate that the most difficult workplace is on the excavation location (excavator operator). This method can be successfully used for solving similar kinds of problems, in order to improve working conditions.

- **Keywords:** workplace, working conditions, ranking, PROMETHEE/GAIA

Ashtekar Shirish, Vishal Kapadia, Sanjeev Kumar, Sunil Kumar, Sukhdev Mishra & Gyanendra Singh. *Effectiveness of a cooling jacket with reference to physiological responses in iron foundry workers.* Pages 487-493.

Personal cooling garments (PCGs) have gained increased attention in recent years due to heat stress and strain in the working environment. The present study was conducted in hot environments of an iron foundry to evaluate the efficacy of a battery-operated PCG. Twenty-four workers were exposed to climatic conditions of 35.89 ± 1.25 °C, 35% relative humidity during 90-min work with PCG and habitual clothing (HC). Mean weighted skin temperature was significantly lower by 4.84 ± 1.05 °C compared with HC 0.38 ± 1.02 °C ($p < 0.05$). A statistically significant difference was also observed for 0.492 ± 0.26 g mean sweat loss in the PCG group compared with 0.775 ± 0.42 g in the HC group ($p < 0.05$). Heart rate, and back and chest skin temperatures were comparatively more reduced in the PCG group compared with the HC group. PCG provides a practical and economical way of alleviating the physiological effects of heat stress when environmental control is not feasible.

- **Keywords:** cooling suit, heat stress, physiological strain

Elżbieta Łastowiecka-Moras & Eliza Kozyra-Pydyś. *Changes in the central and peripheral circulatory system in response to the cold: own studies using impedance plethysmography and Doppler ultrasound.* Pages 494-500.

The aim of the study was to determine the cardiovascular response to continuous (4 °C for 60 min) and intermittent (10 min at 4 °C and 10 min at room temperature alternately) exposure to the cold in 30 healthy young men. The subjects were equipped with a set of identical clothing (insulation 2.1 clo) and during the stay in the chamber and outside performed the same activities, i.e., walking on a treadmill at a speed of 0.5 km/h. The tests included assessing the central circulatory system using the Holter system and assessing the peripheral circulatory system using impedance plethysmography and Doppler ultrasound. The analysis of the parameters that describe the central and peripheral circulation poses a difficulty in determining which variant of exposure constitutes a greater load on the circulatory system. It should be noted that even the conditions used in the study may cause adverse effects in the cardiovascular system.

- **Keywords:** cold environment, continuous exposure, intermittent exposure, peripheral blood circulation, central circulation, impedance plethysmography, Doppler ultrasound

Elżbieta Łastowiecka-Moras, Joanna Bugajska & Ireneusz Jurczak. *Changes in the peripheral blood flow in legs in response to the cold: own studies using plethysmography.* Pages 501-507.

The thermal environment in the workplace is an important factor which affects workers' health. During 2011 in Poland, 14,781 workers were exposed to a cold working environment, i.e., 3.8% of persons employed in hazardous work conditions. The aim of this study was to determine the cardiovascular response to continuous (4 °C for 60 min) and intermittent (10 min at 4 °C and 10 min at room temperature alternately) exposure to the cold in 30 healthy men aged 20–27 years. Peripheral blood flow was assessed with impedance plethysmography. Heart rate and arterial blood pressure were monitored with the Holter system. Having assessed the results, it is difficult to say which kind of exposure has a more severe impact on the cardiovascular system. Longer observation and a more detailed analysis would be necessary (e.g., Doppler echocardiography).

- **Keywords:** cold environment, continuous exposure, intermittent exposure, peripheral blood flow, impedance plethysmography

Jewelle Ann Santos & Jinky Leilanie Lu. *Occupational safety conditions of bus drivers in Metro Manila, the Philippines.* Pages 508-51.

The study looks into the occupational safety and working conditions among bus drivers in Metro Manila, the Philippines. Quantitative data were collected through survey interviews of 95 bus drivers using the stratified sampling technique. Results showed that bus drivers worked an average of 16 h/day and were engaged in risky driving behaviors such as over-speeding and road racing in order to reach their quota for the day. Fifty-nine percent experienced work-related accidents, with a mean of three accidents. The most common accident was hitting another vehicle followed by side swipe. The accidents were blamed on other drivers, followed by vehicle defect, inattentiveness and tiredness/micro-sleep or sudden involuntary sleep while driving. The most common health symptoms experienced by the bus drivers were fatigue, back pain, and cough and colds. This study underlines the need for an occupational health and safety program for bus drivers in the Philippines.

- **Keywords:** occupational health and safety, bus drivers, bus-related accidents, long working hours

Ivan Macuzic, Eva Giagloglou, Marko Djapan, Petar Todorovic & Branislav Jeremic. *Occupational safety and health education under the lifelong learning framework in Serbia.* Pages 514-522.

Serbia is aligning with European Union requirements and the occupational safety and health (OSH) administration is one of the most representative sectors of this alignment. Many efforts were made in this field, by introducing new laws and regulations, but it turned out to be insufficient. OSH professionals need to renovate and strengthen their knowledge in accordance with continuous, updated and improved OSH standards and regulation. Lifelong learning (LLL) programmes can contribute to forming professionals who are always up to date. This paper presents an implemented LLL programme, over the duration of two academic years, dedicated to OSH professionals, and investigates whether this programme will be helpful and accepted by professionals. The results from the study show that the given LLL programme had indeed a positive influence on the professional careers of the participants and that the LLL presents the future trend in OSH education.

- **Keywords:** occupational safety and health, lifelong learning, development, andragogy, EU alignment

Ewa Beck-Krala & Katarzyna Klimkiewicz. *Occupational safety and health as an element of a complex compensation system evaluation within an organization.* Pages 523-531.

Occupational safety and health (OSH) plays a significant role in today's organizations, because it helps in attracting and retaining employees as well as molding their attitudes and behaviors at work. This is why the issue of OSH is stressed in a comprehensive approach to employee rewards: the total reward concept. This article explains how OSH may be included in a complex evaluation process of the compensation system. Although the literature on the effectiveness of employee compensation refers mainly to financial and non-financial components, there is a need for inclusion of working conditions in such analyses. An evaluation of the compensation system that incorporates OSH can drive many benefits for both the organization and employees. Obtaining such benefits, however, requires systematic evaluation of the reward system, including OSH.

Incorporation of OSH issue within the comprehensive analysis of compensation systems promotes responsible behavior of all stakeholders.

- **Keywords:** occupational safety and health evaluation, compensation evaluation model, supportive working environment

Ahmad Bahoo Toroody, Mohammad Mahdy Abaei & Reza Gholamnia. *Conceptual compression discussion on a multi-linear (FTA) and systematic (FRAM) method in an offshore operation's accident modeling.* Pages 532-540.

Risk assessment can be classified into two broad categories: traditional and modern. This paper is aimed at contrasting the functional resonance analysis method (FRAM) as a modern approach with the fault tree analysis (FTA) as a traditional method, regarding assessing the risks of a complex system. Applied methodology by which the risk assessment is carried out, is presented in each approach. Also, FRAM network is executed with regard to nonlinear interaction of human and organizational levels to assess the safety of technological systems. The methodology is implemented for lifting structures deep offshore. The main finding of this paper is that the combined application of FTA and FRAM during risk assessment, could provide complementary perspectives and may contribute to a more comprehensive understanding of an incident. Finally, it is shown that coupling a FRAM network with a suitable quantitative method will result in a plausible outcome for a predefined accident scenario.

- **Keywords:** risk assessment, human error, risk FRAM network, lifting support

Raúl Aguilar-Elena, Alberto Campo-Barrio, Rodrigo Morchón & Víctor Martínez-Merino. *Validation of a questionnaire about the perception of occupational biohazard in Spanish companies.* Pages 541-549.

Objectives. The aim of this work was to develop, validate and test a new questionnaire to assess the biological risk in workers with intentional or unintentional exposure to biological agents. **Methods.** A questionnaire including 34 questions was developed to study the perception of workers against occupational biohazard. Content Validity Index (CVI) and Content Validity Ratio (CVR) were calculated for the analysis of content validity. A pilot study was carried out with 60 workers from 17 companies performing analysis of Cronbach's α to assess the internal consistency or reliability. **Results.** A total of 518 workers from 51 Spanish companies in which there is exposure to biological agents participated in the study yielding a response rate of 90%. The final questionnaire obtained a Cronbach's $\alpha > 0.759$ with a stable test-retest result. The questionnaire validation demonstrates that it could be used to evaluate the biological risks and help the prevention of occupational accidents and diseases. **Discussion.** This study has validated the need to evaluate worker's perception against occupational risks, as well as the application of prevention methods and protective equipment. It is a first step towards developing an occupational biohazards assessment method including all the requirements set by the European Health and Safety Strategy 2013–2020.

- **Keywords:** biological agents, risk assessment, validation, questionnaire, health and safety

Michael Decker, Kellie A. Gomas, Steven J. Narvy & C. Thomas Vangsness. *The influence of a dynamic elastic garment on musculoskeletal and respiratory wellness in computer users.* Pages 550-556.

Background. Evidence is growing that computer users are at increased risk of developing musculoskeletal disorders, particularly those involving the upper extremity, with significant financial cost and lost productivity. Objective. The purpose of this study was to determine the short-term effects of wearing a dynamic elastic garment (Posture Shirt; AlignMed, USA) on musculoskeletal wellness and health in the computer workplace. Methods. Ninety-six computer users were evaluated. The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire was completed. A functional assessment of posture, lung function, and grip strength was performed after wearing the Posture Shirt for 4 weeks. A training log was kept to track usage of the garment, as well as weekly sensations of fatigue, productivity, and energy level. Results. After 4 weeks, there was statistically significant improvement in forward shoulder and head posture, thoracic kyphosis, and grip strength. Improvements in spirometry measures did not meet statistical significance. Postural fatigue and muscular fatigue decreased by 21% and 29%, respectively, and energy level and productivity increased by 20% and 13%, respectively. Conclusion. This prospective study demonstrated positive short-term impact of the Posture Shirt on both subjective and objective measures of posture, lung function, grip strength, fatigue, and productivity.

- **Keywords:** feedback, posture, workplace ergonomics

Aurélien Lux, Johann Mawo De Bikond, Alain Etienne & Edwige Quillerou-Grivot. *FMEA and consideration of real work situations for safer design of production systems.* Pages 557-564.

Production equipment designers must ensure the health and safety of future users; in this regard, they augment requirements for standardizing and controlling operator work. This contrasts with the ergonomic view of the activity, which recommends leaving operators leeway (margins for manoeuvre) in performing their task, while safeguarding their health. Following a brief analysis of design practices in the car industry, we detail how the Failure Modes and Effects Analysis (FMEA) approach is implemented in this sector. We then suggest an adaptation that enables designers to consider real work situations. This new protocol, namely, work situation FMEA, allows experience feedback to be used to defend the health standpoint during designer project reviews, which usually only address quality and performance issues. We subsequently illustrate the advantage of this approach using two examples of work situations at car parts manufacturers: the first from the literature and the second from an in-company industrial project.

- **Keywords:** design, ergonomics, FMEA, work situations, margins for manoeuvre

Hamidreza Babaei, Mohsen Razeghi, Alireza Choobineh, Hamidreza Pakshir, Abdolreza Rajaeifard & Jafar Rezaian. *A new method for calculating saddle seat height with an emphasis on optimal posture based on trigonometric relations.* Pages 565-571.

Introduction. Based on the literature, the ergonomic saddle chair provides the most appropriate posture for users. Determination of the seat height is critical to establish the proper posture, carried out using various methods of anthropometry. This study aimed to develop a simple and applied method for determining the saddle seat height with an emphasis on appropriate posture. **Methods.** In this study, anthropometric dimensions including weight, body height, popliteal height and seat height at 135° knee angle in 150 male and female dentists were measured. In the laboratory, to determine the 'acetabuloischial number', 25 male and female natural hip bones were measured. The mean saddle-chair height with knee angle of 135° was then compared by two different methods, field measurement and the new calculation method. **Results.** The results showed a strong correlation between data gathered from the two different methods, the field measurement and the new calculation method (98%), and Cronbach's α from the

intraclass correlation was equal to 0.994 ($p < 0.05$). This indicated that the two methods produced similar results. **Conclusion.** The new method can be applied to calculate the optimal height of the saddle seat based on body height and popliteal height.

- **Keywords:** anthropometry, acetabuloischial, ergonomics, saddle seat, height determination

Pooja Tawde, Rachana Dabadghav, Nilima Bedekar, Ashok Shyam & Parag Sancheti. *Assessment of cervical range of motion, cervical core strength and scapular dyskinesia in violin players.* Pages 572-576.

Background. Playing the violin can lead to asymmetric postures which can affect the cervical range of motion, cervical core strength and scapular stability. **Objective.** The objective of the study was to assess the cervical range of motion, cervical core strength and scapular dyskinesia in violin players and non-players of the same age group. **Methods.** An inclinometer was used to assess the cervical range of motion, pressure biofeedback was used to assess cervical core strength and scapular dyskinesia was also assessed in 30 professional violin players (18–40 years) compared with 30 age-matched non-players. Analysis was done using an unpaired t test. **Results.** Significant change was seen with respect to extension ($p = 0.051$), cervical core strength ($p = 0.005$), right (Rt) superior angle 0° ($p = 0.004$), Rt superior angle 45° ($p = 0.015$) and Rt inferior angle 90° ($p = 0.013$). **Conclusion.** This study shows a significant difference in extension range of motion and cervical core strength of violin players. Also, there was scapular dyskinesia seen at 0° and 45° right-side superior angle of the scapula and 90° right-side inferior angle of the scapula.

- **Keywords:** violin players, cervical range of motion, cervical core strength, scapular dyskinesia

Roman Broszkiewicz. *Affluence, occupational safety and ergonomics: are they interdependent?* Pages 577-579.

The number of fatal occupational injuries (FOI), the number of scientific publications in ergonomics (SP) and the gross domestic product (GDP) of 30 countries were investigated for their mutual dependence. This article shows that, although the ratio of FOI/SP decreases exponentially with a linear increase in the GDP, GDP may be only one of the major influencing factors.

- **Keywords:** fatal occupational injuries, gross domestic product, scientific publications

Kaitlin M. Gallagher & Jack P. Callaghan. *Influence of an oblique path of staircase descent on toe placement and foot clearance.* Pages 580-586.

During their commute, pedestrians encounter a variety of staircase designs. One such design is the oblique staircase that allows pedestrians to descend at an angle. The purpose of this study was to assess the influence of an oblique path of descent on heel and toe clearance, and toe placement on a step. Sixteen participants descended a staircase on an angled path at three angles: 0° (perpendicular), 25° , and 45° . Toe placement and foot clearances were compared between the descent angles and feet. An increase in descent angle demonstrated increased clearance of the heel apex compared with straight descent; however, the aspect of the foot closest to the stair changes in angled descent, moving from the apex to the side of the heel. A greater portion of the foot was placed on the stair tread during angled descent. Future work should address the influence of angled descent on fall risk.

- **Keywords:** safety, asymmetry, geometry, adaptation, falls, locomotion