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PROTECTION OF HUMAN IN THE WORKING ENVIRONMENT

Brian N. Craig, Jerome J. Congleton, Eric Beier, Carter J. Kerk, Alfred A. Amendola & William G. Gaines. Occupational Risk Factors and Back Injury. S. 335-345.

Twenty-one risk factors affecting laborers in manual materials handling tasks were analyzed to determine what, if any, statistically significant relationships existed between the factors and the emergence of occupational back injury. The statistically significant risk factors ($p \leq .05$) in the univariate analysis were determined to be weight lifted per hour (work intensity), trunk twists per hour, weight lifted per day, frequency of lift, trunk motions per hour, and trunk flexions per hour, with odds ratios (ORs) of 1.28–2.88. In addition, self-reported discomfort in the neck, middle back, knees, and lower back was associated with the outcome of back injury ($p \leq .05$, OR = 1.75–2.66). In the multivariate analysis, the statistically significant risk factors ($p \leq .05$) were weight lifted per hour (work intensity), average weight of lift, and number of trunk twists per hour, with ORs of 1.74–4.98.

Khalid Al-Saleh & Salaheddine Bendak. An Ergonomics Evaluation of Certain ATM Dimensions. S. 347-353.

Although millions of automatic teller machines (ATMs) are currently used all over the world, users of ATMs still have usability problems including inappropriate user-ATM interaction, display problems and others. Many developed countries already have standards in place for ATMs. However, this is not the case in many other countries. This paper aims to assess certain dimensions of ATM machines and their suitability for users in Middle Eastern countries using anthropometric measurements of the user population taking Saudi Arabia as a case study. Dimensions of all ATMs used in Saudi Arabia were measured and compared with recommended dimensions based on anthropometric measurements of the user population. Results show that there is a mismatch between the dimensions of ATMs used in Saudi Arabia and the recommended dimensions based on the user population. Practical recommendations are given as to improve the usability of ATMs in Saudi Arabia and other Middle Eastern countries.

Krisada Asawarungsaengkul & Suebsak Nanthavani. *On Evaluation and Localization of Auditory Warning Devices for Adequate Audibility.* S. 355-369.

This paper presents an analytic procedure to assist safety practitioners in evaluating the audibility of an existing auditory warning system in their workplaces. Two alarm location models are described: (a) a model with an unknown signal sound level, and (b) a model with a known signal sound level. A heuristic algorithm to determine a minimum number of alarm devices and their locations so that the warning signals can be clearly heard by workers is also proposed. The algorithm considers the ambient noise level, noise levels generated by individual machines, locations where workers are likely to be present, and noise levels at worker locations. From the numerical examples and the computation experiment, both the optimization and heuristic approaches yield solutions that satisfy the 15-dBA constraints. The heuristic approach is efficient in solving large alarm location problems due its capability to find near-optimal solutions within reasonable computation time.

Iwona Komorska. *A Vibroacoustic Diagnostic System as an Element Improving Road Transport Safety.* S. 371-385.

Mechanical defects of a vehicle driving system can be dangerous on the road. Diagnostic systems, which monitor operations of electric and electronic elements and devices of vehicles, are continuously developed and improved, while defects of mechanical systems are still not managed properly. This article proposes supplementing existing on-board diagnostics with a system of diagnosing selected defects to minimize their impact. It presents a method of diagnosing mechanical defects of the engine, gearbox and other elements of the driving system on the basis of a model of the vibration signal obtained adaptively. This method is suitable for engine valves, engine head gasket, main gearbox, joints, etc.

Katarzyna Majchrzycka, Agnieszka Brochocka, Anna Łuczak & Krzysztof Łężak. *Ergonomics Assessment of Composite Ballistic Inserts for Bullet-and Fragment-Proof Vests.* S. 387-396.

Personal protective equipment worn by uniformed services (e.g., the police and the military) must ensure protection against bodily injuries. However, a high degree of protection is always associated with significant discomfort. This article presents the results of an assessment of the ergonomics parameters of new specialpurpose products, ballistic inserts with improved ballistic resistance, and an assessment of the impact of the burden related to their use on the psychomotor performance of the subjects. An obstacle course and subjective ergonomics assessment questionnaires were used in tests. Thermal discomfort was also assessed. Psychological testing included tests enabling an assessment of the subjects' cognitive and psychomotor performance, and a subjective assessment of mental load. The tests did not show any decrease in the comfort of use of the new inserts with improved ballistic resistance compared to the inserts currently used.

Dohyung Kee, Seokhee Na & Min K. Chung. *Effect of External Load at Varying Hand Positions on Perceived Discomfort.* S. 397-408.

The purpose of this study was to assess the effect of external load at varying hand positions on discomfort, and to provide a new classification of external load. An experiment was carried out in which 16 postures with an external load of 0, 1.5, 3 kg were tested. The postures were controlled by 2 independent variables of hand distance and hand height. The subjects were instructed to rate their perceived discomfort with magnitude estimation after holding a given posture for 1 min. Analysis of variance (ANOVA) exhibited that the main effects of the 3 independent variables were statistically

significant for discomfort. Discomfort increased linearly with external load and hand distance. Hand height showed a quadratic relation with discomfort, which exhibited a slightly different trend from hand distance and external load. Based on the results, a new classification of external load was proposed with 3 classes grouped by perceived discomfort.

Karolina Pawłowska-Cyprysiak & Maria Konarska. *Working Life of Women With Disabilities—A Review.* S. 409-414.

The aim of this study was to present the situation of women with disabilities on the labour market. Women with disabilities suffer from social and professional discrimination. They are discriminated because of their gender and disability. The Q1 Labour Force Participation Study (2013) showed that, in Poland, labour force participation for men and women with disabilities was 29.4% and 14.7%, respectively, while the unemployment rate was 16.1% for men and 17.2% for women. Quarterly information on employment, unemployment and economic inactivity was gathered from a Labour Force Survey in the first quarter of 2013; data from the Ministry of Labour and Social Policy were also included. The participants of the survey were 15 years old or older; they were members of a sample household. The methodology was based on definitions recommended by the International Labour Office and Eurostat. It is important that women with disabilities are substantially less professionally active, while the unemployment rate for them is only slightly higher.

PROTECTION OF HUMAN AT THE WORKSTATION

Kristina M. Gruievski, Colin D. McKinnon, Clark R. Dickerson & Jack P. Callaghan. *The Impact of Mobile Data Terminal Use on Posture and Low-Back Discomfort When Combined With Simulated Prolonged Driving in Police Cruisers.* S. 415-422.

The introduction of mobile computing within a constrained vehicle environment has led to changes in the task demands of occupational groups such as professional drivers and law enforcement officers. The purpose of this study was to examine how mobile data terminal (MDT) use interacts with prolonged driving to induce postural changes or low-back discomfort. Eighteen participants (9 male, 9 female) completed two 120-min simulated driving sessions. Time-varying lumbar spine and pelvis postures, seat pan interface pressures and ratings of perceived discomfort were recorded at 15-min intervals. The introduction of a computer interface decreased pelvic posterior rotation by an average of 15° with respect to upright standing and increased peak average discomfort in the neck (5.9 mm), left shoulder (6.8 mm), midback (10.9 mm), low back (10.6 mm) and pelvis (11.5 mm) compared to driving alone. The incorporation of mobile computing warrants consideration in the design of vehicle work environments.

Jesús A. Carrillo-Castrillo, Juan C. Rubio-Romero & Luis Onieva. *Causation of Severe and Fatal Accidents in the Manufacturing Sector.* S. 423-434.

The main purpose of this paper is to identify the most frequent causes of accidents in the manufacturing sector in Andalusia, Spain, to help safety practitioners in the task of prioritizing preventive actions. Official accident investigation reports are analyzed. A causation pattern is identified with the proportion of causes of each of the different possible groups of causes. We found evidence of a differential causation between slight and nonslight accidents. We have also found significant differences in accident causation depending on the mechanism of the accident. These results can be used to prioritize preventive actions to combat the most likely causes of each accident mechanism. We have also done research on the associations of certain latent causes with specific active

(immediate) causes. These relationships show how organizational and safety management can contribute to the prevention of active failures.

Yanhong Gong, Jincong Yu, Xiaochang Zhang & Yuan Liang. *Occupational Safety and Health Status of Sanitation Workers in Urban Areas: A Pilot Study From Wuhan, China.* S. 435-442.

Sanitation workers' workload increases quickly with rapid urbanization, but there is almost no evidence or policy recommendations for their management in developing countries. This study describes the health status and occupational protection of sanitation workers; it also explores risk factors related to their health status in Wuhan City, China. Three hundred and eighty-five sanitation workers from 54 streets of Wuhan were surveyed. Their prevalence of 2-week illness and arthritis was relatively higher than in the general population in China. Findings related to occupational protection showed that both sanitation workers (users) and their managers (providers) neglected the role of low-cost protection measures, especially masks, soap/hand sanitizer and prejob training (use rate of 7.27%, 26.75% and 43.64%, respectively). High-intensity workload was an important risk factor for 2-week illness, and prejob training was an important protective factor against arthritis.

Magdalena Zwolińska & Anna Bohdan. *Thermal Sensations of Surgeons During Work in Surgical Gowns.* S. 443-453.

Standards for surgical procedures and medical clothing, designed for use in the operating theatre, have been gradually developed with the progress in science and technology. Standard No. EN 13795:2011, determining the requirements concerning materials for production of surgical gowns, was introduced in 2003. It concerns, e.g., resistance to microbial penetration. Little attention is given to thermal comfort, even though it is well known that thermal discomfort can have an adverse effect on the quality and efficiency of work. During a real-life test and laboratory tests, 2 male surgeons and 8 male volunteers were asked to describe their subjective sensations before and after work. The results of the real-life test and the laboratory tests are comparable. They show a clear lack of thermal comfort when medical clothing designed for the operating theatre is used.

Subhashis Sahu, Subhabrata Moitra, Santigopal Maity, Asis K. Pandit & Biswajit Roy. *A Comparative Ergonomics Postural Assessment of Potters and Sculptors in the Unorganized Sector in West Bengal, India.* S. 455-462.

Potters and sculptors perform their work in very awkward postures. The purpose of this study was to analyse these postures. The modified Nordic questionnaire was used to analyse musculoskeletal discomfort. Rapid entire body assessment (REBA) and rapid upper limb assessment (RULA) were used to evaluate the subjects' postures. There were no significant differences between times of discomfort and the group of subjects. However, there were significant differences in discomfort in different body parts. The analysis indicated that various body postures were harmful to the subjects and that there were profound deviations from natural curvature of various body parts due to awkward body postures. Ergonomics intervention was required to improve the quality of life.

Ingegerd Skoglind-Öhman & Seppo Väyrynen. *Team-Based Risk Assessment and Action Plans as Participatory Methods for Safe Patient Handling in Two Swedish Municipal Care Homes for the Elderly.* S. 463-474.

Objective. We investigated the usefulness of a team-based risk assessment method in patient transfer situations in municipal care homes for the elderly. Methods. Evaluation of

risk assessment and action plans carried out in 2009. Focus group interviews with care givers and one-to-one interviews with managers and occupational therapists. Results. The evaluation showed that action plans and interventions were developed for each resident with identified risk connected with movement/transfer in daily life. Twenty-six patients (28%) of a total number of 94 were assigned to the "no risk" category regarding movement/transfer situations in daily life. The other 68 patients (72%) required further interventions, which were documented in action plans. The interviews indicated that the approach of team-based risk assessment and action plans was perceived as a functional participatory method aiming to improve daily life and work. Conclusion. Systematic team-based risk assessment and action plans benefit staff as well as residents at care homes for the elderly.

Majid Motemedzade. *Ergonomics Intervention in an Iranian Tire Manufacturing Industry.* S. 475-484.

The aim of an ergonomics intervention conducted in the tire manufacturing industry was to improve working conditions. Before the start, a senior manager supported the intervention. Participants were divided into teams and trained. After observing the overall performance of the teams, over 100 improvements were successfully implemented. After the improvements, there were statistically significant differences in annual and weekly prevalence of, and annual disability reported for, the upper back, the lower back, knees and wrists between before and after intervention. The annual prevalence of upper back, lower back, knee and wrist complaints decreased from, respectively, 60.3%, 50.2%, 28.9%, 25.8% before the intervention to 31.3%, 35.9%, 17.1%, 20.7% after the intervention. Significant factors were training and supportive environment based on full commitment of the top management.

Achim Elfering Veronique Ruppen & Simone Grebner. *Learning to Drive: Learners' Self-Reported Cognitive Failure Level Predicts Driving Instructor's Observation Rating of Driving Performance.* S. 485-491.

Objectives. Evidence increases that cognitive failure may be used to screen for drivers at risk. Until now, most studies have relied on driving learners. This exploratory pilot study examines self-report of cognitive failure in driving beginners and error during real driving as observed by driving instructors. Methods. Forty-two driving learners of 14 driving instructors filled out a work-related cognitive failure questionnaire. Driving instructors observed driving errors during the next driving lesson. In multiple linear regression analysis, driving errors were regressed on cognitive failure with the number of driving lessons as an estimator of driving experience controlled. Results. Higher cognitive failure predicted more driving errors ($p < .01$) when age, gender and driving experience were controlled in analysis. Conclusions. Cognitive failure was significantly associated with observed driving errors. Systematic research on cognitive failure in driving beginners is recommended.