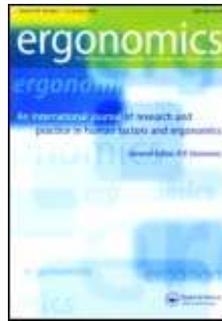


## **Ergonomics– rok 2007, ročník 50**

### **Číslo 3**



#### **Joanne W. Y. Chung; Thomas K. S. Wong. Anthropometric evaluation for primary school furniture design. S. 323–334.**

Musculoskeletal symptoms are one of the top ten health problems among schoolchildren in Hong Kong. Whether or not these symptoms are related to school furniture has yet to be determined and published data on furniture size are lacking. The purpose of the study was to determine whether the design of furniture in schools is appropriate for children's anthropometry. A total of 214 volunteer subjects were recruited. This constituted 90% of the total number of primary 5 and 6 students in the studied school (i.e. those aged 10 and 13 years). The data collected included demographic information, data on perceived health and posture and body and furniture measurements. The girls' BMI was lower than that of the boys. The girls had longer lower limbs and wider hip breadth measurements in the standing position. This was similar in the sitting position. Almost none of the subjects had a chair with an appropriate seat height. Seat depth was found appropriate for large groups of students whether or not a large or small chair was used. Recommendations on the sizes of chairs and desks for boys and girls are discussed.

- **Keywords:** Schoolchildren; Furniture; Anthropometry

#### **G. A. James. Modelling diagnosis in physical therapy: a blackboard framework and models of experts and novices. S. 335–351.**

The primary objective of this study was to explore clinical reasoning in physical therapy and to highlight the similarities and differences by modelling the diagnostic phase of clinical reasoning. An experimental design comparing expert and novice physical therapists was utilized. Concurrent verbal protocols detailing the clinical reasoning about standardized case material were elicited. A framework for modelling diagnosis was specified and provided the parameters for analysis. The diagnostic utterances were classified as cues or hypotheses and the knowledge utilized was identified. The experts recruited significantly more knowledge than the novices ( $p = 0.01$ ) and used more cues ( $p < 0.01$ ). Their diagnoses were more accurate when compared to the original diagnosis. This difference between the experts and novices was reflected in the differences shown in the models ( $p < 0.01$ ). The differences between these subjects focused upon the knowledge recruitment, which impacted on the accuracy of the diagnosis. The novices' inaccurate or non-existent diagnoses led to poor quality of treatment prescription. Modelling proved to be a useful way of representing these differences.

- **Keywords:** Clinical reasoning; Diagnosis; Modelling; Physical therapy

**Mary Ann Holbein-Jenny; Mark S. Redfern; Dan Gottesman; Don B. Chaffin. Kinematics of heelstrike during walking and carrying: implications for slip resistance testing. S. 352–363.**

Slip resistance measurements of shoes and floors are used to evaluate the potential for slip and fall injuries. These measurements are believed to have increased validity when they more closely reflect actual heelstrike biomechanics during locomotion. The purpose of this study was to describe heelstrike kinematics during load carrying to provide data towards improved slip resistance testing. Foot kinematics during load carrying (unladen and carrying from 0 to 13.5 kg) at various cadences (70, 90, 100 steps/min) was recorded. Measures before, during and after heelstrike were analysed. Cadence was an important predictor for all variables measured, associated with changes from 13% to over 100%. The load carried was an important predictor for only the heel slip distance after heelstrike, but this effect needs to be investigated further. These results can be used to improve the fidelity of slip resistance measurements, which is critical to reduce slip and fall injuries in the workplace or during activities of daily living.

- **Keywords:** Falls; Biomechanics; Gait; Postural control; Load carrying

**S. Quanten; A. van Brecht; D. Berckmans. Comparison of thermal comfort performance of two different types of road vehicle climate control systems. S. 364–378.**

The performance of climate control systems in vehicles becomes more and more important, especially against the background of the important relationship between compartment climate and driver mental condition and, thus, traffic safety. The performance of two different types of climate control systems, an un-air-conditioned heating/cooling device (VW) and an air-conditioning climate control unit (BMW), is compared using modern and practical evaluation techniques quantifying both the dynamic 3-D temperature distribution and the local air refreshment rate. Both systems suffer from considerable temperature gradients: temperature gradients in the U-AC (VW) car up to 8-9°C are encountered, while the AC (BMW) delivers clear improvement resulting in temperature gradients of 5-6°C. The experiments clearly demonstrate the effect of the presence of even a single passenger on the thermal regime, increasing the existing thermal discrepancies in the compartment with 15% independent of ventilation rate. Furthermore, in terms of air refreshment rates in the vehicle compartment, an air-conditioning unit halves the air refreshment time at all positions in the vehicle cabin, delivering a significant improvement in terms of human comfort. Similarly, extra air inlets in the back compartment of a car deliver progress in terms of cabin refreshment rate (93 s down to 50 s).

- **Keywords:** Vehicle driver; Climate controller; Heat production; Thermal comfort

**Thomas Waters; Christin Rauche; Ash Genaidy; Tarek Rashed. A new framework for evaluating potential risk of back disorders due to whole body vibration and repeated mechanical shock. S. 379–395.**

A number of studies have examined the potential relationship between exposure to occupational vibration and low back pain associated with operation of vehicles. Only a handful of studies, however, have attempted to differentiate between the relative contributions of the steady state and transient mechanical shock components (the latter also being known as 'jarring and jolting', 'high acceleration event', 'multiple shocks' and 'impact') of the vibration exposure. The primary objective of this paper is to present a review of current studies that examine mechanical shock, present a case for the importance of evaluating both steady state and mechanical shock components and

propose a new framework for evaluating the health effects due to occupational vibration exposure. A computerized bibliographical search of several databases was performed with special reference to the health effects of mechanical shock in relation to lower back disorders. Based on the analysis, eight experimental studies and nine epidemiological studies with relevance to exposure to 'mechanical shock' were identified. These studies suggested that rough vehicle rides are prevalent and that repeated exposure to mechanical shock may increase the risk of lower back pain. There is an urgent need for assessing the health effects of mechanical shocks in epidemiological studies. In particular, the new ISO 2631-5: International Organization for Standardization 2004 standard for shock exposure assessment should be evaluated with regard to musculoskeletal health effects.

- **Keywords:** Mechanical shocks; Whole-body vibration; Health effects

**Julia Parakkat; Gang Yang; Anne-Marie Chany; Deborah Burr; William S. Nadras. The influence of lift frequency, lift duration and work experience on discomfort reporting. S. 396–409.**

Discomfort surveys are commonly used to assess risk in the workplace and prioritize jobs for interventions before an injury or illness occurs. However, discomfort is a subjective measure and the relationship of discomfort to work-related factors is poorly understood. The objective of this study was to understand how reports of discomfort relate to work-related risk factors for the low back. A total of 12 novice and 12 experienced manual materials handlers performed repetitive, asymmetric lifts at different load levels and at six different lift frequencies throughout an 8-h exposure period. Discomfort was recorded hourly throughout the day. Analyses were performed to determine which experimental factors influenced reporting of discomfort and if discomfort trends matched spine loading trends. Novice lifters reported significantly higher discomfort levels than experienced subjects. They also reported increases in discomfort as moment exposure increased and as the exposure time increased. Novices lifting at 8 Nm load moment level reported increased discomfort from 0.07 to 0.63 by the end of the day, at 36 Nm they reported an increase from 0.04 to 0.40 and at 85 Nm they reported an increase from 0.37 to 3.06. Experienced subjects, on the other hand, reported low levels of discomfort regardless of moment exposure, lift frequency or exposure duration. The reported discomforts were generally unrelated to the biomechanical loading on the spine. Discomfort reporting appears to be more a reflection of experience than of work risk factor exposure. Experienced subjects may have more efficient motor patterns, which reduce spinal load and thus discomfort. Novice subjects seemed to have a lower threshold of discomfort. Caution is needed when using discomfort reporting as a means to identify jobs in need of interventions, in that biomechanical loading may not be accurately represented. Discomfort should only be used as a supplement to objective measures, such as spinal loading, to assess the risk of low back disorders.

- **Keywords:** Low back pain; Spine loads; Modelling; Discomfort

**Heather L. Butler; Cheryl L. Hubley-Kozey; John W. Kozey. Changes in trunk muscle activation and lumbar-pelvic position associated with abdominal hollowing and reach during a simulated manual material handling task. S. 410–425.**

The purpose of this study was to investigate the effect of abdominal hollowing (AH) on trunk muscle activation and lumbar-pelvic motion during a controlled lift and replace task. Surface electromyograms were recorded from five abdominal and two back muscle sites. Sagittal lumbar-pelvic motion was recorded by video. Subjects lifted a 3.8 kg load in normal, maximum and extreme reaches, first while performing their preferred lifting style (PLS) and then maintaining an AH technique. The external oblique muscle site activities were significantly higher ( $p < 0.05$ ) for the AH technique (ranging from 7–20%

of maximal voluntary activation (MVIC)) than at any of the abdominal sites for the PLS (ranging from 2-10% MVIC). Differences were found among abdominal sites for the AH, but not for the PLS. The back muscle site activities (ranging from 9-30% MVIC) were significantly higher ( $p < 0.05$ ) than for any of the abdominal muscles for all conditions, except for the anterior external oblique for AH. The pelvic and lumbar angles changed significantly ( $p < 0.05$ ) between normal and maximal reaches and between techniques. The AH technique altered abdominal muscle activation amplitudes, with minimal differences in trunk extensors compared to the PLS. The AH resulted in more posterior pelvic tilt.

- **Keywords:** Electromyography; Kinematics; Reach; Lifting; MMH

**C. Armbrüster; C. Sutter; M. Ziefle. Notebook input devices put to the age test: the usability of trackpoint and touchpad for middle-aged adults. S. 426–445.**

In two experiments, the usability of input devices integrated into computer notebooks was under study. The most common input devices, touchpad (experiment 1) and trackpoint (experiment 2) were examined. So far, the evaluation of mobile input devices has been restricted to younger users. However, due to ongoing demographic change, the main target group of mobile devices will be older users. Therefore, the present study focused on ageing effects. A total of 14 middle-aged (40-65 years) and 20 younger (20-32 years) users were compared regarding speed and accuracy of cursor control in a point-click and a point-drag-drop task. Moreover, the effects of training were addressed by examining the performance increase over time. In total, 640 trials per task and input device were executed. The results show that ageing is a central factor to be considered in input device design. Middle-aged users were significantly slower than younger users when executing the different tasks. Over time, a significant training effect was observed for both devices and both age groups, although the benefit of training was greater for the middle-aged group. Generally, the touchpad performance was higher than the trackpoint performance in both age groups, but the age-related performance decrements were less distinct when using the touchpad.

- **Keywords:** Ageing; Input device; Computer notebook; Touchpad; Trackpoint; Motor performance; Cursor control; Point-click task; Point-drag-drop task

**G. E. Brogmus. Day of the week lost time occupational injury trends in the US by gender and industry and their implications for work scheduling. S. 446–474.**

While there is a growing body of research on the impact of work schedules on the risk of occupational injuries, there has been little investigation into the impact that the day of the week might have. The present research was completed to explore day of the week trends, reasons for such trends and the corresponding implications for work scheduling. Data for the number of injuries and illnesses involving days away from work (lost time; LT) in 2004 were provided by the US Bureau of Labor Statistics Office of Safety and Health Statistics. Data from the American Time Use Survey database were used to estimate work hours in 2004. From these two data sources, the rate of LT injuries and illnesses (per 200 000 work hours) by day of the week, industry sector and gender were estimated. The analysis revealed clear differences by day of the week, gender and major industry sector. Sundays had the highest rate overall - nearly 37% higher than the average of the remaining days, Monday to Saturday. Mondays had the next highest rate followed closely by Saturdays. This pattern was not the same for males and females. For males, Mondays had the highest LT rate (27% higher than the average of all other days) with all remaining days having essentially the same rate. For females, Sundays and Saturdays had much higher LT rates - 122% and 60% higher, respectively, than the average weekday rate. There were also differences by industry and differences between genders by industry. The present analysis suggests that several factors may be contributing to the weekend and Monday trends observed. Lower-tenured (and younger)

workers on the weekends, lower female management/supervision and second jobs on the weekend seem to be contributors to the high Saturday and Sunday LT rates. Differences in day of the week employment by industry did not account for the trends observed. Fraud and overtime also could not be confirmed as contributing to these trends. Monday trends were more complex to explain, with possible explanations including non-work-related weekend injuries being reported on Mondays, soft-tissue symptoms becoming more noticeable on Mondays, greater Monday morning flexion risk and reduced supervision in the construction industry on Mondays. Interpretation of these trends and the implications for work scheduling are discussed.

- **Keywords:** Work scheduling; Weekend; Weekday; Injury rate; overtime; Gender differences; Day of the week