

Ergonomics– rok 2022, ročník 65

Číslo 6



Byoung-Keon D. Park, Monica L. H. Jones, Sheila Ebert & Matthew P. Reed. *A parametric modeling of adult body shape in a supported seated posture including effects of age.* Pages: 795-803

Statistical body shape models (SBSM) provide compact, flexible representations of body shape that can be implemented in design software. However, few SBSMs have been created to represent adults in supported seated postures that are relevant for the design of seated environments, and none has incorporated the effects of age. This paper presents an SBSM based on surface laser-scan data from 155 U.S. adults. The data were processed to obtain homologous mesh structure and symmetric geometry, and the processed data were statistically analysed using principal component analysis to obtain a compact representation of the data variance. Regression analysis was conducted to predict body size and shape from stature, body mass index, ratio of sitting height to stature, sex, and age. The resulting model allows rapid generation of realistic body models for applications, including product design, accommodation assessment, and safety system optimisation. The model is publicly accessible at HumanShape.org.

Practitioner summary: This paper presents a statistical model that represents adult body shapes in a supported seated posture based on 3D anthropometric measurements. This model is the first whole-body parametric model known to incorporate age effects based on data extending beyond 65 years of age.

- **Keywords:** Statistical body shape model, SBSM, supported seated model, parametric model, age effect

Peyman Piranveyseh, Reza Kazemi, Ahmad Soltanzadeh & Andrew Smith. *A field study of mental workload: conventional bus drivers versus bus rapid transit drivers.* Pages: 804-814.

Road traffic accidents are increasing worldwide and cause a high number of fatalities and injuries. Mental Work Load (MWL) is a contributing factor in road safety. The primary aim of this work was to study important MWL factors and then compare conventional and BRT (Bus Rapid Transit) drivers' MWL. This study evaluated bus drivers' MWL using the Driving Activity Load Index (DALI) questionnaire conducted with 123 bus drivers in Tehran. The results revealed significant differences between conventional and BRT

drivers' mental workload. Moreover, data modelling showed that some organisational and environmental factors such as bus type, working hours per day, road maze, and route traffic volume contribute to drivers' mental workload. These findings suggest some essential customised factors that may help measure and offer practical solutions for decreasing the level of bus drivers' MWL in real-world road driving. **Practitioner summary:** Mental workload is affected by several contributing factors. Depending on the working context, some of these contributing factors have a more significant influence on the level of the experienced MWL. Therefore, the main factors influencing the MWL of BRT and conventional bus drivers were assessed in their real-life environment.

- **Keywords:** Mental workload, DALI, real-world driving, conventional bus driver, BRT bus driver

Dechristian França Barbieri, Luiz Augusto Brusaca, Svend Erik Mathiassen, Divya Srinivasan & Ana Beatriz Oliveira. *Effects on variation in shoulder, forearm and low back muscle activity from combining seated computer work with other productive office tasks: results from a simulation study.* Pages: 815-827.

Physically demanding water and over land winch rescues are critical tasks for helicopter paramedics. To assess the physiological demands of winch rescue, 14 intensive care flight paramedics (12 male, 2 female, mean (\pm SD) age 44.3 (\pm 5.4) years, experience 7.1 (\pm 5.2) years) completed land and water-based task simulations. For the land task, VO_2 was 41.7 (\pm 4.5) mL kg⁻¹ min⁻¹, or 86 (\pm 11) % of VO_{2peak} . Task duration was 7.0 (\pm 3.6) min, or 53 (\pm 27) % of maximal acceptable work duration (MAWD) (13.2 (\pm 9.0) min). For the water task, VO_2 was 36.7 (\pm 4.4) mL kg⁻¹ min⁻¹, (81 (\pm 12) % of VO_{2peak}). Water task duration was 10.2 (\pm 1.1) min, or 47.6 (\pm 4.8) % of calculated MAWD (21.0 (\pm 15.6) min). These results demonstrate that helicopter rescue paramedics work at very high physiological workloads for moderate durations, and these demands should be considered when developing selection tests and when deploying to rescues, to ensure staff are capable of task performance. **Practitioner summary:** Paramedics performed helicopter winch rescue task simulations in water and over land. Paramedics worked at 81% of VO_{2peak} for 10.2 min and 86% of VO_{2peak} for 7 min for swim and land tasks respectively. Rescue organisations should consider these demands when selecting and credentialing staff and when deploying to incidents.

- **Keywords:** Human performance, aerobic capacity, physical employment standards, search and rescue, paramedic

Ben Meadley, Ella Horton, Luke Perraton, Karen Smith, Kelly-Ann Bowles & Joanne Caldwell. *The physiological demands of helicopter winch rescue in water and over land.* Pages: 828-841.

Physically demanding water and over land winch rescues are critical tasks for helicopter paramedics. To assess the physiological demands of winch rescue, 14 intensive care flight paramedics (12 male, 2 female, mean (\pm SD) age 44.3 (\pm 5.4) years, experience 7.1 (\pm 5.2) years) completed land and water-based task simulations. For the land task, VO_2 was 41.7 (\pm 4.5) mL kg⁻¹ min⁻¹, or 86 (\pm 11) % of VO_{2peak} . Task duration was 7.0 (\pm 3.6) min, or 53 (\pm 27) % of maximal acceptable work duration (MAWD) (13.2 (\pm 9.0) min). For the water task, VO_2 was 36.7 (\pm 4.4) mL kg⁻¹ min⁻¹, (81 (\pm 12) % of VO_{2peak}). Water task duration was 10.2 (\pm 1.1) min, or 47.6 (\pm 4.8) % of calculated MAWD (21.0 (\pm 15.6) min). These results demonstrate that helicopter rescue paramedics work at very high physiological workloads for moderate durations, and these demands should be considered when developing selection tests and when deploying to rescues, to ensure staff are capable of task performance. **Practitioner summary:** Paramedics performed helicopter winch rescue task simulations in water and over land. Paramedics worked at

81% of VO_{2peak} for 10.2 min and 86% of VO_{2peak} for 7 min for swim and land tasks respectively. Rescue organisations should consider these demands when selecting and credentialing staff and when deploying to incidents.

- **Keywords:** Human performance, aerobic capacity, physical employment standards, search and rescue, paramedic

Mehdi Nematimoez & James S. Thomas. *The effect of head movement restriction on the kinematics of the spine during lifting and lowering tasks.* Pages: 842-856.

This study aimed to examine the effects of head movement restriction on relative angles and their derivatives using the stepwise segmentation approach during lifting and lowering tasks. Ten healthy men lifted and lowered a box using two styles (stoop and squat), with two loads (i.e. 10% and 20% of body weight); they performed these tasks with two instructed head postures [(1) Flexing the neck to keep contact between chin and chest over the task cycle; (2) No instruction, free head posture]. The neck flexion significantly affected the flexion angle of all segments of the spine and specifically the lumbar part. Additionally, this posture significantly affected the derivatives of the relative angles and manifested latency in spine segments movement, that is, cephalad-to-caudad or caudad-to-cephalad patterns. Conclusively, neck flexion as an awkward posture could increase the risk of low back pain during lifting and lowering tasks in occupational environments. **Practitioner summary:** Little information is available about the effects of neck flexion on other spine segments' kinematics and movement patterns, specifically about the lumbar spine. The result of this experimental study shows that neck flexion can increase the risk of low back pain by increasing lumbar flexion angle and spine awkward posture.

- **Keywords:** Head movement restriction, spine kinematic, lifting, low back painstepwise segmentation

Erika Nelson-Wong, John Corrigan, Patrick Mertz, Stephanie Kutcher, Ingrid Carlson, Tara DiRocco & Brianna Hall-Nelson. *Office-workers maintain decreased workplace sitting time long-term following participation in a sit-stand desk intervention study.* Pages: 857-865.

Previous studies report decreased workplace sitting time when standing desk interventions are provided to office workers. It is unclear whether decreased sedentary behaviours are maintained long-term. This was a follow-up to a previous intervention study to investigate whether observed sitting time decreases of 30–50% were sustained 12–24 months later. A secondary aim was to compare overall physical activity between office workers with and without standing desks. Although sitting time increased over the follow-up period, this did not reach significance and reductions in workplace sitting remained significantly lower (23.5% decrease) from baseline values. There were no differences in the physical activity measures between workers with and without access to standing desks, although this was a small sample size and further research is needed. Individuals who are motivated to try standing desks at work can benefit through decreased sitting time long-term, however this may not extend to increased overall physical activity levels. **Practitioner summary:** Providing standing desk options to office-based employees can have long-lasting impacts with reducing sitting time at work. Office workers who choose to stand at work do not appear to compensate with overall activity level reduction outside of work.

- **Keywords:** Ergonomics, standing, sit-stand desk, low back pain, physical activity

Marco Arkesteijn, Rhys Jones & Daniel C. Low. [The effect of walking and stationary work on the acute back pain, muscle activation, posture and postural control of older women](#). Pages: 866-876.

Back pain is associated with activity such as walking or assembly line work that involves upper-body movement. However, no single study has explored the effect of these tasks on back pain, spinal angles and balance in an older adult female population. This study investigated changes in back pain, postural sway, upper-, lower- and full-spine angle and EMG activation of trunk muscles following 30 minutes of walking and a modified quiet standing task. Fourteen older adult females (62 ± 11 yrs) with low to moderate chronic back pain were recruited as participants. Findings demonstrated that following these activities, increased acute back pain and upper-spine flexion occur although acute back pain was not clinically significant; postural control and muscle activation remained unchanged. This suggests that walking and modified quiet standing can lead to subtle acute back pain in older females that could be due to an increased upper spinal flexion rather than muscle fatigue. **Practitioner summary:** Back pain and postural problems are common in older adults. Older adult female participants experienced increased back pain and greater upper-spine flexion following 30-minute walking and standing with trunk rotation, but the practical importance was less clear. However, balance was unaffected, suggesting no increase in fall risk.

- **Keywords:** Back pain, posture, balance, walking, standing

Eduardo Gallas Leivas, Juliana Valentim Bittencourt, Arthur Sá Ferreira & Leandro Alberto Calazans Nogueira. *Is it possible to discriminate workers with a higher prevalence of low back pain considering daily exposure time in a work-related lumbar posture? A diagnostic accuracy study*. Pages: 877-885.

The study aimed to develop and validate a cut-off for daily postures to discriminate workers with low back pain. The self-reported episode of low back pain in the last year and during the previous week and the total spent time in occupational postures of 529 workers were used to screen workers who more likely would report low back pain. The receiver operating characteristics curve verified the ability of daily time in each posture in discriminating workers with low back pain in a training sample. Then, the chi-squared test and measurements of the diagnostic accuracy were performed in the testing sample. The daily time spent in a given posture was not able to accurately discriminate against workers with low back pain. Total time spent walking was the only daily posture that discriminated workers with low back pain in the last year in the testing sample, albeit with low accuracy. **Practitioner Summary:** The daily time spent in a given posture was not able to accurately distinguish workers with low back pain. Total spent time in walking presented modest diagnostic accuracy and should be interpreted cautiously. The spent time in a particular posture did not detect workers with LBP in the last week.

- **Keywords:** Low back pain, posture, standing, sitting, walking

Matthew J. M. Dunn, Brett R. C. Molesworth, Tay Koo & Gabriel Lodewijks. *Measured effects of workload and auditory feedback on remote pilot task performance*. Pages: 886-898.

Absent or reduced sensory cueing can deprive pilots operating remotely piloted aircraft beyond visual line of sight (BVLOS) of vital information necessary for safe flight. The present study tested the effects of real-time auditory feedback on remote pilot perception and decision-making task performance in an automated BVLOS flight, under three levels of workload (Low, Moderate and High). Results from 36 participants revealed workload and auditory feedback influenced perception task performance in terms of error type

count, with misses more frequent than wrong identifications. In terms of performance in the decision-making task, under low and moderate levels of workload, auditory feedback was found to improve performance. Conversely, under high workloads, an inflexion or tipping point occurred whereby auditory feedback became detrimental to task performance. These results correspond with the expected behavioural responses to external stressors as predicted by the Arousal and Maximal Adaptability theory, and build upon previous findings related to workload, auditory feedback and remote pilot task performance. **Practitioner summary:** This study tested the effect of real-time auditory feedback and dynamic workloads on remote pilots' task performance. Auditory feedback and workload each influenced the perception tasks in terms of error types committed. Auditory feedback improved decision-making task performance under low and moderate workloads, and reduced performance under high workloads. These results may benefit practitioners by considering the nuanced effects of auditory feedback on human task performance within sensory deprived working environments, including those utilising teleoperated systems.

- **Keywords:** Workload, auditory feedback, noise, RPAS