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Errol R. Hoffmann. *Naïve judgements of stimulus–response kompatibility*. Pages 1061 – 1071.

An experiment is reported that is an extension of Payne (1995) and of Vu and Proctor (2003). These authors used various light/key arrangements to determine the ability of naïve subjects to rate the usability of interface designs and found that naïve judgements were not accurate, apart from selecting a best design. In this experiment, there were one, two, four and eight arrangements of lights and response keys with varying levels of compatibility between them. Response time is shown to be determined by two main factors: the level of response uncertainty (the number of light/key combinations); the correlation between stimulus-light and response key location, accounting for up to 93% of the experimental variance. Subjective response time (SRT), or judged response time, was responsive to the level of response uncertainty and also the correlation between light/key combinations, showing good correspondence to actual reaction times. It was found that SRT showed a stronger relationship to actual response time when subjects were presented with the full set of situations that they were to respond to, prior to judgements being made, rather than just individual sets for comparison. In interface design it is essential that, in order to reduce reaction times and error rates, there is a high level of user expectancy between locations of the stimulus and corresponding response. This research indicates how designs might be evaluated, based on the geometrical layout of stimuli and response arrangements.

- **Keywords:** judged reaction time; stimulus-response compatibility; subjective judgements of kompatibility

Gregory D. Roach; David Darwent; Drew Dawson. *How well do pilots sleep during long-haul flights?* Pages 1072 – 1075.

It is imperative that shiftworkers in safety-critical workplaces obtain sufficient sleep to operate effectively. This presents a challenge to long-haul airline pilots who are required to supplement normal bed sleep with sleep on-board an aircraft during flight. In the current study, the sleep/wake behaviour of 301 airline pilots operating long-haul flight patterns was monitored for at least 2 weeks using self-report sleep diaries and wrist activity monitors. The data indicate that sleep opportunities in on-board rest facilities during long-haul flights result in a similar amount of sleep, but only 70% as much recovery, as duration-matched bed sleeps. **Statement of Relevance**: This study

indicates that in-flight sleep provides airline pilots with 70% as much restoration as duration-matched bed sleep. To increase the restoration provided by in-flight sleep, airlines could take measures to improve the quality, or increase the amount, of sleep obtained by pilots during flights.

- **Keywords:** naps; recovery; restoration; sleeps; pilots

Anne-Sophie Nyssen; Virginie Côte. *Motivational mechanisms at the origin of control task violations : an analytical case study in the pharmaceutical industry*. Pages 1076 – 1084.

The introduction of rules and procedures to guide front-line operators' behaviour and to decrease the frequency of errors is a growing safety strategy in complex risk systems. It is thought to be a useful way of controlling and standardising human practices and of increasing safety and quality. However, merely developing procedures does not ensure that they are followed. In this study, observation was used to collect information on procedural violations in a pharmaceutical company. Interviews were conducted with the operators and the prescriptors to better understand how and why these violations were occurring. Results showed that a small number of procedures were breached by the majority of operators and that the rules that were violated were the ones associated with a perception of minimum risk. Results suggest the rationality of operators is a response to cognitive and social influences, which must be taken into account when designing procedures. **Statement of Relevance**: This paper is about violation and risk perception. This focus is relevant for ergonomic research and practice, taking into account the accumulation of rules and procedures that are found in work in order to improve safety. The results help to better understand the cognitive and social mechanisms underlying violations and give some insights for designing procedures.

- **Keywords:** cognitive and social rationality; risk perception; safety; violations

F. Ladstätter; E. Garrosa; C. Badea; B. Moreno. *Application of artificial neural networks to a study of nursing burnout*. Pages 1085 – 1096.

Nursing is generally considered to be a profession with high levels of emotional and physical stress that tend to increase. These high stress levels lead to a high risk of burnout. The objective was to assess whether artificial neural network (ANN) paradigms offer greater predictive accuracy than statistical methodologies, which are commonly used in the field of burnout. A radial basis function (RBF) network and hierarchical stepwise regression was used to assess burnout. The comparison of the two methodologies was carried out by analysing a sample of 462 nurses and student nurses. The subjects were from three hospitals in Madrid (Spain), who completed the 'Nursing Burnout Scale' survey. A RBF network was better suited for the analysis of burnout than hierarchical stepwise regression. The outcomes indicate furthermore that the relationship with the burnout process of the predictive variables age, job status, workload, experience with pain and death, conflictive interaction, role ambiguity and hardy personality is not entirely linear. The usage of ANNs in the field of burnout has been justified due to their superior ability to capture non-linear relationships, which is relevant for theory development. **Statement of Relevance**: Due to the superior ability to capture non-linear relationships, ANNs are better suited to explain and predict burnout and its subdimensions than common statistical methods. From this perspective, more specific programmes to prevent burnout and its consequences in the workplace can be designed.

- **Keywords:** artificial neural networks; burnout; nursing; radial basis function; regression

Joanne N. Hodder; Michael W. R. Holmes; Peter J. Keir. *Continuous assessment of work activities and posture in long-term care nurses*. Pages 1097 – 1107.

The high prevalence of low back injuries in nursing has prompted the use of mechanical lift assists while overall assessment of activities and postures remains limited. The purpose of this study was to chronicle trunk posture and work tasks of long-term healthcare professionals. An inclinometer monitored trunk posture for 27 workers, 20 of whom were also observed continuously throughout their shift. Patient lifts and transfers accounted for less than 4% of the shift while patient care, unloaded standing and walking and miscellaneous tasks accounted for 85%. Manual lifts and transfers occurred twice as often as mechanically assisted lifts but took only half the time. The workers had a median trunk flexion angle of 9.2°, spent 25% of their time flexed beyond 30° and had peak flexion angles greater than 75° in many tasks. Analysis of posture throughout the entire working shift indicates that, in addition to lifts and transfers, emphasis needs to be placed on patient care and miscellaneous activities when assessing injury risk for nurses. **Statement of Relevance**: Patient handling has been the focus in the effort to reduce back pain and injury in nursing. In addition to the use of mechanical lifts, there is a need to examine other aspects of nursing, including patient care and other ancillary tasks, which comprise the majority of the work shift and, while often unloaded, exhibit extreme postures that may also lead to injury.

- **Keywords:** low back; nursing; patient handling; posture

Michael W. R. Holmes; Joanne N. Hodder; Peter J. Keir. *Continuous assessment of low back loads in long-term care nurses*. Pages 1108 – 1116.

Considerable effort has been spent evaluating aspects of low back injury risk in nursing yet comprehensive evaluation of all work tasks has been limited. The purpose of this study was to evaluate peak and cumulative lumbar spine loads experienced by personal support workers. A total of 20 female long-term care workers were observed and had trunk posture monitored via an inclinometer throughout their shift. When adjusted for an 8-h workday, workers experienced cumulative loads of 21.3 ± 4.6 MNs, 1.8 ± 0.6 MNs and 2.9 ± 1.4 MNs for compression, lateral and anterior shear, respectively. Patient care, unloaded standing, walking and miscellaneous tasks accounted for almost 80% of cumulative compression, while lifts and transfers accounted for less than 10%. Mechanical lift assists reduced peak loads and contributed minimally to cumulative loading. These findings suggest that both peak and cumulative spine loads should be considered when evaluating injury risk in the nursing profession. **Statement of Relevance**: This study has shown that tasks other than patient transfers and lifts are important in the assessment of low back injury risk in nurses. The method developed is a relatively straightforward approach that can be used to estimate peak and cumulative spine load to provide insight to risk of injury in many occupational settings.

- **Keywords:** cumulative loading, force; nurse; patient handling; spine

Erika Nelson-Wong; Samuel J. Howarth; Jack P. Callaghan. *Acute biomechanical responses to a prolonged standing exposure in a simulated occupational petting*. Pages 1117 – 1128.

Prolonged occupational standing has previously been associated with low back pain (LBP) development. The immediate effects of a bout of prolonged standing on subsequent functional movement performance have not been investigated. It is possible that including a period of prolonged standing may have acute, detrimental effects. The purpose of the study is to investigate the impact of a prolonged standing exposure on

biomechanical profiles (trunk muscle activation, joint stiffness and kinematics) during three functional movements. A total of 23 volunteers without history of LBP performed lumbar flexion, single-leg stance and unloaded squat movements pre- and post 2 h of standing exposure. It was found that 40% of the participants developed LBP during the standing exposure. There was a decrease in vertebral joint rotation stiffness in lateral bending and increased centre of pressure excursion during unilateral stance following standing exposure. There may be adverse effects to prolonged standing if followed by activities requiring precise balance or resistance of side loads. **Statement of Relevance**: Prolonged standing may result in decreases in balance reactions during narrow base conditions as well as in the capacity to effectively resist side-loads at the trunk. Consideration should be given when prolonged standing is included in the workplace.

- **Keywords:** low back pain; standing; vertebral stiffness

S. Bao; N. Howard; P. Spielholz; B. Silverstein. *Inter-observer reliability of forceful exertion analysis based on video-recordings*. Pages 1129 – 1139.

The objectives were to examine inter-observer reliability of job-level forceful exertion analyses and temporal agreement of detailed time study results. Three observers performed the analyses on 12 different jobs. Continuous duration, frequency and % time of lifting, pushing/pulling, power and pinch gripping exertions and estimated level of the exertions were obtained. Intraclass correlation coefficient and variance components were computed. Temporal agreement analyses of raw time study data were performed. The inter-observer reliability was good for most job-level exposure parameters (continuous duration, frequency and % time of forceful exertions), but only fair to moderate for the estimated level of forceful exertions. The finding that the between-observer variability was less than the between-exertion variability confirmed that the forceful exertion analysis method used in the present study can detect job exertion differences.Using three observers to perform detailed time studies on task activities and getting consensus of the majority can increase the between-observer agreement up to 97%.**Statement of Relevance**: The results inform researchers that inter-observer reliability for job-level exposure measurement of forceful exertion analysis obtained from detailed time studies is generally good, but the observers' ability in the estimation of forceful exertion level can be poor. It also provides information on the temporal agreement of detailed forceful exertion analysis and guidelines on achieving better agreement for studies where accurate synchronisation of task activities and direct physiological/biomechanical measurements is crucial.

- **Keywords:** forceful exertion; inter-rater reproducibility; observation method; temporal agreement; time study

José Antonio Prieto Saborit; Miguel del Valle Soto; Vicente González Díez; Maria Ángeles Montoliu Sanclement; Paloma Nistal Hernández; Jorge Egocheaga Rodríguez; Luís Santos Rodríguez. *Physiological response of beach lifeguards in a rescue simulation with surf*. Pages 1140 – 1150.

The objective of this study was to examine the physiological response of 14 lifeguards in a swimming pool simulation with 1.7 m waves and to study the efficiency of the torpedo buoy. The rescue time was determined with and without material, as were lactate levels, heart rate and VO_{2max}. The results obtained showed a $VO_{2\ max}$ rate of 3.4 ± 0.8 l/min without equipment and 3.3 ± 0.8 l/min with equipment. Moreover, the time taken to swim towards the victim without equipment decreased by 7.7 s, while towing time was reduced by 10.8 s if said equipment was used. These results show that aquatic rescue

makes considerable physiological demands on the swimmer and they also provide important data on the type of training and aptitude levels required by individuals wishing to join these rescue groups. The equipment currently used has a negative affect on the swim. **Statement of Relevance**: The study shows that beach rescues make very high physiological demands on rescuers, thus underlining the need to perform entry tests for these highly demanding rescue teams. The auxiliary equipment is a help in the return time of rescue. However, it causes delays in the approach to the victim.

- **Keywords:** lifeguard; maximal oxygen uptake; physiology; safety and rescue equipment