



## HUMAN RESPONSE TO VIBRATION

### ABSTRACTS

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Ø. B. Hansen and A. S. Wagstaff 2001 *Aviation, Space, and Environmental Medicine*, **72**, 161–164. Low back pain in Norwegian helicopter aircrew. (4 pages, 9 figures, 0 tables, 17 references) (in English).

*Authors' Abstract.* The size and consequences of low back pain (LBP) in Norwegian helicopter aircrew have been investigated in a retrospective and prospective survey. With 50.5% reporting such pain in a 2-year period, and Sea King aircrew reporting LBP on almost half (49.3%) of the missions flown, the magnitude of the problem equals that reported from other air forces. Pilots reported LBP six times more often than other crewmembers and almost half (48.6%) felt that the pain influenced the quality of work. This could have flight safety implications. Crewmembers with total flying time over 2000 h have a significantly higher incidence of sick leave than those with less than 2000 h. Only 1 pilot out of 10 with total flying time under 500 h had flight-related LBP. *Topics:* Injury and disease (chronic and acute).

T. K. Palmer, K. Walker-Bone, M. J. Griffin, H. Syddall, B. Pannett, D. Coggon and C. Cooper 2001 *Scandinavian Journal of Work, Environment and Health* **27**, 49–56. Prevalence and occupational associations of neck pain in the British population. (8 pages, 0 figures, 4 tables, 40 references) (in English).

*Authors' Abstract.* Objectives—This study determined the prevalence of neck pain and its relation to occupational activities in the general population. Methods—A questionnaire was mailed to 21 201 subjects aged 16–64 years, randomly selected from the patient registers of general practices in England, Scotland, and Wales, and to 993 subjects randomly selected from pay records of the armed services. Information was collected on occupation, workplace physical activities, neck pain in the past week and year, headaches, and feelings of tiredness or stress. Associations were explored by logistic regression, the resultant odds ratios being converted to prevalence ratios (PR). Results—Among 12 907 respondents, 4348 and 2528 reported neck pain in past year (1421 with pain interfering with normal activities) and week respectively. Symptoms were the most prevalent among male construction workers [past week and year 24 and 38% (pain interfering with activities 11%), respectively], followed by nurses, armed services members, and the unemployed. Generally, the age-standardized prevalence of neck pain varied little by occupation. Work with arms above the shoulders for >1 h/day was associated with a significant excess of symptoms [PR 1.3–1.7 (women) and 1.2–1.4 (men)], but no associations existed for typing, lifting, vibratory tool use, or professional driving. Stronger neck-pain associations were found with frequent headaches (PR 2.3–2.8) and frequent tiredness or stress (PR 2.2–2.5) than with occupational activities.

*Topics:* Injury and disease (chronic and acute).

P. Wild, N. Massin, G. Lasfargues, V. Baudin, D. Unlu and P. Donati 2001 *Ergonomics* **44**, 649–657. Vibrotactile perception thresholds in four non-exposed populations of working age. (9 pages, 1 figure, 2 tables, 17 references) (in English).

*Authors' Abstract.* The purpose of this study was to establish a basis for the use of a device for measuring vibrotactile perception thresholds for epidemiological purposes on a series of non-exposed populations. Vibrotactile perception thresholds (VPTs) were measured with a vibrometer in 218 men and 160 women belonging to two non-exposed male blue-collar populations, one white-collar population and one age and gender stratified sample of the general population. VPTs were measured on the middle and the little finger of the dominant hand at 31.5 and 125 Hz. The VPTs were expressed in dB and the effect of a series of factors including the population, age and gender and digital temperature was assessed in a regression analysis weighted by the inverse variance of the measurements. Adjusted for age, no significant difference between the VPTs in the four male populations was observed. At frequency 125 Hz, the effect of age (0.3 dB/year) was more important than at frequency 31.5 Hz (0.2 dB/year). In the two female populations, the results were less stable than among males and the VPTs were higher than among males. However, the age-dependence was similar among males and females. The within-test variance is a valuable indicator of the quality of the VPT measurements. Weighting by its inverse improved the fit of the regression models. Normal values for VPTs in non-exposed populations were obtained, which were reproducible in four separate populations.

*Topics:* Vibration sense (thresholds); subject type (age, gender, occupation).

M. Kubo, F. Terauchi, H. Aoki and Y. Matsuoka 2001 *International Journal of Industrial Ergonomics* **27**, 219–232. An investigation into a synthetic vibration model for humans: an investigation into a mechanical vibration human model constructed according to the relations between the physical, physiological and psychological reactions of humans exposed to vibration (13 pages, 9 figures, 5 tables, 5 references) (in English).

*Authors' Abstract.* We aim to develop a synthetic vibration model reproducing the relations between the physical, psychological and physiological reactions of the human body exposed to external vibrations. The synthetic vibration model consisted of a mechanical vibration model simulating the physical behavior of the human body and multiple regression equations describing the above three relations. The mechanical vibration models formalized according to Lagrange's equation of motion were employed. The experiment was carried out under conditions in which five people were exposed to external vibration that vertically vibrated at various frequencies. As a result, it was clear that there were resonance points showing remarkable shaking of the head, the chest and the abdomen in the frequency range 2–11 Hz. Moreover, it was indicated that the relations between the physical reactions and the resulting psychological and physiological reactions might be expressed in terms of multiple regression analysis. Finally, the simple vibration model of a person riding in an automobile was numerically constructed to reproduce the physical reactions of the human body, and then the psychological and physiological reactions were predicted.

*Topics:* Biodynamics (modelling), subjective assessment (general).

M. Futatsuka, Y. Fukuda and M. Uchino 2000 *Journal of Occupational Health* **42**, 192–195. A follow up study on the consequence of VWF patients in workers using chain saws in Japanese national forests. (4 pages, 1 figure, 4 tables, 11 references) (in English).

*Authors' Abstract:* The authors carried out more than 20 year of follow up studies of vibration-induced white finger (VWF) from the time the use of chain saws ceased. A total of

496 workers who were affected by VWF during the period 1955–1982 were followed up to observe the consequences of VWF. These subjects were selected from a total of 1586 chain saw operators who had used chain saws as a professional operator during some of the years from 1955 to 1982 in the national forests on Kyushu Island, Japan. In 1997, the authors had verified the current status and the course of VWF by direct interviews. A life table Product Limit method analysis of VWF prevalence was carried out to describe the consequences of VWF from the time the use of chain saws ceased. Out of the total number of subjects it was possible to follow 488 workers (98.4%) to ascertain their current states. Four hundred and eighty-one (98.6%) workers had retired and of these 124 (25.4%) had died. The rate of prevalence of VWF fell continuously after the use of chain saws ceased from 29.3% to a final value of 18.8% after more than 20 years' observation. It was observed that the percentage prevalence depended significantly on the severity: 87% for the subjects with stage 3, 53% for stage 2 and 17% for stage 1. The time course of the rate of recovery from moderate VWF differed from that of severe VWF. Peripheral neuropathies and sympathetic disturbances were predominantly observed in the severe stage VWF cases in pathophysiological examinations.

*Topics:* Vibration syndrome (vibration-induced white finger).

C. J. Lindsell and M. J. Griffin 2001 *International Archives of Occupational and Environmental Medicine* **74**, 325–335. Interpretation of the finger skin temperature response to cold provocation. (11 pages, 5 figures, 3 tables, 30 references) (in English).

*Authors' Abstract.* Objectives—To compare alternative methods of interpreting the response of finger skin temperature (FST) to cold provocation for the detection of the abnormal cold response observed in vibration-induced white finger (VWF). Method—The FST response to cold provocation was measured in 36 male subjects: 12 office workers, 12 manual workers and 12 manual workers with symptoms of VWF. The FSTs were monitored continuously on the distal phalanges of all five fingers of test hand for 2 min before, for 5 min during, and for 10 min following, immersion of the test hand in water at 15°C. Of the fingers investigated, 147 were reported not to exhibit blanching and 33 were reported to exhibit blanching. Twenty-one alternative methods of interpreting the response of FSTs to cold provocation were assessed. These were grouped as: (1) areas above the response profile (i.e., the area above the curve showing the FSTs as a function of time during cooling and recovery), (2) areas below the response profile, (3) absolute temperatures during and following cold provocation, (4) percentage differences in FSTs, (5) the times taken for FSTs to rise by specified amounts and (6) rates of change of FSTs. Differences in the response to cooling between those fingers reported to blanch and the fingers not reported to blanch were tested, and receiver operating characteristics (ROCs) were used to compare the sensitivity and specificity of the various measures to symptoms of VWF. Results—The areas above the response profile, areas below the response profile, percentage FSTs, absolute FSTs and rates of changes of FSTs tended to discriminate between healthy and unhealthy subjects on a group basis. However, some of these methods of interpreting the FST response to cold provocation did not show a high sensitivity or specificity to vascular dysfunction on individual fingers. The area above the response profile, the percentage of initial temperature at the fifth minute of recovery and the maximum temperature during the 10-min recovery period, were found to show the highest sensitivity and specificity to symptoms of vascular dysfunction. Conclusions—The method chosen to interpret the FST response to cold provocation affects the ability of the test to detect abnormal cold response. The area above the response profile, the percentage of initial temperature at the fifth minute of recovery and the maximum temperature achieved during a 10-min recovery period appear to be the most suitable measures for monitoring vascular function in workers

exposed to hand-transmitted vibration. It is suggested that the FST response to cold provocation should be interpreted with respect to the state of initial blood flow.

*Topics:* Vibration syndrome (vibration-induced white finger; diagnosis).

*Note:* copies of all papers in this section will be found in the Human Response to Vibration Literature Collection at the Institute of Sound and Vibration Research, University of Southampton. The papers may be used by persons visiting the Institute.

*Contributions to the Literature Collection are invited. They should be sent to Professor M. J. Griffin, Human Factors Research Unit, Institute of Sound and Vibration Research, University of Southampton, Southampton, SO17 1BJ, England.*