76 EFFECTS OF CONCRETE BIT WEAR ON DRILL HANDLE VIBRATION, DRILLING PRODUCTIVITY AND CHANGES IN BIT TIP GEOMETRY

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Introduction The use of hammer drills for concrete drilling exposes construction workers to high levels of hand vibration that may lead to hand arm vibration syndrome and other musculoskeletal disorders. The aim of this study was to investigate the effects of concrete bit wear on drill handle vibration, productivity, and change in bit shape.

Methods A laboratory test bench system was used to automatically advance an active 8.3 kg hammer drill with a 1.9 cm diameter carbide-tipped bit into aged concrete block under feed force control to a depth of 7.5 cm while drill handle vibration (ISO 5349 and 28927) and penetration rate (mm/s) were measured. Bits were worn to 4 levels by consecutively drilling holes to cumulative depths of 0, 1900, 5700 and 7600 cm. Image analysis methods quantified 13 geometric parameters of the carbide tip. Changes in the geometric parameters were compared to changes in penetration rate.

Result Z-axis handle vibration increased significantly ($p<0.05$) from 4.8 to 5.1 m/s^2 (ISO weighted) and from 42.7 to 47.6 m/s^2 (unweighted) when comparing a new bit to a bit worn to 1900 cm of cumulative drilling depth, but did not increase further with more wear. Drilling time increased by 58% for the worn (5700 cm) bit compared to a new bit. Changes in bit shape highly correlated to reduced productivity were increased fluke slope, increased shoulder rounding, and decreased tip width.

Discussion Carbide-tipped bit wear was associated with a small increase in ISO weighted and unweighted z-axis handle vibration and a large decrease in drilling productivity. To reduce drill-handle vibration levels and exposure time to hand vibration, construction contractors should implement a bit replacement program guided by bit wear. Other controls, such as exposure time per day, may also be necessary to adequately protect workers from hazardous levels of hand vibration.

781 A NOVEL MEASUREMENT TECHNIQUE FOR THE ASSESSMENT OF INDUSTRIAL ULTRASONIC NOISE

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Introduction Although the possible negative health effects of exposure to high energetic ultrasonic noise were discussed since the adoption of the technology in the 1940s, no major research was conducted on this topic since the late 20th century and it only regained focus approximately 10 years ago. Nevertheless, guideline values and limits have been established for the exposure to ultrasonic noise in several countries. The Ears II project was brought to life under the umbrella of the EU's EMPIR, to investigate the human perception of non-audible sound and its possible effects on human health. In this context the Institute for Occupational Safety and Health and the National Metrology Institute of Germany developed a measurement technique for assessing industrial ultrasonic noise.

Methods Existing measurement techniques for audible sound were evaluated for their applicability to measuring ultrasound. Through evaluation of existing data a reference workplace was developed for laboratory measurements. These comprised simulated practical measurements and high spatial resolution scans of the sound field of an ultrasonic welding machine. Finally, a method was developed and tested in field measurements.

Results The existing standards for assessment of the exposure to noise negate the applicability to ultrasonic noise. The same is true for the standards covering technical requirements for sound level metres. A novel technique was successfully developed and field measurements were carried out.

Conclusion The existing standards are mostly insufficient for the assessment of the exposure to ultrasonic noise. Either applicability to ultrasound is ruled out a priori or the methods or technical specifications are insufficient for the measurement of ultrasound, because the frequency range of interest is not covered, for example.

Based on an existing guideline a novel method was developed, which will, if necessary, be adapted to practical needs after examination of its practical applicability by evaluation of the field tests.

796 RETURN TO WORK AMONG SELF-EMPLOYED CANCER SURVIVORS: A EUROPEAN COMPARATIVE STUDY

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Introduction Studies on cancer survivors' (CS) return to work (RTW) after cancer have mostly focused on salaried workers. RTW among self-employed CS has almost not been focused although there are big differences in these two groups' working conditions and social welfare provisions. The aim of this study is therefore to bring together data from multiple European countries to:

- describe RTW–related outcomes after cancer in self–employed people;
- compare these outcomes for the self–employed with those for salaried workers; and
- describe RTW–related outcomes after cancer for self–employed people across countries.

Methods Eleven cross-sectional studies from seven countries were included. All studies had survey data on work-outcomes in self-employed and salaried CS who were employed at time of diagnosis (n=22–261 self-employed/101–1627 salaried). The studies included different cancers and assessed different outcomes at different times post-diagnosis.

Results Fewer self-employed CS took time off work due to cancer compared to salaried survivors. More self-employed than salaried worked post-diagnosis in almost all countries. Among those working at the time of survey, self-employed survivors had made a larger reduction in working hours compared to pre-diagnosis, but they still worked more hours per

week post-diagnosis than salaried survivors. The self-employed had received less financial compensation when absent from work post-cancer, and more self-employed, than salaried, survivors reported a negative financial change due to the cancer. There were differences between self-employed and salaried survivors in physical job demands, work ability and quality-of-life but the direction and magnitude of the differences differed across countries.

Discussion Self-employed and salaried CS differ when it comes to RTW-related outcomes, but the patterns vary between countries. Support should be provides to self-employed survivors to help them balance their health needs with those of their business.

834 FULL-SHIFT HAND-ARM VIBRATION MEASUREMENTS AMONG ROCK DRILLERS

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Introduction Rock drills expose workers to high levels of hand-arm vibration, and extensive use of these tools give an increased risk of hand-arm vibration syndrome. Hand-arm vibration exposure can be difficult to estimate by using the task-based method because of an intermittent exposure pattern and changing working conditions throughout the work shift. New advances in measurement technology make it possible to perform full-shift measurements at the workplace.

Methods Hand-arm vibration exposure for rock drillers/rock face stabilisers in Norway was assessed by full-shift field measurements with Svantek SV103 vibration metres on both right and left hand simultaneously.

Result The mean daily vibration exposure for the rock drillers was 4.9 m/s^2(A8) (range 2.7–8.8) for the right hand and 4.4 m/s^2(A8) (1.0–7.0) for the left hand, based on 17 full-shift measurements. The mean exposure magnitude from the tools was 14.0 m/s^2 (9.2–20.0). For 12 of the 17 measurements the exposure was highest on the dominant hand.

Discussion The full-shift method was practical to implement in the field measurements, and should be considered as an alternative to the task based method. This method has the potential to reduce the uncertainties associated with unpredictable changes in exposure like changing hardness of the rock. The daily exposure to hand-arm vibrations for the rock drillers was high compared to the occupational exposure limit. Thus, implementation of efficient strategies to reduce vibration exposure is important.

850 OCCUPATIONAL HEALTH AND THE SOCIAL DETERMINANTS OF HEALTH: IDENTIFYING THE ETHICAL ISSUES

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Introduction 'Job security increases health, wellbeing and job satisfaction. Higher rates of unemployment cause more illness and premature death'. Encouraging individuals to be at work can be beneficial, but it also raises questions such as: Do the socially disadvantaged have access to opportunities to improve their health? Do they have fair access to health-enhancing 'good' work? OH professionals can have an important influence in matters of health and work, both at 'front line' and policy levels. This paper identifies the ethical issues that arise in the wider social determinants of health (SDOH) discourse, from an OH perspective.

Methods An applied ethics analytical approach was used to examine the relationship between OH and SDOH, especially in terms of worklessness arising from ill-health. The capability approach as a theory of justice was used. Specifically, a concept of health justice when one is unable to work through ill-health or disability was explored.

Results Areas of ethical concern:

- The medicalisation of the ill–health assessment process, whereas societal factors are ignored.
- The extension of 'responsibilisation', i.e. making individuals responsible for their ability to work as well as for their health.
- Ethical tensions for OH practitioners when their relationship with the worker may not be the traditional 'doctor–patient' one.

Discussion Unemployment, job insecurity and sickness absence are serious problems, impacting on the health of individuals and society, and a financial burden to employers and the State. However, although it may be desirable for individuals to be in employment to improve their health, there is also a danger that those unable to work become stigmatised. So, 'tackling' these problems should be done in fair and ethical ways. A first step is identifying the ethical issues.

87 MUSCULAR ACTIVATION IN VIBRATION PERTURBED HUMAN WALKING AND MODELLING

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Introduction Walking on vibrating floor causes a complex exposure pattern and the superimposition of walk and vibration may induce early muscular fatigue.[1] The problem is relevant is many field, as sea platform or railway transports. The present study studies the leg muscular activation and stride phases during walking under vibration to derive a muscle model in these circumstances.

Methods Subjects walked on a treadmill positioned on a 6-DOF vibrating table. Vibration was imposed at four frequencies (4, 8, 12, 16 Hz) along vertical and transversal direction. The walking speed was set at 1.25 m/s. Surface electromyography (sEMG) of four muscles was recorded. Stride phases were recorded using accelerometers and stride length was