Risks of Occupational Vibration Exposures

VIBRISKS

FP5 Project No. QLK4-2002-02650
January 2003 to December 2006

Annex 1 to Final Technical Report

Title: Protocol for epidemiological studies of hand-transmitted vibration

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European Commission

Quality of Life and Management of Living Resources Programme
Key Action 4 - Environment and Health

7th January 2007

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1. INTRODUCTION

This protocol defines the procedures to be used by partners in VIBRISKS during the conduct of epidemiological studies of hand-transmitted vibration. It is hoped that the document may also be useful for others conducting epidemiological, clinical, or experimental investigations of the effects of hand-transmitted vibration.

Each study is conducted for a slightly different purpose, so not all parts of this protocol will be appropriate for all studies. Nevertheless, it is hoped that the procedures used here may help to avoid unnecessary differences and thereby maximise the comparison of results between studies.

As understanding of the effects of hand-transmitted vibration advances, all of the methods defined here may be improved. A defined method should not be used in preference to any future method that arises as a result of greater understanding.

2. DIAGNOSTIC TESTS

This section summarises the standardised methodology for conducting diagnostic tests so as to provide as sensitive, repeatable, and reproducible results as possible within the constraints of current knowledge, practicality, simplicity and cost.

Diagnostic tests should be performed in the following order:

(i) Measurement of finger skin temperature ($\geq$ 22°C)

(ii) Purdue pegboard test of dexterity

(iii) Jamar grip meter test of grip force

(iv) Thermal aesthesiometer test of thermal thresholds

(v) Tactile vibrometer test of vibrotactile thresholds

(vi) Finger systolic blood pressures (at 30°C and 10°C)

(vii) The measurement of finger re-warming times.

2.1 General considerations

There are several considerations that apply to all tests.

2.1.1 Environment

The tests should be performed in a room of temperature 22°C (± 2°C), airflow should not be noticeable (< 0.2 ms^{-1}).

Subjects should be dressed in light indoor clothing (e.g. shirt and trousers) and they should be habituated to the environment of the test room for at least 15 minutes before tests begin.

The external temperature at the time of the testing shall be reported, together with the most recent 10-year average temperature for that month of the year and the 10-year range of average temperatures for that location.

2.1.2 Noise

Ambient noise level should be below about 50 dB(A), sudden and loud noises should be avoided. Ear defenders are recommended when conducting thermal thresholds tests and must be worn during vibrotactile threshold tests.

2.1.3 Finger skin temperature and room temperature

Finger skin temperature should be measured by a thermocouple attached to the distal phalanx of the right middle finger. Alternatively, finger temperature may be measured by lightly squeezing a thermocouple between the thumb and right middle finger.

The finger skin temperature should be not less than 22°C. When the fingers are at a lower temperature they should be allowed to warm prior to testing.

The tests should be performed in a room of mean temperature 22°C (± 2°C). There should no noticeable fluctuations in room temperature during the tests.

Finger skin temperature and room temperature should be reported to an accuracy of 0.5 °C.

2.1.4 Exclusions

Vibration exposure of the hand should be excluded for 2 hours prior to assessment. Caffeine, alcohol, and nicotine should be avoided immediately prior to testing. Any current medication should be reported with results, especially the monitoring of the use of vasoactive and neuro-active physical and chemical agents prior to measurements is recommended.

2.2 Purdue pegboard

Subjects should sit on a height-adjustable office chair to perform the Purdue pegboard test. The pegboard should be placed on a horizontal bench of 760 mm height. The pegboard should be placed 50 mm from the edge of the bench to avoid stretching of the upper limbs to reach the required pegs.

Prior to performing the test, the purpose should be explained using verbal instructions (see Appendix 1).

Subjects should be instructed to use each hand separately to pick up pegs from the cup on the corresponding side of the board to the hand being tested and place as many pegs in the holes as possible within 30 seconds (see Appendix 1).

A practice should be performed with each hand prior to the test. The test should be completed once for each hand and once for both hands together.

2.3 Jamar grip meter

Subjects should sit on a height-adjustable office chair to perform the hand function tests on a bench of 760 mm height. Prior to performing the test, the purpose should be explained using verbal instructions (see Appendix 2).

Grip strength should be measured using a Jamar 5030J1 hydraulic dynamometer set at the second handle position (i.e. 5 cm setting). Subjects should sit with their elbows flexed to 90°, wrist in neutral position and forearm supported on the bench. They should be instructed to squeeze the dynamometer three times with each hand with a 10 s interval between each attempt.

The average value of the three grip strength attempts should be recorded.

2.4 Thermal thresholds

Thermal thresholds should be measured with the method of limits using a rate of change of temperature of 1°C/s and a reference temperature of 32.5°C (± 2°C).

Measurements should be made on both hands using at least one finger innervated with the median nerve and one finger innervated with the ulnar nerve. Measurements should be made on the fleshy part of the palmar surface of the most distal phalanx of the test digit (i.e. at the centre of the whorl on the distal phalanx).

The stimulus should be applied to the palmar surface of the most distal phalanx of the test digit by means of a smooth flat surface. The phalanx should apply a force of 2 N (± 0.5 N) to this surface. The hand of the subject should be supported at the wrist.

The mean hot and the mean cold threshold should be measured independently, with a minimum of six judgements of each threshold. There should be a delay of at least 3 seconds at the reference temperature between judgements. The first two hot judgements and the first two cold judgements should be ignored when calculating mean threshold values. A minimum of four judgements should be used to calculate a mean threshold.

Table 1 Recommended parameter values for the measurement of thermal thresholds.

Parameter	Value
Push force	2 N ± 0.5 N
Contactor area	2.5 cm x 2.0 cm minimum
Contactor surface	Smooth and planar
Psychophysical method	Method of limits
Reference temperature	32.5°C ± 2°C
Rate of change of temperature	1°C/s (± 0.5°C/s)
Number of judgements	Minimum of six warm or six cold

The mean hot threshold, the mean cold threshold, and the neutral zone (the difference between the mean hot threshold and the mean cold threshold) should be reported. All measures should be reported in degrees Celsius (°C).

The test parameters for determining thermal thresholds are summarised in Table 1.

2.5 Vibrotactile thresholds

Vibrotactile thresholds should be obtained using the up-and-down method of limits (von Békésy method) with sinusoidal vibration. The test frequencies should include 31.5 Hz and 125 Hz.

Measurements should be made on both hands using at least one finger innervated with the median nerve and one finger innervated with the ulnar nerve.

The vibration stimulus should be applied at the centre of the whorl on the most distal phalanx of the test digit by means of a circular contactor, 4 mm (± 2 mm) diameter, concentric to an annular surround, allowing a gap of 2 mm between contactor and surround. The test digit should push on the surround with a force of 2 N (± 0.5 N) and the contactor should either apply a force to the digit of 1 N (± 0.5 N) or indent the skin by an equivalent amount.

Vibrotactile thresholds should be reported in ms^{-2} r.m.s. (or dB with reference to 1.0×10^{-6} ms^{-2} r.m.s.).

The vibration magnitude is increased from zero until a subject perceives the vibration, and responds. The vibration magnitude is then decreased until the subject no longer perceives the vibration, and responds again and the stimulus magnitude begins to rise. This cycle is repeated several times, the test duration at each frequency should be between 30 and 45

Table 2 Recommended parameter values for the measurement of vibrotactile thresholds.

Parameter	Value
Push force	2 N ± 0.5 N
Contactor shape	Cylindrical, 4 mm ± 2 mm
Contactor surface	Smooth and planar
Contactor force[1]	1 N ± 0.5 N
Surround surface	Smooth and circular
Gap	2 mm ± 0.5 mm
Psychophysical method	Up-and-down method of limits
Frequency	31.5 Hz; 125 Hz
Rate of change of stimulus	3 dB/s (6 dB/s during 1st cycle)
Measurement duration	30 - 45 seconds
Number of reversals	Minimum of six

[1] Contactor force or skin indentation should be controlled. If force is not controlled, a skin indentation corresponding to a 1-N force should be used (current information suggests that a skin indentation of 1 mm may be appropriate).

seconds. The rate of change of stimulus level may be 6 dB/s during the first cycle but 3 dB/s for all subsequent cycles.

The threshold should be calculated from the mean of the average peak and the average trough. The first cycle (i.e. first peak and first trough) should be ignored when calculating the threshold. The measurement should be repeated if less than six cycles are completed or if either the peaks or the troughs vary by more than about 10 dB within themselves.

Test parameters for determining vibrotactile thresholds are summarised in Table 2.

2.6 Finger systolic blood pressures

Prior to measurements of finger systolic blood pressures, workers should acclimatise in the thermal environment at 22°C ±2°C for 15 minutes.

Subjects should be sitting or lying comfortably during the test. The hands should be supported at the level of the heart, with the wrists held straight during blood pressure measurements. Support for the hands should make as little skin contact as possible.

The measurement of the finger systolic blood pressures (FSBPs) on all fingers (not including the thumbs) is preferred. If finger systolic blood pressure measurements are not obtained on all digits of both hands, the digits most affected by symptoms of blanching should be tested.

Finger systolic blood pressures should be obtained simultaneously with reference measures from the thumb. A single-inlet air-inflated cuff should be placed around the proximal phalanx of the thumb (reference digit). If the thumb is damaged or is missing, the middle phalanx of

Table 4 Recommended test parameters for the measurement of finger systolic blood pressures.

Parameter	Value
Cuff size	width 24 mm
Cuff location	middle phalanx (proximal phalanx of the thumb)
Transducer location	distal phalanx
Cooling period	5 minutes
Cuff deflation rate	< 3 mmHg/s
Water temperature	30°C, 10°C (± 1°C)

an alternative digit may be used as the reference. If the thumb is reported as blanching, it should still be used as the reference site but this should be reported.

Double-inlet, water-perfused cuffs should be placed around the middle phalanges of the test digits (for practical reasons, the proximal phalanx may be used for the little finger). The inner surface of the cuff should remain contiguous with the entire surface of the test site throughout the pressure cycle.

Transducers (mercury in silastic strain gauges) should be attached around the distal phalanges of the reference digit and the test digits to measure the return of blood flow. The transducers must be sensitive to the return of blood flow in the digital arteries during cuff deflation and should not interfere with the circulation.

The fingers should be squeezed for 5 seconds and then suprasystolic pressure (at 250 mmHg) applied simultaneously to all cuffs. Water, controlled at the required temperature, should then perfuse the double-inlet cuffs for five minutes. After thermal provocation, water should cease circulating whilst the cuffs are slowly deflated (at < 3 mmHg/s).

Finger systolic blood pressure should be measured after thermal provocation at 30°C ± 1°C and after thermal provocation at 10°C ± 1°C. Cuffs should not restrict finger circulation during a recovery period.

Percentage finger systolic blood pressures should be calculated using the formula:

$$\%\mathrm{FSBP} = \frac{FSBP_{TEST,10^{\circ}C}}{FSBP_{TEST,30^{\circ}C} - \left(FSBP_{REF,30^{\circ}C} - FSBP_{REF,10^{\circ}C}\right)}$$

where *%FSBP* is the percentage finger systolic blood pressure; $FSBP_{TEST,10°C}$ is the finger systolic blood pressure of the test finger after thermal provocation at 10°C; $FSBP_{TEST,30°C}$ is the finger systolic blood pressure measured on the test digit after thermal provocation at 30°C; $FSBP_{REF,30°C}$ is the finger systolic blood pressure measured on the reference digit (e.g.

thumb) after thermal provocation of the test digit at 30°C; $FSBP_{REF,10°C}$ is the finger systolic blood pressure measured on the reference digit after thermal provocation of the test digit at 10°C.

The external temperature at the time of the testing shall be reported, together with the most recent 10-year average temperature for that month of the year and the 10-year range of average temperatures for that location.

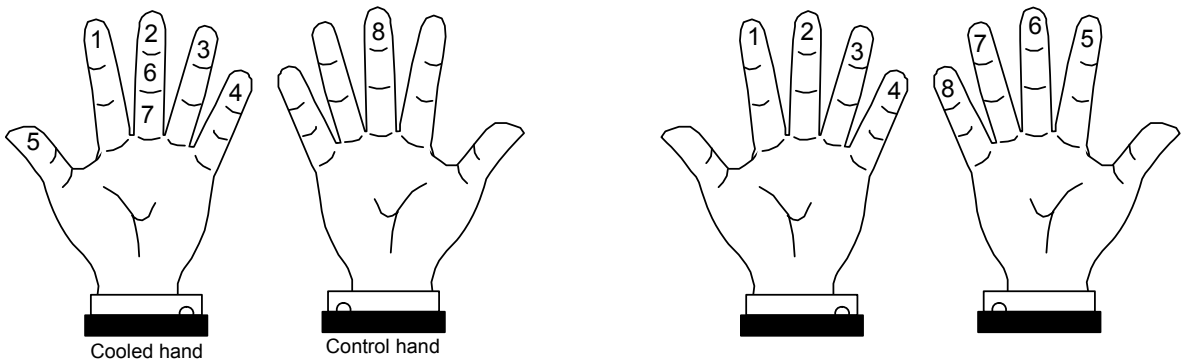
2.7 Finger re-warming test

When using the re-warming test as the only cold provocation test during an examination, both hands should be tested simultaneously. When performing both the re-warming test and the finger systolic blood pressure test, the fingers systolic blood pressures should be measured first; only one hand may then be cooled in the re-warming test, the other hand being used as a control.

The fingers to be tested should have attached to them thermocouples (or similar transducers) at the sites suggested in Figure 1, numbered in order of recommended importance. The thermocouples should not be attached with adhesive tape wrapped around the finger, as this may inhibit blood flow.

The hands and fingers should be kept dry during immersion by means of a waterproof covering. The covering should provide little thermal insulation between the hands and the water. The hands should not be maintained in an ischaemic state during immersion and the waterproof covering should not be tight enough to interrupt blood supply to the skin.

Skin temperatures should be recorded continuously, commencing with a 5-minute settling



(a) Cold provocation of one hand only

(b) Cold provocation of both hands

Figure 1 Recommended positions for transducers (e.g. thermocouples) in the measurement of re-warming times for: (a) cooling of one hand only, and (b) cooling of both hands.

period. The test hand should then be immersed into water controlled at 15°C ± 1°C for a

period of 5 minutes (Table 3). The hand(s) should be submerged to the level of the wrist on both the palmar and the dorsal surfaces.

Table 3 Recommended test parameters for the measurement of finger re-warming times.

Parameter	Value
Water temperature	15°C (± 1°C)
Settling period	5 minutes
Immersion period	5 minutes
Recovery period	15 minutes
Hand conditions during immersion	Dry, non-ischaemic

The waterproof covering should be removed from the hands when they are removed from the water after the 5-minute period of cold provocation.

The hands should be allowed to re-warm for a period of 15 minutes, or until the skin temperature during the settling period is reached, whichever is sooner. The re-warming curve for each measurement location from the beginning of the settling period to the end of the test should be reported. A summary of recommended test parameters is given by Lindsell and Griffin (2001).

3. COLOUR CHARTS

Colour charts may be used to assist the identification of colour changes in the hands and fingers. So as to avoid influencing responses to the questionnaires, the colour charts in Appendix 3 must not be shown to the patient until after the completion of the questionnaires.

The photographs show various normal and abnormal colours of the whole hand (e.g. normal, whiteness, cyanosis, hyperaemia, patching, etc.).

Patients should be asked three questions:

Have you experienced any of these colour changes in your fingers or hands?
If yes …

(i) Which part (identify by label)?

(ii) When do these colour changes occur?

4. DIAGNOSIS OF CARPAL TUNNEL SYNDROME

The diagnosis of carpal tunnel syndrome (CTS) may be made according to the consensus criteria for the classification of CTS in epidemiologic studies as proposed in the paper by Rempel *et al.* (*Am J Publ Health* 1998; 88:1447-1541).

According to the group consensus, the combination of electrodiagnostic study findings and symptom characteristics provides the most accurate CTS diagnosis. However, in the absence of electrodiagnostic findings, combinations of symptoms characteristics and physical examination provide the greatest diagnostic information.

There is no single best scheme for assessing CTS symptoms. A recommended classification of symptom quality and location for use with hand diagrams or focused questions is reported in Table 4 (Katz *et al.*, *J Rheumatol* 1990; 17:1495-1498); Franzblau et al., *J Occup Rehabil* 1994; 4:185-198).

Little information is available on the predictive value of symptom duration or symptom frequency. Franzblau *et al.* (*J Occup Rehabil* 1993; 3:1-14; *Scand J Work Environ Health* 1999; 25:115-124) required symptoms on at least three separate episodes or at least one episode lasting greater than one week within the past year. De Krom *et al.* (*Am J Epidemiol* 1990; 132:1102-1110) required symptom frequency of at least twice per week.

A positive physical examination (PE) is based on Tinel's test, Phalen's test, 2-point discrimination, or carpal compression test.

In VIBRISKS epidemiological studies, *all* the following criteria are required for the 'clinical suspicion' of carpal tunnel syndrome:

(i) **classic/probable symptoms** (numbness, tingling, burning or pain in at least two of the digits 1, 2 or 3);

(ii) **nocturnal symptoms**;

(iii) **positive physical examination** (Tinel's test or Phalen's test).

Table 4 Classification of carpal tunnel syndrome

Symptom	**Description**
Classic/probable	Numbness, tingling, burning, or pain in at least 2 of digits 1, 2, or 3. Palm pain, wrist pain, or radiation proximal to the wrist is allowed
Possible	Tingling, numbness, burning, or pain in at least 1 of digits 1, 2, or 3
Unlikely	No symptoms in digits 1, 2, and 3

The Clinical Questionnaires (Appendix 6b and 6d) include the above-mentioned criteria:

(i) Sections 5.2 and 5.3 include questions on:

   a. tingling and numbness symptoms;

   b. presence of sensorineural symptoms during night;

   c. symptom distribution (hand diagrams).

(ii) Sections 5.4 and 5.5 include other finger and wrist symptoms, such as pain, stiffness, and weakness, as well as the possible effects of such symptoms.

(iii) Section 6.3 includes the findings of physical examination (Tinel's test and Phalen's test).

It is a responsibility of the clinician to advise the affected worker to seek electrodiagnostic testing (including nerve conduction velocity) for a definitive diagnosis of carpal tunnel syndrome.

5. CLINICAL TESTS FOR THE DIAGNOSIS OF UPPER LIMB DISORDERS

Appendix 4 provides brief definitions of the clinical tests sometimes used when assessing patients exposed to hand-transmitted vibration.

6. CRITERIA FOR CLINICAL DIAGNOSES OF NECK AND UPPER LIMB MUSCULOSKELETAL DISORDERS

Appendix 5 provides criteria for the clinical diagnosis of some neck and upper limb musculoskeletal disorders.

7. REPORTED AND OBSERVED EXPOSURE DURATIONS

It is not easy to obtain an accurate estimate of the duration of exposure to hand-transmitted vibration. There can be differences between actual and estimated durations of exposure.

For research purposes, it is desirable to obtain accurate estimates of the durations of exposures to hand-transmitted vibration. This may require direct observation or indirect measurement of the duration of vibration exposure.

The discrepancy between actual and estimated durations of exposure has not been recognized in the evolution of dose-response relationships in guidance on the risks arising from hand-transmitted vibration. In consequence, since actual exposures are often less than estimated exposures, accurately measured exposure durations may underestimate the risk if they are compared with current guidance.

8. MEASURES OF VIBRATION DOSE

Appendix 6 defines alternative measures of vibration dose for research investigations. The measures include those in past and current standards, but also include some to assist the development of a better understanding of the relative importance of vibration magnitude, vibration frequency, vibration direction, and duration of vibration exposure.

9. SUMMARY OF VIBRATION EXPOSURES AND EFFECTS

Appendix 7 lists an example summary table that combines typical summary descriptions of the exposed population and their exposures to hand-transmitted vibration with typical summary descriptions of relevant aspect of their health.

The table in Appendix 7 is given for the purposes of illustration only since the actual measures will vary according to the objectives of each study.

In addition to the tabular summary, epidemiological studies should provide the information in Table 5.

Table 5 Information to be included in epidemiological studies of hand-transmitted vibration

1. Prevalence of vascular, sensorineural, and musculoskeletal symptoms at the cross-sectional survey of the study population
2. Main results of objective tests at the cross-sectional survey
3. Incidence of vascular, sensorineural, and musculoskeletal symptoms at the follow up survey(s) of the study population
4. Comparison of objective test results between the cross-sectional and follow up survey(s)
5. Metrics of vibration exposure and ergonomic risk factors used according to HTV procedure manual
6. Possible exposure-response (for symptoms) or dose-effect (for objective test results) relationships at the cross-sectional survey
7. Possible exposure-response (for symptoms) or dose-effect (for objective test results) relationships for the changes in the outcomes over time during the follow up period(s)
8. Contribution of the two exposure factors (vibration magnitude and duration of exposure) used to construct doses for the prediction of the outcomes (symptoms and objective test results) over time, adjusted for personal, social and health covariates

10. QUESTIONNAIRES

Four questionnaires are provided: a Self-administered Questionnaire (Appendix 8a) and a Clinically administered Questionnaire (Appendix 8b), and similar follow-up questionnaires (a

Self-administered Follow-up Questionnaire in Appendix 8c, and a Clinically Administered Follow-up Questionnaire in Appendix 8d).The clinically administered questionnaires should be administered by health professionals.

The six-page Self-administered Questionnaire (Appendix 8a) includes basic questions on personal identification, social history with reference to smoking and drinking habits, and medical history. Self-reported vascular, sensorineural, and musculoskeletal complaints in the upper extremities (finger colour changes, tingling, numbness, pain in the neck and upper limbs, and effects of symptoms in the hands and fingers) are investigated in detail so as to test agreement between self-administered questionnaire and interview with the clinically administered questionnaire.

For purpose of comparison, the Self-administered Questionnaire (Appendix 8a) must be completed before the Clinically-administered Questionnaire (Appendix 8b).

The Clinically-administered Questionnaire includes a comprehensive set of questions devoted to personal, occupational, social, medical, and symptom histories, as well as a section dedicated to physical examination with particular reference to vascular, neurological and musculoskeletal systems. Exposure to hand-transmitted vibration and ergonomic risk factors are extensively investigated in an ad-hoc section of the Clinically-administered questionnaire.

Personal, social, and medical histories in the Clinical administered Questionnaire provide more details than those included in the Self-administered Questionnaire, whereas questions on symptoms in the finger-hand-arm system are almost identical in both questionnaires.

In all VIBRISKS epidemiological studies, past and present occupational exposures to hand-transmitted vibration must be assessed in terms of job title(s), types of tool used, and exposure duration when tool is operated and hands are in contact with vibration.

For current jobs only, ergonomic risk factors during an average working day are assessed in terms of repetitive movements, manual handling, lifting, and prolonged or uncomfortable carrying, pushing or pulling of loads.

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APPENDIX 1 Purdue pegboard patient instructions

Purdue pegboard patient instructions

When the person is seated comfortably at the table in the correct posture, the examiner should give the following instruction.

"*This is a test to see how quickly and accurately you can work with your hands. Before you begin each part of the test, you will be told what to do and then you will have an opportunity to practice. Be sure you understand exactly what to do".*

Before each hand is tested, the required task is demonstrated. Begin by saying and demonstrating

"*Pick up one pin at a time with your right hand from the right hand cup. Starting with the top hole, place each pin in the right hand row.* (Leave the pin used for demonstration in the hole). *Now you may insert a few pins for practice. If during the testing time you drop a pin, do not stop to pick it up. Simply continue by picking another pin out of the cup".*

Correct any errors made in placing the pins and answer any questions. When the subject has inserted three or four pins and appears to understand the operation, say:

"*Stop. Now take out the practice pins and put them back into the right hand cup."*

Then say:

"When I say 'Begin' place as many pins as you can in the right-hand row starting with the top hole. Work as rapidly as you can until I say 'Stop'""".

" Are you ready? Begin"

Start timing when you say 'Begin'. At the end of exactly 30 seconds, say

"*Stop".*

Count the number of pins inserted and record the score for the right hand. This is the total number of pins the subject placed with the right hand.

Directions for the left hand test and both hands test are similar to those for the right hand test.

APPENDIX 2 Jaymar grip meter patient instructions

Jaymar grip meter patient instructions

When the person is seated comfortably at the table in the correct test posture, the following instruction should be given by the examiner, following a demonstration of the procedure by the examiner.

"*The purpose of this is to test your maximum hand grip strength. You will be asked to repeat this three times with each side beginning with your right (*or left if appropriate*) side. Please hold the grip strength meter in a comfortable position and when you are ready squeeze the handle as hard as you are able. After one maximum squeeze relax your hand and I will take the meter from you and record the measurement".*

After recording the measurement the examiner will hand back the meter to the subject then give the following instruction

"When I say 'Begin' I would like you to repeat the test you have just done by giving the meter another hard squeeze with your hand"

This procedure should be repeated once more to give a total of three measurements per hand tested. Then the subject should change position to their other (non dominant) hand and the whole test process is repeated.

APPENDIX 3 Colour charts

1. Administration of colour charts

Patients should be shown the colour chart (see next page) and asked three questions:

(i) Have you experienced any of these colour changes in your fingers or hands?

If YES.....

(ii) Which part (identify by label)?

(iii) When do these colour changes occur?

2. Vibration-induced white finger

Only the colouration indicated by the two areas labelled 1A is indicative of finger blanching associated with vibration-induced white finger.

3. Labelling of colour charts

The conditions reflected in the colour charts are as follows:

0A = normal colour of fingers

0B = normal colour of hand palm

1A = white finger

1B = white patching of hand palm

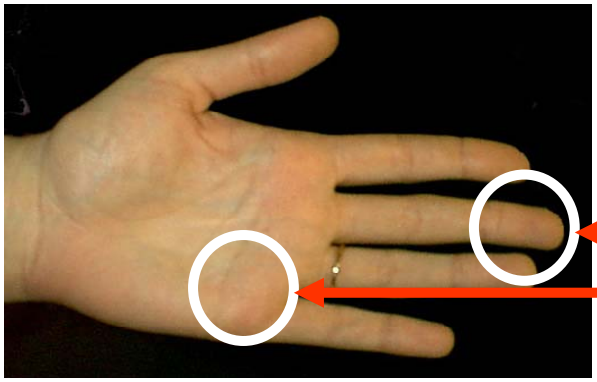
2A+2B = acrocyanosis

3A = cyanosis of fingers

3B = bluish patching of hand palm

4A = redness of fingers

4A+4B = erythromelalgia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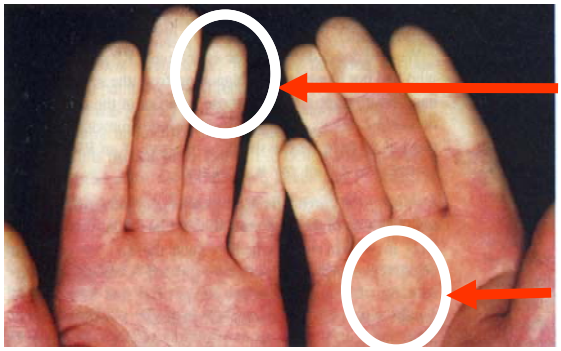
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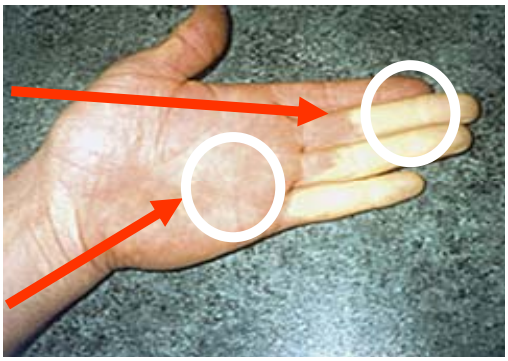

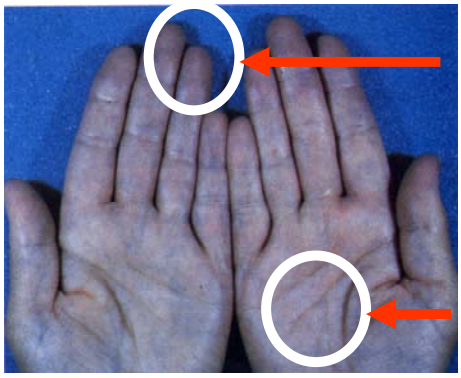
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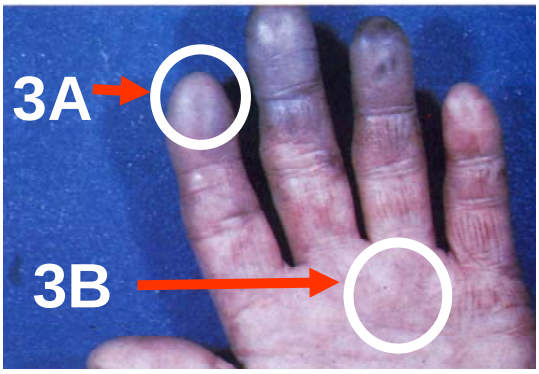

3A
3B


4 B
4 A

APPENDIX 4 Clinical tests for the diagnosis of upper limb disorders

CLINICAL TESTS FOR THE DIAGNOSIS OF UPPER LIMB DISORDERS

Carpal tunnel syndrome

Tinel's sign. This test, if positive, is consistent with the presence of carpal tunnel syndrome. The subject's hand and forearm are rested horizontally on a flat, firm surface with the palm uppermost. The examiner places his/her index finger over the carpal tunnel at the wrist and applies a sharp tap to it with a tendon hammer. The complaint of pain or tingling in the subject's fingers (thumb, index, or middle finger) indicates median nerve compression at the wrist. A positive Tinel's sign over the Guyon's tunnel or the cubital tunnel suggests ulnar nerve compression at the wrist or the elbow, respectively.

Phalen's test. This test, if positive, is consistent with the presence of carpal tunnel syndrome. The subject raises his/her arms to chin level and then allows both hands to flex at the wrist by gravity. This posture should be maintained for one minute. Pain, tingling, or numbness in the median-nerve distribution of the hand is indicative of compression of the median nerve under the carpal ligament.

Thoracic outlet syndrome

Adson's test. This test is designed to detect the vascular component of the thoracic outlet syndrome. During deep inspiration, with the head rotated to the side being tested and the arm abducted, the radial artery at the wrist is palpated. In presence of subclavian obstruction, the radial pulse is reduced or absent.

Roos's test. This test is designed to detect the neurogenic component of the thoracic outlet syndrome. The subject sits erect and elevates both arms to the 90° abduction-external-rotation position with the elbows slightly braced back of the frontal plane. The subject is then asked to open and close his/her hands slowly for three minutes. Patients with thoracic outlet syndrome develop progressive distress and reproduction of their usual symptoms such as pain in the neck, shoulder and/or arms; numbness and/or tingling of the extremities; heaviness, fatigue, and weakness of the arm and/or hand.

Vascular function of the hand

Allen's test. This test examines the patency of the palmar arches and the digital arteries. The examiner uses the fingers of each hand to compress the radial and ulnar arteries at the wrist and then raises the subject's hand while the subject opens and closes the hand for 20

seconds to empty the palmar arches and subcutaneous vessels. The hand is then lowered and one of the arteries released. Prompt flushing of the hand indicates a normal contribution from the tested artery. Faint and delayed flushing of the fingers (more than five seconds) indicates that either the deep palmar or the digital arteries may be occluded. The test is also used for the diagnosis of the hypothenar hammer syndrome which consists of symptoms and signs of digital ischaemia caused by thrombosis and/or aneurysm of the ulnar artery and/or the superficial palmar arch. It should be noted that normal anatomical variations may give rise to false positive results.

Lewis Prusik test. This test is designed to assess capillary circulation. Pressure is applied to the nail bed for ten seconds and, on release, normal colour should return in two seconds or less. The method is poorly standardised.

De Quervain's disease

Finkelstein's test. This test, if positive, is consistent with the presence of De Quervain's disease (inflammation of the tendons to the long abductor and the short extensor muscle of the thumb). The subject makes a fist over the thumb, which is flexed into the palm, followed by ulnar deviation of the wrist. This maneuver increases the excursion of the first dorsal compartment tendons and leads to significant discomfort in individuals affected with De Quervain's disease.

Cervical nerve root disorder

Spurling's test. This is a test for cervical nerve root disorder. The patient's cervical spine is placed in extension and the head rotated toward the affected shoulder. An axial load is then placed on the neck. Reproduction of the patient's shoulder or arm pain indicates possible cervical nerve root compression and warrants further evaluation of the bony and soft tissue structures of the cervical spine.

APPENDIX 5 Criteria for clinical diagnoses of neck and upper limb musculoskeletal disorders

CRITERIA FOR CLINICAL DIAGNOSES OF NECK AND UPPER LIMB MUSCULOSKELETAL DISORDERS

Disorder	Symptoms and signs
Acromioclavicular syndrome	Local pain and tenderness at the acromioclavicular joint, pain at the end of abduction or in adduction of the arm over the chest
Bicipital tendinitis	Anterior shoulder pain, pain over the long head of biceps tendon on resisted flexion of the elbow (Speed's sign) or on resisted supination of the forearm with the elbow flexed 90° (Yergason's test)
Carpal ganglia (cysts arising from a joint or tendon sheath)	Firm mass or fullness over the dorsum of the wrist at the radiocarpal joint or at the palmar aspect of the wrist just radial to the flexor carpi radialis tendon, often asymptomatic, occasionally complaints of aching or discomfort of the wrist exacerbated by activity, rarely loss of wrist motion secondary to pain
Carpal tunnel syndrome (median nerve entrapment at the wrist)	Pain, paraesthesia, or numbess in the median nerve distribution of the hand, nocturnal exacerbation of symptoms, sensory loss in three and a half fingers on the radial side of the hand, positive Tinel's sign over the carpal tunnel, positive Phalen's test, weakness in pinching or gripping, atrophy of abductor pollicis brevis
Cervical syndrome	Neck pain radiating to one or both arms, numbness in the hands, limited neck movements, radiating pain provoked by test movements, diminished muscle force of the deltoid, triceps, and biceps muscles
Cubital tunnel syndrome (ulnar nerve entrapment at the elbow)	Pain, paraesthesia, or numbness in the ulnar nerve distribution of the hand, sensory loss in 4^{th} and 5^{th} fingers, positive Tinel's sign over the cubital tunnel, decreased strength in spreading the fingers and in flexion of the distal phalanx of 5^{th} finger, loss of power grip, atrophy of hypothenar and interosseus muscles
De Quervain's disease	Pain over the radial styloid, tender swelling of the first extensor compartment, pain on resisted thumb extension or positive Finkelstein's test
Dupuytren's contracture (palmar fibromatosis)	Nodules, thickening or retraction of the skin, cords, and bands on the palmar surface of the hands and fingers, and, finally, progressive and irreversible flexion of the fingers, mostly the ring finger followed by the little finger
Epicondylitis	Pain at the epicondyle either during rest or motion, local tenderness at the lateral or medial epicondyle, pain during resisted extension of the wrist and fingers (lateral epicondylitis), pain during resisted flexion of

	the wrist and fingers (medial epicondylitis)
Frozen shoulder syndrome	Pain in the deltoid area (often nocturnal and related to activity), restricted and painful active and passive movements of the shoulder in a capsular pattern (external rotation > abduction > internal rotation)
Guyon's syndrome (ulnar nerve entrapment at the wrist)	Pain, paraesthesia, or numbness in the ulnar nerve distribution of the hand, sensory loss in 4^{th} and 5^{th} fingers, positive Tinel's sign over the Guyon's tunnel, decreased strength in spreading the fingers
Hypothenar hammer syndrome	Paraesthesias, numbness, cold sensitivity, colour changes without cold exposure in the affected hand, positive Allen's test
Pronator syndrome (median nerve entrapment at the forearm)	Pain in the proximal forearm, pain and numbness in radial side of palm and palmar side of first three and a half fingers, local tenderness over the edge of m. pronator teres, pain and decreased strength in pronation, decreased flexion strength of the wrist and/or of the distal phalanxes of 1^{st} and 2^{nd} fingers
Shoulder tendinitis	Pain in the deltoid region, limited and painful resisted movements (abduction of the supraspinatus; external rotation of the infraspinatus and teres minor; internal rotation of the subscapularis)
Tenosynovitis of the wrist	Pain on movement localised to the affected tendon(s) in the wrist, palpable tenderness of the tendon(s), local swelling, pain on resisted active movement of the affected tendon(s) with the forearm stabilised, weakness in gripping
Tension neck syndrome	Neck pain, feeling of fatigue or stiffness in the neck, headache radiating from the neck, muscle tightness, palpable hardenings and tender spots in muscles, straightening of the cervical spine
Thoracic outlet syndrome	Pain and paraesthesia radiating to an upper limb, fatigability or weakness in the arms, numbness of an upper limb while sleeping, coolness and Raynaud-like symptoms, tenderness in the shoulder pouch (Morley's sign), bruit in infraclavicular area, positive Adson's test and/or positive Roos test, drooping shoulder
Trigger finger (stenosing tenosynovitis of the digital flexor tendons)	Tenderness along the palmar flexor tendon sheath over the first annulary pulley in the distal palm with discomfort on repeated digital flexion, difficulty initiating extension of the fingers or thumb from a flexed position with accompanied pain, palpable nodule on the flexor tendon accentuated with active flexion and extension of the involved finger, inability to completely extend the finger ("locked" or incarcerated trigger finger)
Unspecified MS symptoms (cumulative trauma disorders,	Recurring or persistent pain, aching, numbness, stiffness or weakness across the upper limbs with concomitant

occupational cervicobrachial disorders, repetitive strain injuries, overuse syndrome)	headache, loss of function, muscle tenderness, slowing of fine movements, unspecified findings on clinical examination and failure to meet the diagnostic criteria for other specific diagnoses and diseases

APPENDIX 6 Alternative measures of vibration dose

1. INTRODUCTION

This document specifies the method of calculating measures of dose for exposures to hand-transmitted vibration to be used in the epidemiological studies of hand-transmitted vibration.

The methods are offered here may be useful in the development of epidemiological studies but it is recognized that many alternative measures of dose are possible. The guidance may be further developed in the light of experience gained while using the methods defined.

The procedures defined allow some flexibility depending on the type and quality of data obtained in individual studies.

2. SOURCE OF DATA

The information from which dose measures are calculated is of two types: (i) measures, or estimates, of vibration magnitude and (ii) measures, or estimates, of exposure duration.

2.1 Vibration magnitude

The vibration magnitude should be measured in three orthogonal axes in accord with ISO 5349-1 and ISO 5349-2.

The vibration should be evaluated using two different frequency weightings:

(i) With no frequency weighting but band-limiting filters at 6.3 and 1250 Hz so as to produce $a_{x,uw}$, $a_{y,uw}$, $a_{z,uw}$.

(ii) With frequency weighting W_h, as defined in ISO 8041 (with band-limiting filters at 6.3 and 1250 Hz), so as to produce $a_{x,w}$, $a_{y,w}$, $a_{z,w}$.

For the calculation of the dose, the root-sums-of-squares (sometimes referred to as the 'vector sum') should be used to obtain for each tool, n, both the unweighted acceleration, $a_{uw(n)}$, and the weighted acceleration, $a_{uw(n)}$:

$$a_{uw(n)} = (a^2_{x,uw} + a^2_{y,uw} + a^2_{z,uw})^{½}$$

$$a_{w(n)} = (a^2_{x,w} + a^2_{y,w} + a^2_{z,w})^{½}$$

It is recommended to also calculate a measure of the variability in the value of $a_{uw(n)}$ and $a_{w(n)}$ and consider the influence of this variability on the measures of dose calculated below.

2.2 Exposure duration

It is not easy to obtain an accurate estimate of the duration of vibration exposure. There can be differences between actual and estimated durations of exposure, and this has not been recognised in the evolution of dose-response relationships in current guidance.

2.2.1 Measurement of exposure duration

It is desirable to obtain objective measures of the duration of vibration exposure. For some tools and processes, the actual duration of exposure can be very different from the duration judged by the operator of the tool. Both the actual duration of exposure and the estimated duration of exposure are useful measures.

It is particularly useful to obtain objective measurements of exposure durations for comparison with self-reported exposures using the questions in the questionnaire.

2.2.2 Estimation of exposure duration

The exposure duration may be estimated from self-reported exposures using the VIBRISKS questionnaires.

At Section 2.1, the questionnaire requires responses to the following question:

> Does your current job involve the use of powered tools that vibrate your hands? No ☐ Yes ☐
>
> If no, go to question 2.2
>
> If yes, which tools are you using?
>
> Duration tool is operated and hands are in contact with vibration

Tools used	Minutes per day	Days per week	Weeks per year	No. of years
1_____	_____	_____	_____	_____
2_____	_____	_____	_____	_____

Sources of error

1. Workers may be confused between:
   (i) duration of exposure to hand-transmitted vibration,
   (ii) duration of holding the tool
   (iii) duration of work that primarily involves using the tool
2. Workers may find it difficult to give an average duration and may report:
   (i) the greatest exposure duration
   (ii) the greatest common exposure duration
   (iii) their estimate of an average exposure duration
3. The cumulative durations calculated from the questionnaire may not be reasonable. For example, the durations may correspond to more than 8 hours per day when this is known to be not correct.
4. Use of tools may not occur on every day.

3. CALCULATION OF DOSE

It is possible to calculate very simple measures of dose if it is assumed that the current exposure is representative of all past years of exposure. In practice, exposure will have varied – and this greatly complicates some commonly used measures of dose, such as $A(8)$. Consequently, various measures are defined below. The values are shown with excessive accuracy to assist the checking of calculations.

Table 1 Exposure duration and vibration magnitude for each tool or machine *i.*

Tool, n	n	Start year	End Year	Minutes per day	Days per week	Weeks per year	Number of years	Total hours per tool	Acceleration	
									UNweighted	Weighted
				$t_{m(n)}$	$t_{d(n)}$	$t_{w(n)}$	$t_{y(n)}$	$t_{T(n)}$	$a_{uw(n)}$	$a_{w(n)}$
Chain saw A	1	1985	1995	60	5	30	10	1500	40	5.5
Chain saw B	2	1995	2005	30	5	30	10	750	30	4
Brush saw	3	1997	2002	45	3	15	5	168.75	25	5

Table 2 Dose measures to be calculated (using information from Table 1 as an example).

Dose	Formula	Value	Description	Units
Dose 1	Σt_{Ti}	2418.75	Total hours exposure	h
Dose 2	$\Sigma a_{wi} t_{Ti}$	12093.75	at weighted total dose	$ms^{-2}.h$
Dose 3	$\Sigma a_{wi}^{2} t_{Ti}$	61593.75	a^2t weighted total dose	$m^2s^{-4}.h$
Dose 4	$\Sigma a_{wi}^{4} t_{Ti}$	1670062.5	a^4t weighted total dose	$m^4s^{-8}.h$
Dose 5	$\Sigma a_{uwi} t_{Ti}$	86718.75	at unweighted total dose	$ms^{-2}.h$
Dose 6	$\Sigma a_{uwi}^{2} t_{Ti}$	3180468.75	a^2t unweighted total dose	$m^2s^{-4}.h$
Dose 7	$\Sigma a_{uwi}^{4} t_{Ti}$	4513417969	a^4t unweighted total dose	$m^4s^{-8}.h$
Dose 8	$\lvert a_w \rvert_{max}$	5.5	a - max weighted any tool	ms^{-2}
Dose 9	$\lvert a_{uwi} \rvert_{max}$	40	a - max unweighted any tool	ms^{-2}
Dose 10	(Current date) – (date current job started)	20	Total years exposure	y
Dose 11	$\lvert \Sigma t_{mi} \rvert_{max}$	60	Max daily exposure each tool	minutes
Dose 12	$A_w(8) = \lvert (\Sigma(a_{wi}^2 t_{mi})/(60 \,.\, T_{(8)}))^{½} \rvert_{max}$	1.944543648	Max weighted A(8) each tool	ms^{-2}
Dose 13	$A_{uw}(8) = \lvert (\Sigma(a_{uwi}^2 t_{mi})/(60 \,.\, T_{(8)}))^{½} \rvert_{max}$	14.14213562	Max unweighted A(8) each tool	ms^{-2}
Dose 14	$A_w(8) = (\Sigma(a_{wi}^2 t_{mi})/(60 \,.\, T_{(8)}))^{½}$	1	Current weighted A(8)	ms^{-2}
Dose 15	$A_{uw}(8) = (\Sigma(a_{uwi}^2 t_{mi})/(60 \,.\, T_{(8)}))^{½}$	7.5	Current unweighted A(8)	ms^{-2}
Past exposure	Hours of exposure to hand-transmitted vibration in previous jobs (see Section 3.2).	see questionnaire	Hours exposure to HTV in previous jobs (Section 3.2).	h
Leisure exposure	Hours of exposure to hand-transmitted vibration in leisure (see Section 3.3).	see questionnaire	Hours exposure to HTV in leisure (Section 3.3).	h

3.1 Current job

Table 1 summarises the information on the durations of exposure and the magnitudes of hand-transmitted vibration that should be obtained for each individual over the period of current employment. The table shows an example for an individual who used three different tools at various times during the period of employment.

Table 2 summarises the dose measures that should be calculated for each individual using the information on individual exposure duration and tool vibration in Table 2.

3.2 Past jobs

There are four alternative ways of using the questionnaire information on past exposure to hand-transmitted vibration.

3.2.1 Keep as separate dose measures

The dose for past jobs is calculated as for the current job and retained as separate variables for use in statistical analysis.

3.2.2 Combine past and current dose

The dose for past jobs is calculated as for the current job and summed with the dose from current jobs. The summation is linear addition of the two doses for dose 1 to dose 7 and for dose 10. For other doses, the appropriate formula must be used to combine exposure in past and current jobs.

3.2.3 Calculate years of exposure

If information on durations and tool use are not reliable, consider calculating total hours of past exposure (i.e. dose 1) or years during which past exposure to hand-transmitted vibration occurred (i.e. dose 10) from the information provided at Section 2 of the questionnaire. The minimum information should be the years during which there was exposure to hand-transmitted vibration (i.e. difference between the date starting the job and finishing the job) and not the total of the right column (calendar year) since this may be composed of duplicate entries from the use of more than one tool in a year.

3.3.4 Dichotomous variable

If the duration is not know at all, then use a dummy variable indicating whether or not there has been any prior occupational exposure to hand-transmitted vibration.

3.3 Leisure exposure

There are two alternatives on how to quantify exposure during leisure activity.

3.3.1 Total duration

The total duration (in hours) of exposure to hand-transmitted vibration during leisure activities (e.g. home use and sport) should be calculated from the product:

[(minutes per week)x(weeks per year)x(number of years)]/60.

3.3.2 Dichotomous variable

A dummy variable may be used to indicate whether or not there has been leisure exposure to hand-transmitted vibration. The variable may either be:

(i) whether or not there has been regular use outside work of a tool or machine that made the hands vibrate, or

(ii) whether or not the regular use (calculated as in Section 0 above) is more or less than the 50^{th} percentile use outside work.

4. CONCLUSIONS

The information in Table 2 is suggested as the information that should be calculated and used as the basis of dose-response calculations.

APPENDIX 7 Example summary table

Variable	**Example**	
Population	Foresters	
Number exposed	120	
Tool(s)	Chain saw	Brush saws
From measurements on each tool:		
Average acceleration (a_{hw}) x_h	3.7 ms^{-2} r.m.s.	2.7 ms^{-2} r.m.s.
Average acceleration (a_{hw}) y_h		
Average acceleration (a_{hw}) z_h		
SD acceleration (a_{hw}) x_h		
SD acceleration (a_{hw}) y_h		
SD acceleration (a_{hw}) z_h		
Max acceleration (a_{hw}) x_h		
Max acceleration (a_{hw}) y_h		
Max acceleration (a_{hw}) z_h		
Min acceleration (a_{hw}) x_h		
Min acceleration (a_{hw}) y_h		
Min acceleration (a_{hw}) z_h		
From questionnaire (exposure):		
Average daily exposure duration	137 mins	
SD daily exposure duration		
Max daily exposure duration		
Min daily exposure duration		
Average years exposure		
SD years exposure		
Max years exposure		
Min years exposure		
Percent with more than 1 year exposure to hand-transmitted vibration prior to current job	9%	
Spare time regular use of tools making hands vibrate (percent responding “Yes”)	12%	
From questionnaire (symptoms):		
% with whiteness	57%	
Average whiteness score in those with whiteness	23	
% with tingling	29%	
Average tingling score in those with tingling	17	
% with numbness	43%	
Average numbness score in those with numbness	27	
% with neck pain	12%	
% with shoulder pain	7%	
% with elbow pain		
% with wrist pain		
% with hand or finger pain		

APPENDIX 8a Self-administered Questionnaire

Hand-transmitted vibration

Self-Administered

Questionnaire

Section 1 - Personal identification

Surname _____ Name _____

Serial number |__|__|__|__| Date |___|___|_____|

Gender: M |_| F |_| Age |__|__|

Section 2 - Social history

2.1 *Nicotine consumption*

Do you smoke or have you ever smoked ? No |_| Yes |_|

If yes, when did you start smoke regularly ? 19 __

Do you still smoke ? No |_| Yes |_|

If no, when did you give up to smoke ? 19 __

If yes, how much did/do you smoke ? Cigarettes per day: |___|

Cigars per day: |___|

Pipe/rolling tobacco g per day:|___|

Do you snuff or chew tobacco regularly? No |_| Yes |_|

If yes, how many times per day ? |___|

2.2 *Alcohol consumption*

Do you drink alcohol (wine, beer, etc.) ? No |_| Yes |_|

How much do you drink daily? 0-1 unit |_| 2-3 units |_| more than 3 units |_|

How much do you drink weekly? 1-3 units |_| 4-6 units |_| more than 6 units |_|

Note: 1 unit = ½ pint of beer, glass of wine, or single spirit

Section 3 – Medical history

3.1 *Injury*

Have you ever injured your hands |_|, arms |_|, shoulders |_|, neck |_|, back |_| ?

If yes, specify (lacerations, fractures, etc.) _____

3.2 *Surgical treatment*

Have you ever received surgery in your hands |_|, arms |_|, shoulders |_|, neck |_|, back |_| ?

If yes, specify _____

3.3 *Medical treatment*

Are you on any long-term medication for any chronic disease? No |_| Yes |_|

If yes, details _____

Section 4 - Symptoms

4.1 *Colour changes*:

Have you ever experienced any colour changes in your fingers? No |_| Yes |_|

If no, go to section 4.2

If yes, what colours ? blue |_| white |_| red |_|

If you have experienced white finger, was the whiteness clearly demarcated ? No |_| Yes |_|

If yes, when did you first notice this ? 19__

When did the last episode of white finger occur?

|__|__| day(s) ago |__|__| month(s) ago |__|__| year(s) ago

Do any members of your family suffer from white finger ? No |_| Yes |_|
(only the blood relatives)

If yes, do they work with vibrating tools? No |_| Yes |_|

If you suffer from white finger, how often does it occur ?

Several times a year |_| Several times a month |_|
Several times a week |_| Several times a day |_|

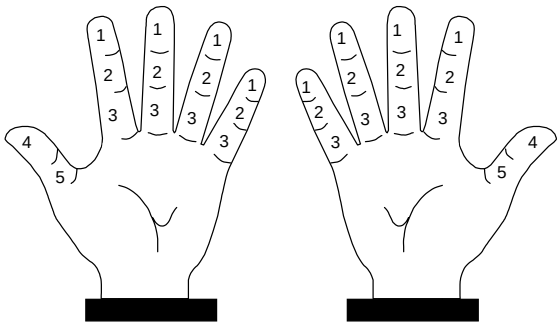
Does it occur in winter, summer or both ? Winter |_| Summer |_| Both |_|

Does any factor trigger it ?: Cold condition |_| Handling cold object |_|

When feeling the vibration from vibrating tools |_|

Others _____

Which fingers/thumbs are affected with whiteness?
(indicate by shading the parts that go white on the diagram)



Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

4.2 *Tingling:*

Have you ever experienced tingling in the fingers ? No |_| Yes |_|

If yes, when did you first notice this ? 19__

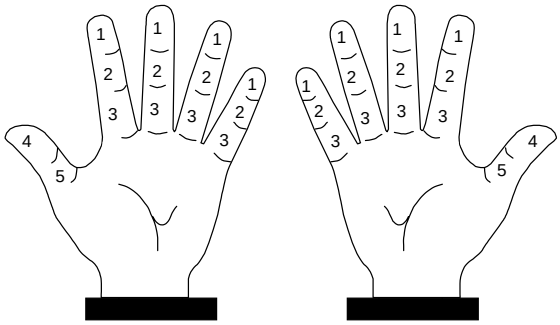
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with tingling?
(indicate by shading the parts that get tingling on the diagram)



Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

4.3 *Numbness:*

Do your fingers go numb ? No |_| Yes |_|

If yes, when did you first notice this? 19__

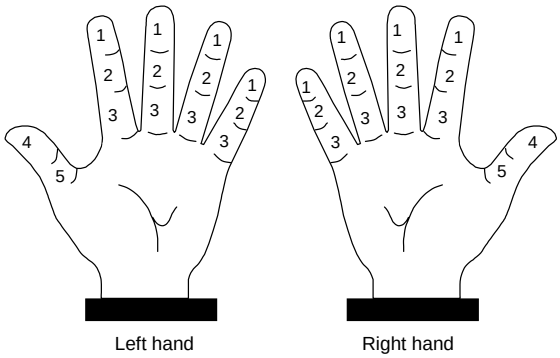
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with numbness?
(indicate by shading the parts that get numbness on the diagram)



Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

4.4 *Musculoskeletal complaints in the upper limbs and neck:*

Did/do you suffer from muscle/joint troubles in the upper limbs? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Did/do you suffer from muscle/joint troubles in the neck? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

4.5 *Effects of symptoms in the hands and fingers*

In the PAST 12 MONTHS have symptoms in the hands caused any difficulty with the following activities?:

	No difficulty	Difficult but not impossible	Impossible
Turn a door knob or lever	|_|	|_|	|_|
Open a tight jar lid	|_|	|_|	|_|
Put on a jacket or pullover	|_|	|_|	|_|
Fasten buttons	|_|	|_|	|_|
Handling and picking up coins	|_|	|_|	|_|
Pour from a jug or a pot	|_|	|_|	|_|

Did symptoms in the hands affect your work ability? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|

Was there any reduction in your work output in the LAST 7 DAYS due to the above symptoms? No |_| Yes |_|

APPENDIX 8b Clinically-administered Questionnaire

Hand-transmitted vibration

Clinically-Administered Questionnaire

Section 1 - Personal identification

°°

Surname ________________________________ Name ___________________________

Address____
____ Post code |__|__|__|__|__|

Telephone number__________________________

°°

Serial number |__|__|__|__| Date |___|___|_____|

Gender: M |_| F |_| Date of birth |___|___|_____| Age |__|__|

Ethnic group: European |_| African |_| Caribbean |_|

Asian |_| Other ________________________________

Height: |____| cm Weight: |____| kg

Dominant hand: Left hand |_| Right hand |_|

Marital status: Single |_| Married |_|

Widow |_| Divorced |_|

Other |_|

How many school years have you completed ? less than 6 yr |_|
7-12 yr |_|
more12 yr |_|

Section 2 - Occupational history

2.1 *Present occupation (if any)*:

Company _____ Work area _____

Job title _____

Description of work _____

_____

When did you start your current job ? 19 |__|__|

Does your current job involve the use of powered tools that vibrate your hands? No |_| Yes |_|

If no, go to question 2.2

If yes, which tools are you using?

	Duration tool is operated and hands are in contact with vibration			
Tools used	Minutes per day	Days per week	Weeks per year	No. of years
1_____	_____	_____	_____	_____
2_____	_____	_____	_____	_____
3_____	_____	_____	_____	_____
4_____	_____	_____	_____	_____
5_____	_____	_____	_____	_____
6_____	_____	_____	_____	_____
7_____	_____	_____	_____	_____
8_____	_____	_____	_____	_____

2.2 *Past occupations with exposure to hand-transmitted vibration*

			Duration tool is operated and hands are in contact with vibration			
Job title	Company name	Tools used	Minutes per day	Days per week	Weeks per year	Calendar year
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__
_____	_____	_____	_____	_____	_____	19__ 19__

Description of work with past exposure to hand-transmitted vibration _____

_____

_____

_____

When did your first significant exposure to hand-transmitted vibration start?: 19__ at age ___

What are your hobbies? _____ _____ _____

In your spare time (i.e. outside work) have you ever regularly used a tool or machine that made your hands vibrate? No |_| Yes |_|

	Duration tool is operated and hands are in contact with vibration		
Tool names	Minutes per week	Weeks per year	No. of years
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

2.3 *Does **an average working day** in your current job involve any of the following conditions?*

How many times in a day is prolonged or recurrent work done with the back:

(a) bent forwards, backwards or sideways? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) twisted? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) bent and twisted simultaneously? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is the neck repeatedly or for long periods:

(a) bent forwards, backwards or sideways? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) twisted? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) bent and twisted simultaneously? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is prolonged or recurrent work performed with the arms stretched forwards, or outwards unsupported or above shoulder height?

Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is work repeatedly done with the forearms and hands with:

(a) twisting movements? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) forceful movements? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) uncomfortable hand positions/grips? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(d) heavy demands on precision? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

If manual lifting is involved, how often in a day do you:

(a) lift? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) lift weights of 10 kg or more by hand? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) lift weights of 25 kg or more by hand? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(d) handle beyond knee level? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(e) handle above shoulder height? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(f) have difficulty of grasping the load? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is there repeated, prolonged or uncomfortable carrying, pushing or pulling of loads? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

During the last month, have you carried out work tasks where the same hand or finger movements were repeated several times a minute (e.g. turning knobs, pinching, grasping, typing, keyboard work, sorting paper) for altogether more than ½ hour per day?:

(a) No, never or hardly ever |_|
(b) Yes, some days per month |_|
(c) Yes, some days per week |_|
(d) Yes, daily or almost daily |_| Give the average time per day: …….% of working days

During the last month, have you carried out precision work (e.g work with precision tools, computer mouse or the like) for altogether more than ½ hour per day?

(a) No, never or hardly ever |_|
(b) Yes, some days per month |_|
(c) Yes, some days per week |_|
(d) Yes, daily or almost daily |_| Give the average time per day: …… % of working days

2.4 *Have you ever been exposed to **chemical agents** at the workplace*? No |_| Yes |_|

If yes, what chemical agents have you been exposed to at work?

Chemical	*Industry*	*Job title*	*Years of exposure*
Solvents (n-hexane, ketones, carbon disulphide)	_____	_____	19__ 19__
Metals (lead, arsenic, thallium, mercury)	_____	_____	19__ 19__
Pesticides (TOCP, carbammates, organophosph.)	_____	_____	19__ 19__
Nitrates (explosives industry)	_____	_____	19__ 19__
Acrylamide (flocculators/grouting agents)	_____	_____	19__ 19__
Vinyl chloride (manufacture of PVC)	_____	_____	19__ 19__

Section 3 - Social history

3.1 *Nicotine consumption*

Do you smoke or have you ever smoked ? No |_| Yes |_|

If yes, when did you start smoke regularly ? 19 __

Do you still smoke ? No |_| Yes |_|

If no, when did you give up to smoke ? 19 __

If yes, how much did/do you smoke ? Cigarettes per day: |___|

Cigars per day: |___|

Pipe/rolling tobacco g per day:|___|

Do you snuff or chew tobacco regularly? No |_| Yes |_|

If yes, how many times per day ? |___|

3.2 *Alcohol consumption*

Do you drink alcohol (wine, beer, etc.) ? No |_| Yes |_|

How much do you drink daily? 0-1 unit |_| 2-3 units |_| more than 3 units |_|

How much do you drink weekly? 1-3 units |_| 4-6 units |_| more than 6 units |_|

Note: 1 unit = ½ pint of beer, glass of wine, or single spirit

Section 4 – Medical history

Have you ever had any serious disease of:

4.1 *Heart or blood vessels* No |_| Yes |_|

If yes, specify _____

4.2 *Nerves* No |_| Yes |_|

If yes, specify _____

4.3 *Bones and joints* No |_| Yes |_|

If yes, specify _____

4.4 *Connective tissue (e.g. scleroderma, lupus)* No |_| Yes |_|

If yes, specify _____

4.5 *Other (e.g. diabetes, thyroid disease)* No |_| Yes |_|

If yes, specify _____

4.6 *Injury*

Have you ever injured your hands |_|, arms |_|, shoulders |_|, neck |_|, back |_| ?

If yes, specify (lacerations, fractures, etc.) _____

4.7 *Surgical treatment*

Have you ever received surgery in your hands |_|, arms |_|, shoulders |_|, neck |_|, back |_| ?

If yes, specify _____

4.8 *Medical treatment*

Are you on any long-term medication for any condition? No |_| Yes |_|

If yes, details _____

Section 5 - Symptoms

5.1 *Colour changes*:

Do you often suffer from cold hands more than others doing similar activities?
No |_| Yes |_|

Have you ever experienced any colour changes in your fingers? No |_| Yes |_|

If no, go to section 5.2

If yes, what colours ? blue |_| white |_| red |_|

If you have experienced white finger, was the whiteness clearly demarcated ? No |_| Yes |_|

If yes, when did you first notice this ? 19__

Latent interval _____ years

When did the last episode of white finger occur?

|__|__| day(s) ago |__|__| month(s) ago |__|__| year(s) ago

Do any members of your family suffer from white finger ? No |_| Yes |_|
(only the blood relatives)

If yes, do they work with vibrating tools? No |_| Yes |_|

If you suffer from white finger, how often does it occur ?

Several times a year |_| Several times a month |_|

Several times a week |_| Several times a day |_|

Does it occur in winter, summer or both ? Winter |_| Summer |_| Both |_|

How many attacks did you have last winter? (mark on the table below)

0	1-10	11-30	31-100	> 100

How many attacks did you have last summer? (mark on the table below)

0	1-5	6-10	11-20	> 20

What is the longest period your fingers have appeared white? |____| minutes

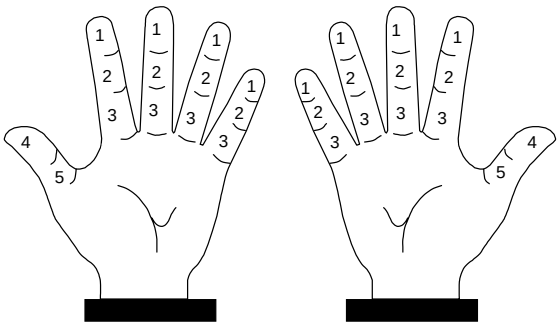
Does any factor trigger it ?: Cold condition |_| Handling cold object |_|
When feeling the vibration from vibrating tools |_|
Others _____

Do you suffer from cold feet? No |_| Yes |_|

Do you suffer from white toes? No |_| Yes |_|

Have you noticed changes in the skin of your fingertips? No |_| Yes |_|

Which fingers/thumbs are affected with whiteness?
(indicate by shading the parts that go white on the diagram)



Score Left |____| Score Right |____| Total |____|

Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

In the PAST 12 MONTHS, has whiteness in your fingers increased? No |_| Yes |_|

5.2 *Tingling:*

Have you ever experienced tingling in the fingers ? No |_| Yes |_|

If yes, when did you first notice this ? 19__

Latent interval _____ years

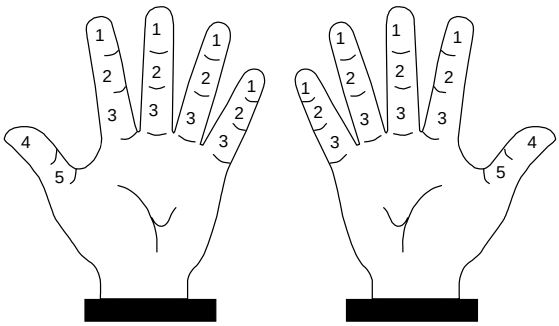
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with tingling?
(indicate by shading the parts that get tingling on the diagram)



Score Left |____| Score Right |____| Total |____|

Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

In the PAST 12 MONTHS, has tingling in your fingers increased? No |_| Yes |_|

5.3 *Numbness:*

Do your fingers go numb ? No |_| Yes |_|

If yes, when did you first notice this? 19__

Latent interval _____ years

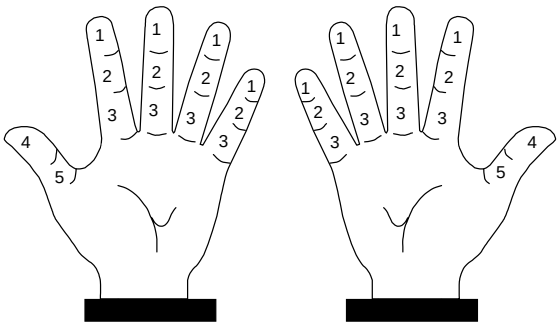
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with numbness?
(indicate by shading the parts that get numbness on the diagram)



Score Left |____| Score Right |____| Total |____|

Does the condition interfere with any leisure activities? No |_| Yes |_|

Does the condition interfere with any work activities? No |_| Yes |_|

In the PAST 12 MONTHS, has numbness in your fingers increased? No |_| Yes |_|

5.4 *Musculoskeletal complaints in the upper limbs and neck:*

Did/do you suffer from muscle/joint troubles in the upper limbs? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Did/do you suffer from muscle/joint troubles in the neck? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Which symptoms did you experience in the neck and/or the upper limbs?

	Pain	**Stiffness**	**Weakness**	**Swelling**	**Numbness**	**Limited movements**
Neck						
Shoulder						
Elbow						
Wrist						
Hand or fingers						

(specify if symptoms occur in the left (L) or the right (R) side)

In the PAST 12 MONTHS, have musculoskeletal symptoms in your neck or upper limbs increased?
No |_| Yes |_|

5.5 Effects of symptoms in the hands and fingers

In the PAST 12 MONTHS have symptoms in the hands (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements) caused any difficulty with the following activities?:

	No difficulty	Difficult but not impossible	Impossible
Turn a door knob or lever	|_|	|_|	|_|
Open a tight jar lid	|_|	|_|	|_|
Put on a jacket or pullover	|_|	|_|	|_|
Fasten buttons	|_|	|_|	|_|
Handling and picking up coins	|_|	|_|	|_|
Pour from a jug or a pot	|_|	|_|	|_|

Did symptoms in the hands (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements) affect your work ability? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|

Was there any reduction in your work output in the LAST 7 DAYS due to the above symptoms (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements)? No |_| Yes |_|

If yes, approximately how long would it take to make up for this reduction? ____minutes

What symptom was the main cause of the reduced output? _____

5.6 Musculoskeletal complaints in the back

During the LAST 12 MONTHS have you had low back troubles? No |_| Yes |_|
(ache, pain, or discomfort)

If yes, did the pain spread down your legs to below the knee? No |_| Yes |_|

Did it make difficult or impossible to put on socks, stocking or tights?

No difficulty |_|, Difficult but not impossible |_|, Impossible |_|

During the LAST 12 MONTHS, what is the total length of time that you have had low back troubles?

0 days |_|, 1-7 days |_|, 8-30 days |_|, more than 30 days but not every day |_|, every day |_|

During the LAST 12 MONTHS, what is the total length of time that low back troubles have prevented you from doing your normal work (at home or away from home)?

0 days |_|, 1-7 days |_|, 8-30 days |_|, more than 30 days |_|

Have you had low back troubles at any time during the LAST 7 DAYS? No |_| Yes |_|

5.7 Other health problems

How often did you suffer from the following health problems in the LAST 7 DAYS? :

Headaches	Never |_|	Some days |_|	Every day |_|
Feeling constantly tired	Never |_|	Some days |_|	Every day |_|
Feeling low in mood or spirits	Never |_|	Some days |_|	Every day |_|
Feeling tired or under stress	Never |_|	Some days |_|	Every day |_|

COLOUR CHARTS
(to be administered after the completion of the questionnaire)

Have you experienced any of these colour changes in your fingers/hands? No |_| Yes |_|

If Yes,

Which part (identify by label)? ……

When do these colour changes occur?……

Section 6 - Physical examination

6.1 *Appearance of hands and arms* (describe)

Deformities:_____

Scars: _____

Callosities: _____

Muscle wasting: _____

Skin trophism: _____

Dupuytren's contracture: _____

Any abnormality of the upper limbs: _____

_____

6.2 *Vascular assessment:*

Pulse:	**Left**			**Right**		
	Good	**Poor**	**Absent**	**Good**	**Poor**	**Absent**
Brachial						
Radial						
Ulnar						
Post. Tibial						

Adson's test: **Left : +ve/-ve** **Right: +ve/-ve**

Blood pressure: **Left arm:_____(mmHg)** **Right arm:_____(mmHg)**
Pulse rate:_____ per minute

Hand circulation:	**Left**	**Right**
Cyanosis	Present/Absent	Present/Absent
Finger temperature	Cool/Warm	Cool/Warm
Allen's test: Radial	+ve/-ve	+ve/-ve
Allen's test: Ulnar	+ve/-ve	+ve/-ve

6.3 *Neurological assessment:*

Test	Left hand		Right hand	
	Normal	/ Abnormal	Normal	/ Abnormal
Manual dexterity (e.g. picking up small coins)				
Pain sensation (pin prick)				
Light touch (cotton wool)				
Temperature (cool & hot appreciation)				
Vibrotactile perception (tuning fork)				

Grip strength (Newtons) **Left |___|** **Right |___|**

Carpal tunnel Syndrome	Left	Right
Tinel's test	+ve/-ve	+ve/-ve
Phalen's test	+ve/-ve	+ve/-ve
Spurling's test (neck compression test)	+ve/-ve	+ve/-ve

Tendon reflexes	Left			Right		
	Hypor.	Normal	Hyper.	Hypor.	Normal	Hyper.
Radial						
Bicipital						
Tricipital						
Quadricipital						
Achilles						

Section 7 - Diagnostic staging*

A. Classification of the vascular symptoms according to the Stockholm scale: |___|

Stage	Symptoms
0	no attacks
1	occasional attacks that affect only the tips of one or more fingers
2	occasional attacks that affect the distal and middle (rarely also proximal) phalanges of one or more fingers
3	frequent attacks affecting all phalanges of most fingers
4	as in stage 3, with trophic skin changes in the finger tips

B. Classification of the sensorineural symptoms according to the Stockholm scale: |___|

Stage	Symptoms
0SN	exposed to vibration but no symptoms
1SN	intermittent numbness, with or without tingling
2SN	intermittent or persistent numbness, reduced sensory perception
3SN	intermittent or persistent numbness, reduced tactile discrimination and/or manipulative dexterity

***Note**: vascular and neurological staging is applicable when hand symptoms are believed to be caused by exposure to hand-transmitted vibration

APPENDIX 8c Self-administered Questionnaire – Follow-up

Hand-transmitted vibration

Health Surveillance-Follow up Assessment

Self-Administered

Questionnaire

°°°

Surname ________________________________ Name ____________________________

°°°

Serial number |__|__|__|__| Date |___|___|_____|

Gender: M |_| F |_| Date of birth |___|___|_____| Age |__|__|

Height: |____| cm Weight: |____| kg

Date of last examination |___|___|_____|

Section 1 - Social history

2.1 *Nicotine consumption*

Do you smoke or have you ever smoked ? No |_| Yes |_|

If yes, when did you start smoke regularly ? 19 __

Do you still smoke ? No |_| Yes |_|

If no, when did you give up to smoke ? 19 __ / 20__

If yes, how much did/do you smoke ? Cigarettes per day: |___|

Cigars per day: |___|

Pipe/rolling tobacco g per day:|___|

Do you snuff or chew tobacco regularly? No |_| Yes |_|

If yes, how many times per day ? |___|

2.2 *Alcohol consumption*

Do you drink alcohol (wine, beer, etc.) ? No |_| Yes |_|

How much do you drink daily? 0-1 unit |_| 2-3 units |_| more than 3 units |_|

How much do you drink weekly? 1-3 units |_| 4-6 units |_| more than 6 units |_|

Note: 1 unit = ½ pint of beer, glass of wine, or single spirit

Section 2 - Symptoms

2.1 *Whiteness*:

Have you ever experienced any colour changes in your fingers? No |_| Yes |_|

If no, go to section 2.2

If yes, what colours ? blue |_| white |_| red |_|

If you have experienced white finger, was the whiteness clearly demarcated ? No |_| Yes |_|

If yes, when did you first notice this ? 19__ / 20__

When did the last episode of white finger occur?

|__|__| day(s) ago |__|__| month(s) ago |__|__| year(s) ago

Do any members of your family suffer from white finger ? No |_| Yes |_|
(only the blood relatives)

If yes, do they work with vibrating tools? No |_| Yes |_|

If you suffer from white finger, how often does it occur ?

Several times a year |_| Several times a month |_|

Several times a week |_| Several times a day |_|

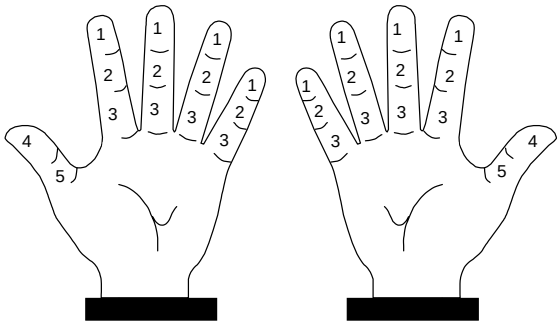
Does it occur in winter, summer or both ? Winter |_| Summer |_| Both |_|

Does any factor trigger it ?: Cold condition |_| Handling cold object |_|
When feeling the vibration from vibrating tools |_|
Others _____

Are your toes also affected ? No |_| Yes |_|

Have you noticed changes in the skin of your fingertips? No |_| Yes |_|

Which fingers/thumbs are affected with whiteness?
(indicate by shading the parts that go white on the diagram)



*The next two questions concern those who have had attacks of whiteness **during the last 2 years*** *If this doesn't apply, skip to question 2.1.1*							
Looking back over the last 12 months when you have had the attacks of whiteness in the fingers or thumbs, would you say they are:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that the attacks of whiteness in your fingers or thumbs are:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger whiteness? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger whiteness? No |_| Yes |_|

2.1.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.2 *Tingling:*

Have you ever experienced tingling in the fingers ? No |_| Yes |_|

If no, go to section 2.3

If yes, when did you first notice this ? 19 __ / 20__

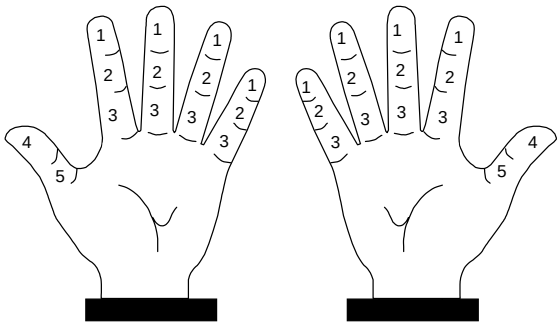
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with tingling?
(indicate by shading the parts that get tingling on the diagram)



Looking back over the last 12 months when you have had troublesome tingling in the fingers or thumbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that the tingling in your fingers or thumbs is:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger tingling? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger tingling? No |_| Yes |_|

2.2.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.3 *Numbness:*

Do your fingers go numb ? No |_| Yes |_|

If no, go to section 2.4

If yes, when did you first notice this? 19 __ / 20__

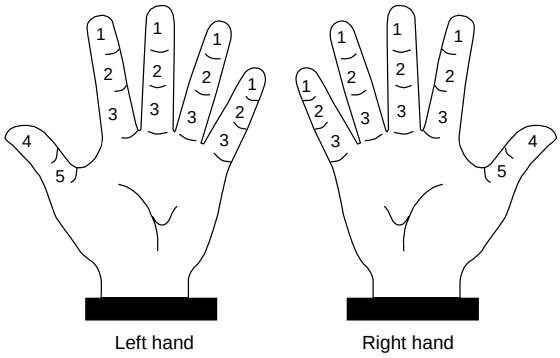
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with numbness?
(indicate by shading the parts that get numbness on the diagram)



Looking back over the last 12 months when you have had numbness in the fingers or thumbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that numbness in your fingers or thumbs is:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger numbness? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger numbness? No |_| Yes |_|

2.3.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.4 *Musculoskeletal complaints:*

Did/do you suffer from muscle/joint troubles in the upper limbs? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Did/do you suffer from muscle/joint troubles in the neck? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Which symptoms did/do you complain in the neck and/or the upper limbs?

	Pain	**Stiffness**	**Weakness**	**Swelling**	**Numbness**	**Limited movements**
Neck						
Shoulder						
Elbow						
Wrist						
Hand						

(specify if musculoskeletal symptoms occur in the left (L) or the right (R) side)

Looking back over the last 12 months when you have had musculoskeletal symptoms in your neck or upper limbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐

Also looking back over the same period, would you say that musculoskeletal symptoms in your neck or upper limbs are:			
Affecting a smaller area?	☐	Affecting a bigger area?	☐
Affecting more or less the same area?	☐	Not sure	☐

Are there leisure activities that you avoid or find difficult because of musculoskeletal symptoms? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of musculoskeletal symptoms? No |_| Yes |_|

2.4.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.5 Effects of symptoms in the hands and fingers

Do the above-mentioned symptoms in the fingers, hands and/or arms (whiteness, tingling, numbess, or pain) cause any difficulty with the following activities? :

	No difficulty	Difficult but not impossible	Impossible
Turn a door knob or lever	|_|	|_|	|_|
Open a tight jar lid	|_|	|_|	|_|
Put on a jacket or pullover	|_|	|_|	|_|
Fasten buttons	|_|	|_|	|_|
Handling and picking up coins	|_|	|_|	|_|
Pour from a jug or a pot	|_|	|_|	|_|

Did/do the above-mentioned symptoms affect your work ability? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

APPENDIX 8d Clinically-administered Questionnaire – Follow-up

Hand-transmitted vibration

Health Surveillance-Follow up Assessment

Questionnaire

and

Clinical Assessment

Surname _____ Name _____

Serial number |__|__|__|__| Date |___|___|_____|

Gender: M |_| F |_| Date of birth |___|___|_____| Age |__|__|

Height: |____| cm Weight: |____| kg

Date of last examination |___|___|_____|

Section 1

1.1 Has there been any change in address? No |_| Yes |_|

If yes, specify: _____

_____

Telephone number _____

1.2 Has there been any change in job activities? No |_| Yes |_|

If yes, new job title _____

Describe new work activities _____

_____

When did you change job ? 20 |__|__|

Does your current job involve the use of powered tools that vibrate your hands? No |_| Yes |_|

If no, go to question 1.3

If yes, which tools are you using?

Tools used	Hours per day	Days per week	Weeks per year	No. of years
1_____	_____	_____	_____	_____
2_____	_____	_____	_____	_____
3_____	_____	_____	_____	_____
4_____	_____	_____	_____	_____
5_____	_____	_____	_____	_____
6_____	_____	_____	_____	_____
7_____	_____	_____	_____	_____
8_____	_____	_____	_____	_____

1.3 *Does **an average working day** in your current job involve any of the following conditions?*

How many times in a day is prolonged or recurrent work done with the back:

(a) bent forwards, backwards or sideways? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) twisted? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) bent and twisted simultaneously? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is the neck repeatedly or for long periods:

(a) bent forwards, backwards or sideways? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) twisted? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) bent and twisted simultaneously? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is prolonged or recurrent work performed with the arms stretched forwards, or outwards unsupported or above shoulder height?

Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is work repeatedly done with the forearms and hands with:

(a) twisting movements? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) forceful movements? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) uncomfortable hand positions/grips? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(d) heavy demands on precision? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

If manual lifting is involved, how often in a day do you:

(a) lift? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(b) lift weights of 10 kg or more by hand? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(c) lift weights of 25 kg or more by hand? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(d) handle beyond knee level? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(e) handle above shoulder height? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

(f) have difficulty of grasping the load? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

How many times in a day is there repeated, prolonged or uncomfortable carrying, pushing or pulling of loads? Never |_|, 1 to 4 |_|, 5 to 20 |_|, More than 20 |_|

During the last month, have you carried out work tasks where the samne hand or finger movements were repeated several times a minute (e.g. turning knobs, pinching, grasping, typing, keyboard work, sorting paper) for altogether more than ½ hour per day?:

(a) No, never or hardly ever |_|

(b) Yes, some days per month |_|

(c) Yes, some days per week |_|

(d) Yes, daily or almost daily |_|

Give the average time per day: …… % of working days

During the last month, have you carried out precision work (e.g work with precision tools, computer mouse or the like) for altogether more than ½ hour per day?

(a) No, never or hardly ever |_|

(b) Yes, some days per month |_|

(c) Yes, some days per week |_|

(d) Yes, daily or almost daily |_|

Give the average time per day: …… % of working days

1.4 Has there been any change in your hobbies? No |_| Yes |_|

If yes, specify _____

_____

In your spare time (i.e. outside work) have you ever regularly used a tool or machine that made your hands vibrated for more than one hour per week? No |_| Yes |_|

Tool names	Hours per week	Weeks per year	No. of years
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1.5 Has there been any change in smoking habit? No |_| Yes |_|

If yes, specify _____

_____

1.6 Has there been any change in drinking habit? No |_| Yes |_|

If yes, specify how many units |___|

1.7 Has there been any change in medication? No |_| Yes |_|

If yes, specify _____

_____

1.8 Has there been any illness since the last examination? No |_| Yes |_|

If yes, specify _____

_____

1.9 Has there been any injury since the last examination? No |_| Yes |_|

If yes, specify _____

_____

1.10 Have you been seen by a doctor because of any illness or injury? No |_| Yes |_|

Have you been hospitalised because of any illness or injury? No |_| Yes |_|

How many days did you have off work during the past 12 months?

0 day |_|,1 week |_|,2 weeks |_|,3 weeks |_|,1 month |_|,2 months |_|,3 months|_|, >3 months|_|

Section 2 - Symptoms

2.1 *Colour changes*:

Do you often suffer from cold hands more than others doing similar activities? No |_| Yes |_|

Have you ever experienced any colour changes in your fingers? No |_| Yes |_|

If no, go to section 2.2

If yes, what colours ? blue |_| white |_| red |_|

If you have experienced white finger, was the whiteness clearly demarcated ? No |_| Yes |_|

If yes, when did you first notice this ? 19__ / 20__

Latent interval _____ years

When did the last episode of white finger occur?

|__|__| day(s) ago |__|__| month(s) ago |__|__| year(s) ago

Do any members of your family suffer from white finger ? No |_| Yes |_|
(only the blood relatives)

If yes, do they work with vibrating tools? No |_| Yes |_|

If you suffer from white finger, how often does it occur ?

Several times a year |_| Several times a month |_|

Several times a week |_| Several times a day |_|

Does it occur in winter, summer or both ? Winter |_| Summer |_| Both |_|

How many attacks did you have last winter? (mark on the table below)

0	1-10	11-30	31-100	> 100

How many attacks did you have last summer? (mark on the table below)

0	1-5	6-10	11-20	> 20

What is the longest period your fingers have appeared white? |____| minutes

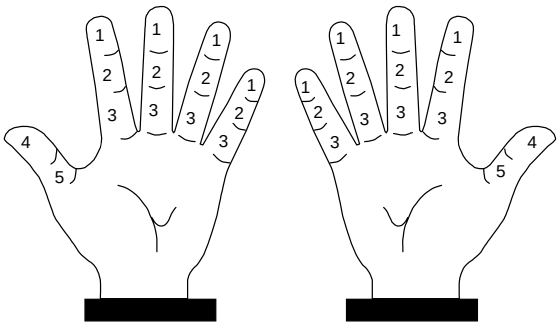
Does any factor trigger it ?: Cold condition |_| Handling cold object |_|
When feeling the vibration from vibrating tools |_|
Others _____

Do you suffer from cold feet? No |_| Yes |_|

Do you suffer from white toes? No |_| Yes |_|

Have you noticed changes in the skin of your fingertips? No |_| Yes |_|

Which fingers/thumbs are affected with whiteness?
(indicate by shading the parts that go white on the diagram)



Score Left |____| Score Right |____| Total |____|

*The next two questions concern those who have had attacks of whiteness **during the last 2 years*** *If this doesn't apply, skip to question 2.1.1*							
Looking back over the last 12 months when you have had the attacks of whiteness in the fingers or thumbs, would you say they are:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that the attacks of whiteness in your fingers or thumbs are:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger whiteness? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger whiteness? No |_| Yes |_|

2.1.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.2 *Tingling:*

Have you ever experienced tingling in the fingers ? No |_| Yes |_|

If no, go to section 2.3

If yes, when did you first notice this ? 19__ / 20__

Latent interval _____ years

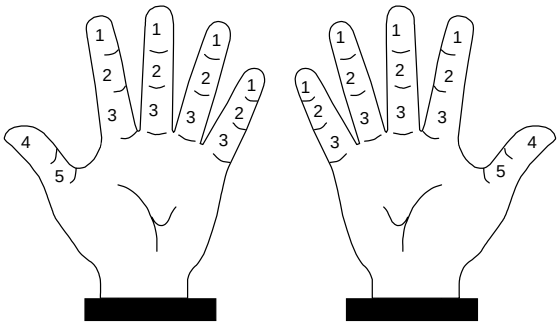
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with tingling?
(indicate by shading the parts that get tingling on the diagram)



Score Left |____| Score Right |____| Total |____|

Looking back over the last 12 months when you have had troublesome tingling in the fingers or thumbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that the tingling in your fingers or thumbs is:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger tingling? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger tingling? No |_| Yes |_|

2.2.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.3 *Numbness:*

Do your fingers go numb ? No |_| Yes |_|

If no, go to section 2.4

If yes, when did you first notice this? 19__ / 20__

Latent interval _____ years

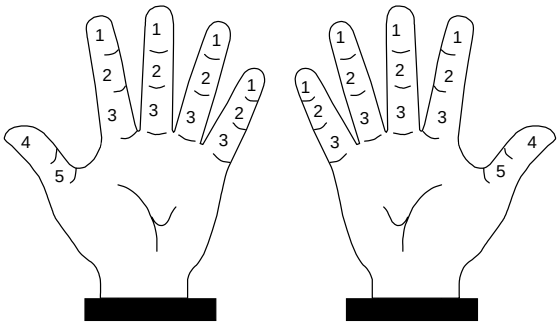
If yes, when ?

While working with vibrating tools |_| After working with vibrating tools |_|

After exposure to cold |_| During white finger |_| After white finger |_|

At night |_| At other time _____

Which fingers/thumbs are affected with numbness?
(indicate by shading the parts that get numbness on the diagram)



Score Left |____| Score Right |____| Total |____|

Looking back over the last 12 months when you have had numbness in the fingers or thumbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐
Also looking back over the same period, would you say that numbness in your fingers or thumbs is:							
Affecting a smaller area?	☐			Affecting a bigger area?	☐		
Affecting more or less the same area?	☐			Not sure	☐		

Are there leisure activities that you avoid or find difficult because of finger numbness? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of finger numbness? No |_| Yes |_|

2.3.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.4 *Musculoskeletal complaints in the upper limbs and neck:*

Did/do you suffer from muscle/joint troubles in the upper limbs? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Did/do you suffer from muscle/joint troubles in the neck? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|, or in the PAST? |_|

Which symptoms did you experience in the neck and/or the upper limbs?

	Pain	**Stiffness**	**Weakness**	**Swelling**	**Numbness**	**Limited movements**
Neck						
Shoulder						
Elbow						
Wrist						
Hand or fingers						

(specify if symptoms occur in the left (L) or the right (R) side)

Looking back over the last 12 months when you have had musculoskeletal symptoms in your neck or upper limbs, would you say it is:							
Becoming less frequent?	☐	Becoming more frequent?	☐	Occurring at about the same frequency?	☐	Not sure	☐

Also looking back over the same period, would you say that musculoskeletal symptoms in your neck or upper limbs are:			
Affecting a smaller area?	☐	Affecting a bigger area?	☐
Affecting more or less the same area?	☐	Not sure	☐

Are there leisure activities that you avoid or find difficult because of musculoskeletal symptoms? No |_| Yes |_|

Are there work activities that you have given up or currently find difficult because of musculoskeletal symptoms? No |_| Yes |_|

2.4.1 If there has been no exposure to hand-trasmitted vibration during the past 2 years:

Have symptoms deteriorated during the last year? No |_| Yes |_|

2.5 Effects of symptoms in the hands and fingers

In the PAST 12 MONTHS have symptoms in the hands (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements) caused any difficulty with the following activities?:

	No difficulty	Difficult but not impossible	Impossible
Turn a door knob or lever	|_|	|_|	|_|
Open a tight jar lid	|_|	|_|	|_|
Put on a jacket or pullover	|_|	|_|	|_|
Fasten buttons	|_|	|_|	|_|
Handling and picking up coins	|_|	|_|	|_|
Pour from a jug or a pot	|_|	|_|	|_|

Did symptoms in the hands (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements) affect your work ability? No |_| Yes |_|

If yes, when: in the LAST 7 DAYS? |_|, in the LAST 12 MONTHS? |_|

Was there any reduction in your work output in the LAST 7 DAYS due to the above symptoms (colour changes, coldness, tingling, numbness, pain, stiffness, weakness, swelling, limited movements)? No |_| Yes |_|

If yes, approximately how long would it take to make up for this reduction? ____minutes

What symptom was the main cause of the reduced output? _____

2.6 Musculoskeletal complaints in the back

During the LAST 12 MONTHS have you had low back troubles? No |_| Yes |_|
(ache, pain, or discomfort)

If yes, did the pain spread down your legs to below the knee? No |_| Yes |_|

Did it make difficult or impossible to put on socks, stocking or tights?

No difficulty |_|, Difficult but not impossible |_|, Impossible |_|

During the LAST 12 MONTHS, what is the total length of time that you have had low back troubles?

0 days |_|, 1-7 days |_|, 8-30 days |_|, more than 30 days but not every day |_|, every day |_|

During the LAST 12 MONTHS, what is the total length of time that low back troubles have prevented you from doing your normal work (at home or away from home)?

0 days |_|, 1-7 days |_|, 8-30 days |_|, more than 30 days |_|

Have you had low back troubles at any time during the LAST 7 DAYS? No |_| Yes |_|

2.7 Other health problems

How often did you suffer from the following health problems in the LAST 7 DAYS? :

Headaches	Never |_|	Some days |_|	Every day |_|
Feeling constantly tired	Never |_|	Some days |_|	Every day |_|
Feeling low in mood or spirits	Never |_|	Some days |_|	Every day |_|
Feeling tired or under stress	Never |_|	Some days |_|	Every day |_|

COLOUR CHARTS
(to be administered after the completion of the questionnaire)

Have you experienced any of these colour changes in your fingers/hands? No |_| Yes |_|

If Yes,

Which part (identify by label)? ……

When do these colour changes occur?……