

Guidelines and Questionnaires for Whole-Body Vibration Health Surveillance

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1. Current knowledge on whole-body vibration injuries

Most of the research on adverse health effects from whole-body vibration (WBV) deals with the musculoskeletal system, in particular, the lumbar spine. There is strong epidemiological evidence that occupational exposure to WBV is associated with an increased risk of low back pain (LBP), sciatic pain, and degenerative changes in the spinal system, including lumbar intervertebral disc disorders (Bovenzi and Hulshof 1999). Summarised results of their meta-analysis of cross-sectional epidemiological studies on drivers with exposure to WBV from industrial vehicles (e.g. fork-lift trucks, wheel loaders, busses, tractors, cranes, subway trains) show age-adjusted prevalence odds ratios and 95% confidence intervals of 2.3 (1.8-2.9), 2.0 (1.3-2.9) and 1.5 (0.9-2.4) for low back pain, sciatic pain and herniated lumbar disc, respectively. Owing to the cross-sectional design of the majority of the performed studies there is not yet sufficient data to outline a clear exposure-response relationship between WBV exposure and LBP disorders. Biodynamic and physiological experiments have shown that seated WBV exposure can affect the spine by mechanical overloading and excessive muscular fatigue supporting the epidemiological findings, supporting the possible causal role of WBV in the development of back trouble. Several data show that in particular the combination of prolonged sitting and exposure to WBV (which is often the case in vehicles) may increase the risk of spinal damage.

Exposure to WBV may also lead to neck-shoulder problems, digestive disorders, circulatory disorders, auditory effects, and reproductive effects as suggested in various studies in the literature. However, this association is less clear than that between WBV and LBP. In some European countries, such as Belgium, Germany, The Netherlands and France, certain disorders of the lumbar spine are under defined conditions recognised as an occupational disease.

2. Prevention measures

On many workplaces, exposure to WBV is still not recognised as a serious problem and many occupational health and safety services have a lack of experience in prevention of adverse health effects. Different elements of prevention can be

distinguished: technical prevention aimed at elimination or reduction of WBV at the source (e.g. suspension seats), organisational changes in the work, personal protection and medical prevention. In most cases only a combination of preventive actions will lead to a successful reduction in vibration exposure (Figure 1).

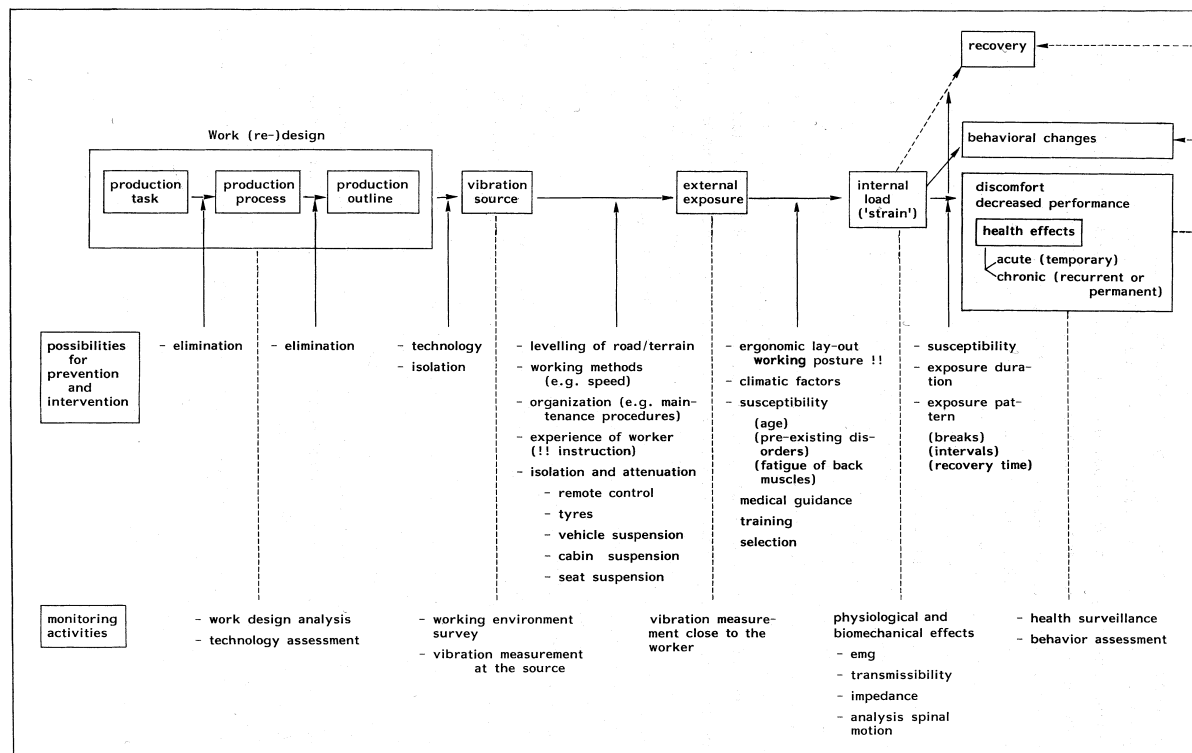


Figure 1. Model of sequence of preventive possibilities

In addition to technical measures, like improvement of the ergonomic lay-out, in particular the forced working posture, and environmental factors, limitation of the vibration exposure duration and medical guidance are important tools for prevention. Appropriate information and advice to employers and employees and instruction in safe and correct work practices, in particular adopting optimal working posture and driving style and limitation of the driving speed, should be given. As personal protective equipment against WBV is not available, information, knowledge and tools enabling employees to cope with risk factors and early effects are basic in the maintenance of health and safety at the workplace.

3. Health surveillance

3.1. Aim of health surveillance

The EU Directive 89/391 (article 14) requires that in the European member states measures are introduced to ensure that workers receive health surveillance appropriate to the health and safety risks they incur at work. Occupational *health surveillance in general* is defined as the ongoing systematic collection, analysis, interpretation, and the dissemination of data for the purpose of prevention (ILO 1997). The results of health surveillance should be used to protect and promote the health of the individual, collective health at the workplace, and the health of the exposed working population. It should lead to action. Furthermore, a workers' health surveillance programme must ensure: professional independence and impartiality of the health professionals, workers' privacy and confidentiality of individual health information.

The aims of *health surveillance with respect to whole-body vibration* are to assess health status and diagnose vibration-induced disorders at an early stage, to inform the workers on the potential risk associated with vibration exposure, to give preventive advice to employers and employees and to control whether preventive measures which have been taken, were successful. The employers should provide a health monitoring program for all workers occupationally exposed to whole-body vibration according to the legislation of the country. Appropriate facilities for the health surveillance of the vibration-exposed workers should be also provided by the employers. The management of a health surveillance program for workers exposed to whole-body vibration should be under the supervision of a physician with a speciality in occupational medicine or at least with a certified training in occupational health. Practical routine procedures for the application of the health surveillance program may be carried out by allied health professionals with experience in occupational health problems. The workers should be informed by the health care staff that their personal and health data will be confidentially treated and preserved.

Pre-placement health assessment and periodic occupational health examinations at regular intervals should be conducted for each worker who is exposed to whole-body vibration at work. Furthermore, consultation of the

occupational health physician by exposed workers who have symptoms or disorders, or who are otherwise concerned about their health shall be recommended.

3.2. Pre-placement health examination

A pre-placement health examination should be offered to each worker who will be exposed to whole-body vibration at work. The main purposes of pre-placement health assessment are to make the worker aware of the hazards connected with exposure to whole-body vibration, to obtain baseline health data for comparison with the findings of subsequent periodical health examinations, and to verify the presence of pathological conditions which could represent possible medical conditions that may increase the risk of adverse effects due to WBV.

The pre-placement health evaluation must be performed according to the principles and practice of occupational medicine and to national legislation or guidelines with respect to pre-placement examinations. It will include a case history, a physical examination and, if necessary, special diagnostic investigations according to the clinical judgement of the physician.

3.2.1. The case history

The case history should focus on:

- Social personal history including use of tobacco and alcohol and being involved in physical activities.
- The work history, with particular reference to past and current occupations with exposure to whole-body vibration; details about the types of vehicles used, the daily and total duration of exposure to whole-body vibration, the working posture, lifting tasks and other work-related back stressors. Leisure activities involving driving of vehicles causing exposure to whole-body vibration should be also investigated.
- The personal medical history, in particular with details of past and present acute or chronic back pain complaints, disorders in the spine, any injuries or surgery to the musculoskeletal system.

Note 1: Information on personal, social, work, and health histories may be obtained by means of a standardised questionnaire. The questions should be validated and the answers easy to be analysed. The use of clinical practical guidelines for LBP is recommended (Bigos et al. 1994).

As part of employee education and health surveillance the occupational health professional should provide information on the possible preventative measures to avoid or minimise the risk of adverse effects due to WBV.

3.2.2. The physical examination

A physical examination on the lower back should be performed on workers who have experienced LBP symptoms over the past 12 months. This physical examination includes:

- examination of the back function and evaluation of the effects on pain:
 - forward flexion
 - extension
 - lateral flexion
- straight leg raising test
- peripheral neurological examination:
 - knee and Achilles tendon reflexes
 - sensitivity in leg/foot
 - signs of muscle weakness (extension mm quadriceps, flexion/extension big toe/foot)
- back endurance test (tentative extra test)
- Waddell's signs of non-organic pain.

Note 2: Appendix IV provide a list of methods for physical examination of the lower back.

3.2.3. Additional investigation

In the absence of positive symptoms and signs and unless indicated by clinical practice guidelines, for the purpose of a pre-placement examination, it is in general not acceptable to perform further diagnostic clinical examinations like X-ray of the lumbar spinal column, CT-scan, myelography, or MRI.

Note 3: At the pre-placement examination, particular attention should be paid to any condition which may aggravate the effects of exposure to WBV (e.g. poor posture, heavy and/or frequent lifting, tobacco use, and psycho-social factors). Appendix III reports a list of possible medical conditions that may increase the risk of disorders of the spine or other organs and structures in workers exposed to WBV.

3.3. Periodic health examination

The pre-placement examination should be followed by periodic health re-assessment with a regular interval according to the legislation of the country. It is suggested that periodic medical examination should be made available at least every two years to all

workers who are exposed to WBV. Any change in vibration exposure at the workplace should be reported by the employer. If an increase in vibration exposure or a change in health status have occurred, the medical re-examination should be offered at shorter intervals at the discretion of the attending physician.

At the periodic medical examination, which should be conducted in the same way as described in 3.2.2 and 3.2.3, any change in work practices with the driving of vehicles or other sources of WBV should be reported in a follow-up questionnaire (Appendix II). Moreover, any illness or injury listed in Appendix III and which has occurred since the last examination, any symptom possibly related to vibration exposure as well as the findings of the physical examination should be also reported. The reported findings for the individual should be compared with previous examinations. Group data should be compiled periodically and reported to management and representatives of employees.

3.4. Medical removal

Avoidance or reduction of vibration exposure for workers affected with disorders possibly related to whole-body vibration and listed in Appendix III should be decided after considering the severity of symptoms, the characteristics of the entire working process, and other aspects related to the company's medical policy and the legislation of the country. Since there is clinical and epidemiological evidence that some of these disorders may be reversible when vibration exposure is ceased, the physician may discuss with the employee the possibility of his/her re-placement in working practices without exposure to WBV.

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Appendix I

Whole-body vibration: Pre-placement Health Surveillance Questionnaire

SECTION 1: Personal and general information

Name: _____ Surname: _____

Address: _____

Post Code: |_|_|_|_|_|_|_|_|

day / month / year
Date of birth _____ Sex: M _____ F _____ Country of birth and raised _____

Height: _____ ft/m _____ in/cm Weight: _____ lbs./kg

Marital Status: Single Married Divorced/Separated Widowed

-
1. Do you exercise regularly? Yes No
 2. How often each week do you engage in any vigorous exercise program or work-out?
Never Less than 1 time 1 to 2 times 3 times or more Everyday
 3. Do you smoke or chew tobacco or have you ever smoked? Yes No
 - 3a. If yes, when did you start smoking regularly? 19____
 - 3b. Do you still smoke? Yes No
 - 3c. If no, when did you give up smoking? 19____
 - 3d. If yes, how much did you or do you smoke? _____
 4. Do you drink alcoholic beverages? Yes No (wine, beer, etc.)
 - 4a. How much do you drink weekly? 1-3 glasses 4-6 glasses more than 6 glasses
 - 4b. How much do you drink daily? 0-1 glasses 2-3 glasses more than 3 glasses
 5. Annual amount of personal car driving? (miles/km): less than 5,000/8,000 5 - 15,000/8 - 24,000
 more than 15,000/24,000
 6. How many school years have you completed? _____ years
 7. What sports, if any, do you weekly participate in? _____

Note: Questionnaire developed within the EU-project "Research network on detection and prevention of injuries due to occupational vibration exposures (BIOMED BMH4-CT98-3251)

SECTION 2: Occupational history

Present Job (if any)

1. What is your current occupation? _____
2. In what industry (e.g. farming, shipyard, etc.) do you carry out this occupation? _____
3. How many years have you spent working in your present job? ____ Years
4. Did or do you drive any kind of vehicle in your current job? (i.e. car, bus, van, truck, train, tram helicopter, other)
 Yes No

If Yes: Type of vehicle	from – until	hours/day	days/week	weeks/year
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks

5. Which postures do you adopt when driving?

	Often	Occasionally	Never
bent forward	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
twisted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
lean against backrest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Do you experience discomfort by mechanical vibration or shock in your work?

vertical vibration	Yes <input type="checkbox"/>	No <input type="checkbox"/>
fore/aft vibration	Yes <input type="checkbox"/>	No <input type="checkbox"/>
side-to-side vibration	Yes <input type="checkbox"/>	No <input type="checkbox"/>

7. How many hours a day do you spend sitting without vibration on the job? _____ hours

8. Does your job include manual lifting? Yes No

Up to 10lbs/5 kg <input type="checkbox"/>	10-20lbs/5-10kg <input type="checkbox"/>	More than 20lbs/10 kg <input type="checkbox"/>
times/day <input type="checkbox"/>	times/day <input type="checkbox"/>	times/day <input type="checkbox"/>

9. Does your job include (on an average working day) any of the following conditions?

Prolonged or recurrent work done with your back:

bent forwards, backwards or sideways	Yes <input type="checkbox"/>	No <input type="checkbox"/>
twisted	Yes <input type="checkbox"/>	No <input type="checkbox"/>
bent and twisted simultaneously	Yes <input type="checkbox"/>	No <input type="checkbox"/>

10. Does your job include repeated, prolonged or uncomfortable carrying, pushing or pulling of loads? Yes No

11. Are there any other duties required in your job that stress your low back or neck?

Previous Job(s)

12. What was/were your previous occupation(s)?

_____ for ____ years
 _____ for ____ years
 _____ for ____ years

13. Did you drive in your previous jobs on vehicles like: trucks, busses, fork lifts, earth moving equipment etc.? Yes

No

If Yes: _____ vehicle

_____ year(s) on a	_____ on average	_____ hours/day
_____ year(s) on a	_____ on average	_____ hours/day
_____ year(s) on a	_____ on average	_____ hours/day
_____ year(s) on a	_____ on average	_____ hours/day
_____ year(s) on a	_____ on average	_____ hours/day
_____ year(s) on a	_____ on average	_____ hours/day

14. Did your previous job(s) involve: prolonged sitting? Yes No

heavy physical demands? Yes No

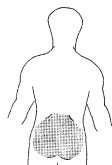
15. Did you ever have low back pain in your previous job/s? Yes No

16. Did or do you drive on a regular basis any kind of vehicle in your spare time (outside work)? Yes No

If Yes: Type of vehicle	from – until	hours/day	days/week	weeks/year
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks

SECTION 3: Personal medical history

In this section, you will be asked about trouble you might have had in different parts of the body and at different time periods. **If you never have had any back pain/problem, ignore this section.**

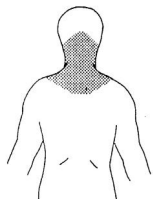
3.1: LOW BACK

	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) back pain only (c) leg pain/symptoms only (d) back and leg pain/symptoms		(a) not applicable/no pain (b) back pain only (c) leg pain/symptoms only (d) back and leg pain/symptoms	
3. How many episodes have you had?	0	1 2-3 More than 4	0	1 2-5 6-10 more than 10
4. How long did they typically last?	not applicable	Hours 1-2 days Always	not applicable	hours 1-2 days 3-6 days 2-4 weeks 1-3 months 3-6 months Always
5. How much time did you have to take off work due to the back/leg pain?	None	1-2 days 3-4 days more than 5 days	None	1-4 weeks 1-3 months 3-6 months more than 6 months
6. Has a doctor told you what was wrong with your back, i.e. given a diagnosis? *	No	Namely	No	Namely
7. Have you <u>ever</u> had a trauma to your back that required a medical visit?	No	What kind of trauma?	When did it happen?	
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, other?)	None	Namely	None	Namely
9. Is there any movement or activity that causes your pain ?	No	Namely	No	Namely
10. Is there any movement or activity which aggravates your pain ?	No	Namely	No	Namely
11. Do you usually get back pain during or shortly after driving a vehicle ?	No	Typically for how long?	No	Typically for how long?
	Yes		Yes	

* i.e. disk herniation/protrusion, spinal stenosis, facet syndrome, spondylosis, spondylolisthesis, nerve root syndrome.

3.2: NECK

If you never have had any neck pain/problem, ignore this section.

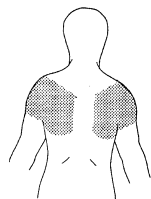


	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) neck pain only (c) arm pain/symptoms only (d) neck and arm pain/symptoms		(a) not applicable/no pain (b) neck pain only (c) arm pain/symptoms only (d) neck and arm pain/symptoms	
3. How many episodes have you had?	0	1 2-3 more than 4	0	1 2-5 6-10 more than 10
4. How long did they typically last?	not applicable	hours 1-2 days always	not applicable	Hours 1-2 days 3-6 days 2-4 weeks 1-3 months 3-6 months Always
5. How much time did you have to take off work due to the neck/arm pain?	None	1-2 days 3-4 days more than 5 days	None	1-4 weeks 1-3 months 3-6 months more than 6 months
6. Has a doctor told you what was wrong with your neck, i.e. given a diagnosis? *	No	Namely	No	Namely
	Yes		Yes	
7. Have you <u>ever</u> had a trauma to your back that required a medical visit?	No	What kind of trauma?	When did it happen?	
	Yes			
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, or other?)	None	Namely	None	Namely
	Yes		Yes	
9. Is there any movement or activity that causes your pain?	No	Namely	No	Namely
	Yes		Yes	
10. Is there any movement or activity, which aggravates your pain?	No	Namely	No	Namely
	Yes		Yes	
11. Do you usually get neck pain during or shortly after driving a vehicle?	No	Typically for how long?	No	Typically for how long?
	Yes		Yes	

* i.e. disk herniation/protrusion, nerve root syndrome, thoracic outlet syndrome.

3.3: SHOULDERS

If you never have had any shoulder pain/problem, ignore this.



	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) shoulder pain only (c) arm/hand symptoms only (d) shoulder and arm pain/symptoms		(a) not applicable/no pain (b) shoulder pain only (c) arm/hand symptoms only (d) shoulder and arm pain/symptoms	
3. How many episodes have you had?	0	1 2-3 More than 4	0	1 2-5 6-10 more than 10
4. How long did they typically last?	not applicable	Hours 1-2 days Always	not applicable	Hours 1-2 days 3-6 days 2-4 weeks 1-3 months 3-6 months Always
5. How much time did you have to take off work due to the shoulder/arm pain?	None	1-2 days 3-4 days more than 5 days	None	1-4 weeks 1-3 months 3-6 months more than 6 months
6. Has a doctor told you what was wrong with your shoulder, i.e. given a diagnosis?	No	Namely	No	Namely
	Yes		Yes	
7. Have you <u>ever</u> had a trauma to your shoulders that required a medical visit?	No	What kind of trauma?	When did it happen?	
	Yes			
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, other?)	None	Namely	None	Namely
	Yes		Yes	
9. Is there any movement or activity that causes your pain ?	No	Namely	No	Namely
	Yes		Yes	
10. Is there any movement or activity which aggravates your pain ?	No	Namely	No	Namely
	Yes		Yes	
11. Do you usually get shoulder pain during or shortly after driving a vehicle ?	No	Typically for how long ?	No	Typically for how long?
	Yes		Yes	

3.4: Other parts of your body

Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:

Elbows

No Yes
 in the right elbow
 in the left elbow
 in both elbows

Wrists/hands

No Yes
 in the right wrist/hand
 in the left wrist/hand
 in both wrists/hands

Upper back

No Yes

Hips/thighs/buttocks

No Yes
 in the right hip
 in the left hip
 in both hips

Knees

No Yes
 in the right knee
 in the left knee
 in both knees

Ankles/feet

No Yes
 in the right ankle/foot
 in the left ankle/foot
 in both ankles/feet

3.5: Other disorders

Did you suffer from the following disorders?

	Ever had?	Ever been treated?
Inguinal (groin) rupture (hernia)	Yes No	Yes No
Digestive disorders (aspecific stomach complaints, gastritis, stomach ulcer, intestinal complaints)	Yes No	Yes No
Circulatory problems (varicose veins, hemorrhoids, hypertension, heart complaints)	Yes No	Yes No
Raynaud's phenomenon, i.e. vibration white finger syndrome (white and/or cold fingers)	Yes No	Yes No
Urinary disorders (prostatitis, renal disorder)	Yes No	Yes No
Vestibular disturbances (dizziness)	Yes No	Yes No
Female questions:		Normal/abnormal?
How many pregnancies have you had?		
Have you ever had an involuntary abortion?	Yes No	
Have you had menstrual irregularities prior to exposure to vibration?	Yes No	

3.6: Pain intensity and Disability (Only if you have not experienced any back, neck or shoulder pain during the past 12 months)

Pain intensity items

1. How would you rate your back/neck/shoulder pain on a 0-10 scale during the last 7 days where 0 is “no pain” and 10 is “pain as bad as it could be”?

	No pain										Pain as bad as it could be	
	0	1	2	3	4	5	6	7	8	9	10	
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

2. In the past 12 months, how intense was your pain rated on a 0-10 scale where 0 is “no pain” and 10 is “pain as bad as it could be”?

	No pain										Pain as bad as it could be	
	0	1	2	3	4	5	6	7	8	9	10	
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

Disability items

3. About how many days in the last 12 months have you been kept from your usual activities (work, school, or housework) because of:

Back pain	Number of days: 0	1–6	7–14	15–30	31+
Neck pain	Number of days: 0	1–6	7–14	15–30	31+
Shoulder pain	Number of days: 0	1–6	7–14	15–30	31+

4. In the past 12 months, how much has back/neck /shoulder pain changed your ability to work (including housework) where 0 is “no change” and 10 is “extreme change”?

	No change										Extreme	
	change											
	0	1	2	3	4	5	6	7	8	9	10	
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

5. In the past 12 months, how much has back/neck/shoulder pain changed your ability to take part in recreational, social, and family activities where 0 is “no change” and 10 is “extreme change”?

	No change										Extreme	
	change											
	0	1	2	3	4	5	6	7	8	9	10	
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

SECTION 2: Work environment information

1. What is your present job? _____

2. How many years have you spent working in your present job? ____ Years

3. What kind of transportation do you use to get to and from work?

Car Bus Train Bicycle Walk

4. How long does it take you to get to work?

Less than 20 min 20-40 min 40-60 min More than 1 hour

5. What kind of vehicles did and do you drive in your current job? (i.e. car, bus, van, truck, train, tram helicopter)

Type of vehicle	from – until	hours/day	days/week	weeks/year
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks
_____	19__ - 19__	__ hrs	__ days	__ weeks

6. On which type of ground surface do you drive regularly?

asphalt/concrete:

good condition	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
poor condition	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
stelcon-plates:	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
paved road (cobbel)	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
track/rail	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
off-road	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
construction road	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle
other, namely	<input type="checkbox"/> no	<input type="checkbox"/> yes	__ hours/day	_____ type of vehicle

7. In which environment do you usually drive?

% time vehicle

highway	_____	_____
country side road	_____	_____
city street	_____	_____
mixed	_____	_____

8. What is your normal style/speed of driving? Smooth slow fast accelerating/braking

9. On what kind of driver seat do you sit regularly?

type _____ has suspension? Yes No

Type of suspension?

mechanical suspension

air suspension

hydraulic suspension system

Is your seat adjustable? yes no

Do you adjust your seat? yes no not applicable

Did you receive instruction on how to adjust your seat? yes no

Do you use automatic or manual gear? Automatic Manual

10. Does your seat have a good back support? yes no

Do you use a separate back support (belt) when you drive? yes no

Does your seat have arm rests? yes no

Do you use a arm rests when you drive? yes no not applicable

11. Which postures do you adopt when driving? Often Occasionally Never

bent forward

twisted

lean against backrest

12. How often does your vehicle jerk or jolt so much that you are uplifted from your seat?

Never Less than 5 times a day More than 5 times a day, but less than 5 times an hour

More than 5 times an hour, but less than 5 times a minute More than 5 times a minute

13. How often does your seat bottom out while you are driving?

Never

Less than 5 times a day

More than 5 times a day, but less than 5 times an hour

More than 5 times an hour, but less than 5 times a minute

More than 5 times a minute

14. Do you experience discomfort by mechanical vibration or shock in your work?

vertical vibration yes no

fore/aft vibration yes no

side-to-side vibration yes no

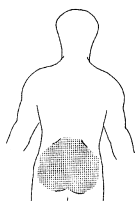
15. How many hours a day do you spend sitting without vibration on the job? _____ hours
 How many days a week do you spend sitting? _____ days
 How many weeks a year do you spend sitting? _____ weeks
16. Do you have to maintain a twisted posture without vibration often and/or for prolonged times? yes no
17. How many hours on a typical day do you spend standing/walking on the job? _____ hours
 How many days a week do you work? _____ days
 How many weeks a year do you work? _____ weeks
18. Does your job include lifting? yes no
 Up to 10lbs/5 kg 10-20lbs/5-10kg More than 20lbs/10 kg
 times/day times/day times/day
19. Do you lift in awkward postures? (bent/twisted) yes no
20. If you drive and lift on the job how often do you lift immediately after driving?
 Seldom Occasionally Often
 Does your job include (on an average working day) any of the following conditions?
 Prolonged or recurrent work done with your back:
 bent forwards, backwards or sideways Yes No
 twisted Yes No
 bent and twisted simultaneously Yes No
22. Does your job include repeated, prolonged or uncomfortable carrying, pushing or pulling of loads? Yes No
23. Are there any other duties required in your job that stress your low back or neck?

24. How many breaks do you usually take during the workday (this means getting out of your vehicle)? _____
25. How long are your breaks? _____ minutes
26. What do you during your breaks? Walk around Sit Stand Other

SECTION 3: Personal medical history

In this section, you will be asked about trouble you might have had in different parts of the body and at different time periods. If you never have had any back pain/problem, ignore this section.

3.1: LOW BACK

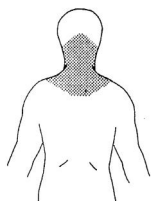


	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) back pain only (c) leg pain/symptoms only (d) back and leg pain/symptoms		(a) not applicable/no pain (b) back pain only (c) leg pain/symptoms only (d) back and leg pain/symptoms	
3. How many episodes have you had?	0	1 2-3 More than 4	0	1 2-5 6-10 more than 10
4. How long did they typically last?	not applicable	Hours 1-2 days Always	not applicable	hours 1-2 days 3-6 days 2-4 wks 1-3 months 3-6 months Always
5. How much time did you have to take off work due to the back/leg pain?	None	1-2 days 3-4 days more than 5 days	None	1-4 weeks 1-3 months 3-6 months more than 6 months
6. Has a doctor told you what was wrong with your back, i.e. given a diagnosis? *	No	Namely	No	Namely
7. Have you <u>ever</u> had a trauma to your back that required a medical visit?	Yes	What kind of trauma?	Yes	When did it happen?
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, other?)	No	Namely	No	Namely
9. Is there any movement or activity that causes your pain ?	Yes		Yes	
10. Is there any movement or activity which aggravates your pain ?	No	Namely	No	Namely
11. Do you usually get back pain during or shortly after driving a vehicle ?	Yes	Typically for how long ?	Yes	Typically for how long?

* i.e. disk herniation/protrusion, spinal stenosis, facet syndrome, spondylosis, spondylolisthesis, nerve root syndrome.

3.2: NECK

(If you never have had any neck pain/problem, ignore this section).

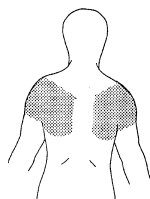


	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) neck pain only (c) arm pain/symptoms only (d) neck and arm pain/symptoms		(a) not applicable/no pain (b) neck pain only (c) arm pain/symptoms only (d) neck and arm pain/symptoms	
3. How many episodes have you had?	0	1	2-3	more than 4
			0	1
			2-5	6-10
				more than 10
4. How long did they typically last?	not applicable		hours	
	not applicable		Hours	
	1-2 days	always	1-2 days	3-6 days
			2-4 weeks	1-3 months
			3-6 months	Always
5. How much time did you have to take off work due to the neck/arm pain?	None	1-2 days	None	1-4 weeks
	3-4 days	more than 5 days	3-6 months	1-3 months
			more than 6 months	
6. Has a doctor told you what was wrong with your neck, i.e. given a diagnosis? *	No	Namely	No	Namely
	Yes		Yes	
7. Have you <u>ever</u> had a trauma to your back that required a medical visit?	No	What kind of trauma?	When did it happen?	
	Yes			
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, or other?)	None	Namely	None	Namely
	Yes		Yes	
9. Is there any movement or activity that causes your pain?	No	Namely	No	Namely
	Yes		Yes	
10. Is there any movement or activity, which aggravates your pain?	No	Namely	No	Namely
	Yes		Yes	
11. Do you usually get neck pain during or shortly after driving a vehicle?	No	Typically for how long?	No	Typically for how long?
	Yes		Yes	

* i.e. disk herniation/protrusion, nerve root syndrome, thoracic outlet syndrome.

3.3: SHOULDERS

(If you never have had any shoulder pain/problem, ignore this section).



	During the last 7 days		During last 12 months	
1. Did you have pain/ troubles	(a) never (b) seldom (c) often		(a) never (b) seldom (c) often	
2. What type of troubles did you have? (Circle all applicable alternatives)	(a) not applicable/no pain (b) shoulder pain only (c) arm/hand symptoms only (d) shoulder and arm pain/symptoms		(a) not applicable/no pain (b) shoulder pain only (c) arm/hand symptoms only (d) shoulder and arm pain/symptoms	
3. How many episodes have you had?	0	1 2-3 More than 4	0	1 2-5 6-10 more than 10
4. How long did they typically last?	not applicable Hours		not applicable Hours	
	1-2 days	Always	1-2 days	3-6 days 2-4 weeks
			1-3 months	3-6 months Always
5. How much time did you have to take off work due to the shoulder/arm pain?	None	1-2 days	None	1-4 weeks 1-3 months
	3-4 days	more than 5 days	3-6 months	more than 6 months
6. Has a doctor told you what was wrong with your shoulder, i.e. given a diagnosis?	No	Namely	No	Namely
	Yes		Yes	
7. Have you <u>ever</u> had a trauma to your shoulders that required a medical visit?	No	What kind of trauma?	When did it happen?	
	Yes			
8. What treatment did your doctor prescribe? (Anti-inflammatory drugs, painkillers, physical therapy, surgery, other?)	None	Namely	None	Namely
	Yes		Yes	
9. Is there any movement or activity that causes your pain ?	No	Namely	No	Namely
	Yes		Yes	
10. Is there any movement or activity which aggravates your pain ?	No	Namely	No	Namely
	Yes		Yes	
11. Do you usually get shoulder pain during or shortly after driving a vehicle ?	No	Typically for how long ?	No	Typically for how long?
	Yes		Yes	

3.4: Other parts of your body

Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:

Elbows

No Yes
 in the right elbow
 in the left elbow
 in both elbows

Wrists

No Yes
 in the right wrist/hand
 in the left wrist/hand
 in both wrists/hands

Upper back

No Yes

Hips/thighs/buttocks

No Yes
 in the right hip
 in the left hip
 in both hips

Knees

No Yes
 in the right knee
 in the left knee
 in both knees

Ankles/feet

No Yes
 in the right ankle/foot
 in the left ankle/foot
 in both ankles/feet

3.5: Other disorders

Did you suffer from the following disorders?

	Ever had?	Ever been treated?
Inguinal (groin) rupture (hernia)	Yes No	Yes No
Digestive disorders (aspecific stomach complaints, gastritis, stomach ulcer, intestinal complaints)	Yes No	Yes No
Circulatory problems (varicose veins, haemorrhoids, hypertension, heart complaints)	Yes No	Yes No
Raynaud's phenomenon, i.e. vibration white finger syndrome (white and/or cold fingers)	Yes	Yes
	No	No
Urinary disorders (prostatitis, renal disorder)	Yes No	Yes No
Vestibular disturbances (dizziness)	Yes No	Yes No
Female questions:		Normal/abnormal?
How many pregnancies have you had?		
Have you ever had an involuntary abortion?	Yes No	
Have you had menstrual irregularities prior to exposure to vibration?	Yes No	

3.6: Pain intensity and Disability

(Only if you have not experienced any back, neck or shoulder pain during the past 12 months)

Pain intensity items

2. How would you rate your back/neck/shoulder pain on a 0-10 scale during the last 7 days where 0 is “no pain” and 10 is “pain as bad as it could be”?

	No pain							Pain as bad as it could be				
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

3. In the past 12 months, how intense was your pain rated on a 0-10 scale where 0 is “no pain” and 10 is “pain as bad as it could be”?

	No pain							Pain as bad as it could be				
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

Disability items

4. About how many days in the last 12 months have you been kept from your usual activities (work, school, or housework) because of:

Back pain?	Number of days: 0	1–6	7–14	15–30	31+
Neck pain?	Number of days: 0	1–6	7–14	15–30	31+
Shoulder pain?	Number of days: 0	1–6	7–14	15–30	31+

4. In the past 12 months, how much has back/neck /shoulder pain changed your ability to work (including housework) where 0 is “no change” and 10 is “extreme change”?

change	No change							Extreme				
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

5. In the past 12 months, how much has back/neck/shoulder pain changed your ability to take part in recreational, social, and family activities where 0 is “no change” and 10 is “extreme change”?

change	No change							Extreme				
Back	0	1	2	3	4	5	6	7	8	9	10	
Neck	0	1	2	3	4	5	6	7	8	9	10	
Shoulder	0	1	2	3	4	5	6	7	8	9	10	

3.7: Roland and Morris Disability Questionnaire

These questions are about the way your pain is affecting your daily life. We would like to know if you are currently in any of the situations listed below.

(If you have not suffered specifically from back pain during the past 12 months go straight to section 4)

Today, are you in any of the following situations?

- | | | | |
|---|-----|-----|----|
| 1. I stay at home most of the time because of my back. | yes | no | |
| 2. I change position frequently to try and get my back comfortable. | | yes | |
| no | | | |
| 3. I walk more slowly than usual because of my back. | yes | no | |
| 4. Because of my back I am not doing any of the jobs that I usually do around the house. | yes | no | |
| 5. Because of my back, I use a handrail to get upstairs. | yes | no | |
| 6. Because of my back, I lie down to rest more often. | | yes | |
| 7. Because of my back, I have to hold on to something to get out of an easy chair. | yes | no | |
| 8. Because of my back, I try to get other people to do things for me. | | yes | |
| no | | | |
| 9. I get dressed more slowly than usual because of my back. | | yes | |
| no | | | |
| 10. I only stand up for short periods of time because of my back. | | yes | |
| no | | | |
| 11. Because of my back, I try not to bend or kneel down. | yes | no | |
| 12. I find it difficult to turn over in bed because of my back | | yes | no |
| 13. My back is painful almost all the time. | yes | no | |
| 14. I find it difficult to get out of a chair because of my back. | | yes | |
| no | | | |
| 15. My appetite is not very good because of my back pain. | | yes | |
| no | | | |
| 16. I have trouble putting on my socks (or stockings) because of the pain in my back. | yes | no | |
| 17. I only walk short distances because of my back pain. | yes | no | |
| 18. I sleep less well because of my back pain. | yes | no | |
| 19. Because of my back pain, I get dressed with help from someone else. | yes | no | |
| 20. I sit down for most of the day because of my back. | | yes | |
| no | | | |
| 21. I avoid heavy jobs around the house because of my back. | yes | no | |
| 22. Because of my back pain, I am more irritable and bad tempered with people than usual. | yes | no | |
| 23. Because of my back pain, I go upstairs more slowly than usual. | | yes | |
| 24. I stay in bed most of the time because of my back. | | yes | |
| no | | | |

3.8: LBP Disability FABQ

What effect did or still does activity and work have on your back pain?

Please answer ALL statements and indicate whether you agree or disagree with each statement by circling the appropriate number on the scale ranging from 1 'Completely disagree' to 5 'Completely agree'.

ACTIVITY AND BACK PAIN	Disagree					Agree
1. My pain was caused by physical activity.	1	2	3	4	5	
2. Physical activity worsens or did worsen my pain.	1	2	3	4	5	
3. Physical activity might harm my back.	1	2	3	4	5	
4. I <u>should</u> not do physical activities because this might make my pain worse.	1	2	3	4	5	
5. I <u>cannot</u> do physical activities because they do or could make my pain worse.	1	2	3	4	5	
YOUR NORMAL WORK AND BACK PAIN	Disagree					Agree
6. My pain was caused by my work or by an accident at work.	1	2	3	4	5	
7. My work aggravates my trouble.	1	2	3	4	5	
8. I have a claim for compensation for my pain.	1	2	3	4	5	
9. My work is far too heavy for me.	1	2	3	4	5	
10. My work makes or made my pain worse.	1	2	3	4	5	
11. My work might harm my back	1	2	3	4	5	
12. I <u>should</u> not do my normal work when I am in pain.	1	2	3	4	5	
13. I <u>cannot</u> do my normal work when I am in pain.	1	2	3	4	5	
14. I should avoid my normal work until my pain is treated.	1	2	3	4	5	
15. I do not think that I will ever be able to do my present work <u>normally</u> .	1	2	3	4	5	

SECTION 4: Work Satisfaction

Below are statements that help us understand your general work situation.

Please answer ALL statements and indicate whether you agree or disagree with each statement by circling the appropriate number on the scale ranging from

1 COMPLETELY DISAGREE to 5 COMPLETELY AGREE

Remember that your employer(s) and your immediate boss will NOT see your answers

	Disagree					Agree
1. I enjoy my work	1	2	3	4	5	
2. My job meets my expectations	1	2	3	4	5	
3. I can turn to a fellow worker for help when I have problems	1	2	3	4	5	
4. I get satisfaction from my job	1	2	3	4	5	
5. I like most of my fellow workers	1	2	3	4	5	
6. My job is mentally demanding	1	2	3	4	5	
7. I enjoy the tasks involved in my job	1	2	3	4	5	
8. My fellow workers talk things over with me	1	2	3	4	5	
9. My job involves a great deal of mental concentration	1	2	3	4	5	
10. I am happy with my job	1	2	3	4	5	
11. My job involves a great deal of responsibility	1	2	3	4	5	
12. I would recommend my job and place of work to a friend	1	2	3	4	5	
13. My job causes me worry	1	2	3	4	5	
14. I would choose the same job, in the same place, again	1	2	3	4	5	
15. My fellow workers accept and support my new ideas	1	2	3	4	5	

Thank you completing this questionnaire!

Appendix III

List of medical conditions that may increase the risk of disorders of the spine or other organs and structures in workers exposed to whole-body vibration

At the pre-placement and periodic health examinations of workers exposed to whole-body vibration (WBV), the occupational health physician shall record the case history to investigate symptoms and signs of disorders possibly caused by excessive exposure to WBV. Since all symptoms and signs associated with these disorders may be found in several other diseases, the physician shall consider all pathological conditions which can either increase the susceptibility of the individual to the adverse health effects of WBV or worsen vibration-induced injuries to the spine or other organs.

The following medical conditions may increase the risk of disorders of the spine or other organs and structures in workers exposed to WBV:

Disorders of the spine

- Distinct premature (not related to age) degenerative changes in the spine
- Disorders of the intervertebral disc (with or without radicular syndromes)
- Active inflammatory conditions of the spine
- Manifest acquired or congenital deformation of the spine
- Surgery of the spine
- Earlier spinal injuries with fractures of vertebrae
- Recurrent episodes of chronic back pain

Other conditions

- Severe neck-shoulder disorders
- Chronic gastritis and/or gastric or duodenal ulcers
- Pregnancy

Appendix IV

Physical examination methods of the lower back

Examination of the back function and evaluation of the effects of pain:

The patient should be barefoot and wear a standard patient gown that is open in back.

Patient standing

The examiner should stand behind the patient and observe the general configuration of the spine to detect any lateral curvatures, kyphosis, or excessive lordosis in the erect posture.

- Forward flexion: the patient is asked to flex forward as far as possible and indicate any pain or discomfort. The examiner should observe the lumbar paraspinal muscles. Any eccentric contractions of the musculature suggest lumbosacral paraspinal spasms; limited motion without evidence of such eccentric contractions suggests lack of patient cooperation. Normal subjects should be able to nearly touch their toes. In general, pain increased by flexion suggests lumbar disc abnormalities. Pain increases with repetitive flexions in patients with discogenic pain. Forward flexion is often associated with a list to one side. Occasionally, patients with lumbosacral paraspinal spasm will be able to flex forward reasonably normally but will have difficulty returning to the erect position. Abnormal spinal rhythm is a typical feature in the clinical diagnosis of instability syndrome. In extreme examples, the patient may “climb up” his/her thighs to return from the flexed position. The range of motion is recorded as the distance of the fingertips from the floor or to the knees. The patient shall return to erect position and a short rest before the next test.
- Extension: during spinal extension, the examiner should ensure that the patient’s hips and knees remain locked. Particular attention should be paid to movement in the lumbar area, and this should be distinguished from hip extension. The patient is asked about the reproduction of typical back pain. Pain increased by (repetitive) extension suggests degenerative changes involving posterior elements of the spine, lumbar spinal stenosis, or both. The range of motion is not measured. The patient shall return to the erect position and a short rest before the next test.
- Lateral flexion: the patient is asked to flex to the side and indicate any pain or discomfort. Normal subjects should be able to reach the fibular heads with their fingertip. The examiner should compare the range of motion to the left and to the right.
- Muscle weakness. The power of plantar flexion is tested by having the patient perform 10 toe raises standing on both feet and then 10 more standing on each foot separately. Repeated activity causes fatigue of the calf muscles and reveals minimum differences in the strength of muscles innervated by the S1 nerve root. The strength of the dorsiflexors, innervated by the L4 and L5 nerve roots, is tested by having the patient walk on his/her heels.
- Quadriceps is tested by having the patient squat holding on to the examiner’s hand for balance.
- The hip abductor muscles are tested in the Trendelenburg’s test, in which the patient is asked to stand on one leg and then the other, while the examiner sits behind the patients with his hands on the patient’s iliac crests. Any drop of the pelvis on the side opposite the stance leg constitutes a positive sign of weakness of the abductors on the stance leg indicating that the L5 nerve root is affected.

Patient sitting on the examination table.

- Peripheral neurologic examination: the knee and Achilles reflexes are tested with the patient sitting on the examining table with legs hanging free. A distinct strike with the reflex hammer on the tested tendon will produce an involuntary extension jerk of the lower leg and the foot respectively. Alternatively, for testing the Achilles reflex the patient can be kneeling on a chair holding on to the

back of the chair with both hands.

- With the patient sitting or lying on the examination table the strength of the extensor hallucis longis is tested by applying a resistance against extension of the both halluces. Weakness indicates that the L5 nerve root is affected. Quadriceps can be tested with the patient sitting on the examination table and asked to extend his/her lower leg from the knee. The examiner puts a resistance against the extension and compares the strength with the unaffected leg. Weakness indicates that L3 and L4 nerve roots are affected. Hip flexion is tested with the patient sitting on the examination table and asked to lift his/her leg up from the table. The examiner puts one hand just above patella and applies resistance by pressing down on the thigh. Weakness indicates that L1 and L2 nerve roots are affected.

Patient lying supine.

- Straight leg raising test is the classic test of sciatic nerve irritation. The examiner stands to one side of the patient, places one hand on the patient's knee to extend the knee and the other hand under the patient's heel and then lifts the leg while keeping the knee straight. A positive result produces typical pain radiating down the back of the thigh below the knee and to the foot while the leg is elevated 60 degrees or less at the hip. However, S1 and occasionally, L5 irritation can stop at the buttocks or posterior thigh. Symptoms produced at elevations greater than 60 degrees may represent irritation of the nerve root, but frequently reflect referred mechanical back pain or hamstring tightness. The examiner should also perform the crossed straight leg raising test by lifting the well leg. If this causes pain on the affected side this demonstrates an extreme irritability of the affected nerve root. Crossover pain describes a situation when pain is produced in the normally asymptomatic leg when the affected leg is lifted. Crossover pain indicates central disc herniation.
- Sensitivity is tested by light strokes, using the index and middle fingers, bilaterally on the medial, anterior and lateral sides of the lower leg, the dorsal, lateral, and medial surface of the foot.
- Back muscle endurance test may be indicated when back pain has been present for a long period of time (months). The patient is lying prone on the examination table. A chair is placed at the top end of the table. The patient's legs and pelvis are supported by the table. The upper trunk is outside the top end of the table and the patient supports himself by his hands on the chair. The legs are either strapped or held down by the examiner when the patient is asked to extend his upper body and put his hands behind his back. Normal or good endurance is the ability to hold the position for 4 minutes at which time the test is interrupted.
- **Waddell's** tests consist of five nonorganic physical signs to identify those patients who have a significant psychological or socioeconomic basis for their pain.
 1. *Nonorganic tenderness* may include either broad, superficial tenderness to light touch in the lumbar region and/or widespread deep tenderness in a nonanatomic distribution.
 2. *Simulation tests* suggest to the patient that a specific examination is being performed though, in fact, it is not. For example, low back pain produced with either axial loading of the skull or passive rotation of the shoulders and pelvis in the plane through the hips suggests involvement of nonorganic factors in the pain response.
 3. *Distraction tests* attempt to reproduce positive physical findings while the patient's attention is distracted. A positive supine straight-leg raising response may be suspect if the patient can flex his/her hip to 90° with the knee extended in the sitting position.
 4. *Regional disturbances* are sensory and motor abnormalities that involve multiple regions and are unexplained on a neuroanatomic basis. "Give way" weakness and sensory loss in a "stocking", rather than dermatomal, distribution probably have a nonorganic component.
 5. *Overreaction* during examination is statistically the most important nonorganic physical sign. Disproportionate verbalisation, inappropriate facial expression, tremor, collapsing, and sweating are all manifestations of this Waddell sign.