



THE FATE OF MRS ROBINSON: CRITERIA FOR RECOGNITION OF WHOLE-BODY VIBRATION INJURY AS AN OCCUPATIONAL DISEASE

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Several recently published critical reviews conclude that there is strong epidemiological evidence for a relationship between occupational exposure to whole-body vibration (WBV), low back pain (LBP) and back disorders. Whether this exposure is only a modest or a substantial risk factor for the onset and recurrence of LBP is still a matter of debate. In spite of this controversy, four European Union countries have decided to recognize and compensate LBP and certain spinal disorders as an occupational disease. In this paper, we review the criteria currently in use for the recognition of this occupational disease. A search of the literature was performed; additional information was obtained in work visits to national occupational disease institutes in Germany, France and Belgium, in annual reports and national statistics on occupational diseases. Belgium was the first country to add WBV injury to the official list of occupational diseases (1978), followed by Germany (1993), the Netherlands (1997), and France (1999). The incidence of newly recognized cases in 1999 varied considerably: 763 in Belgium, 269 in France, 16 in Germany, and 10 reported cases in the Netherlands. The findings of this review indicate that significant differences exist in the established and applied diagnostic and exposure criteria in the four EU countries. This is illustrated by the case of Mrs Robinson, a 41-year-old forklift driver with LBP, who would probably get recognition and compensation in the Netherlands and Belgium but would be rejected in France and Germany. The development of uniform internationally accepted criteria is recommended, also from an epidemiological point of view, as many data are collected in the process of recognition of this occupational disease.

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1. INTRODUCTION

Low back pain (LBP) is among the most common health problems in the world. Lifetime prevalence has been estimated to be 60–80% for industrialized countries, having a large impact on health care utilization and on sickness absence and disability figures and cost

[1, 2]. Occupational, non-occupational, and individual risk factors play a role in the development, the duration, and the recurrence of LBP. Several critical reviews have recently discussed evidence on various occupational risk factors for back disorders [3–7]. All these reviews conclude that there is strong epidemiological evidence for a relationship between occupational exposure to whole-body vibration (WBV) and LBP. Although a clear exposure–response relationship could not be established, in some studies a consistent trend towards higher risks with exposure to higher WBV magnitude or to higher WBV dose was observed [8–10]. Experimental biodynamic research, carried out on vibration-induced strain on the lumbar vertebral column, indicate that WBV may affect the spine by mechanical overloading, leading to muscle fatigue and cumulative fatigue failure of the endplate [11]. In a recent cross-sectional magnetic resonance imaging (MRI) study, LBP was associated with signs of disc degeneration while the risks of LBP and sciatic pain were strongly affected by WBV and prolonged constrained sitting [12]. In contrast, in another MRI study, Videman *et al.* [13] could not confirm rally driving, and its associated WBV, as a significant cause of disc degeneration. The role of WBV in the aetiopathogenesis of low back injuries is not yet fully clarified and it is still a matter of debate whether WBV exposure may be a modest [14] or a substantial [15] risk factor for the onset and recurrence of LBP in exposed workers.

In spite of this controversy, in several European countries, it was decided to recognize and compensate LBP and certain spinal disorders as a WBV-related occupational disease when meeting certain criteria. Due to the high incidence of LBP in general and the fact that WBV is still a common occupational risk factor [16], such a decision may have a high impact. In the countries involved, this has led to dispute among experts and governmental and non-governmental bodies in occupational health and social insurance. The emphasis in this dispute is on the criteria applied. In one country, Belgium, this has led to official revision of the criteria applied [17]. The purpose of this paper is to review the criteria currently in use for the recognition of WBV injury as an occupational disease in the European Union countries.

2. METHODS

2.1. RETRIEVAL OF INFORMATION

A literature search was performed using the databases Medline (National Library of Medicine, U.S.A.), EMBASE (Excerpta Medica Collection, The Netherlands), NIOSHTIC (National Institute for Occupational Health and Safety, U.S.A.), and CISDOC (International Labour Office, Switzerland). The keywords used were: occupational disease(s), (whole-body) vibration, vibration injury, (low) back pain, spinal disorders, diagnostic criteria.

Further information was obtained from work visits to the Occupational Diseases Fund (Fonds voor Beroepsziekten) in Brussels, the Institute for Occupational Safety-BIA (Berufsgenossenschaftliches Institut für Arbeitssicherheit) in Sankt Augustin, Germany, and the National Illness Insurance Fund-CNAM (Caisse National d'Assurance Maladie) in Paris. Data on the incidence and prevalence of established occupational diseases due to WBV were retrieved from annual reports of national occupational disease bodies and from national statistics on occupational diseases. Additional information on applied procedures and criteria for recognition came from the European Forum of insurance against accidents at work and occupational diseases, and from participants in the BIOMED 2 concerted action BMH4-CT98-3251(Vibration Injury Network).

2.2. CASE: MRS ROBINSON

In order to outline the possible impact of the differences in the conditions of recognition in different countries, the information on the established criteria was applied to the case of “Mrs Robinson”, a 41-year-old woman, working as a forklift driver in a chemical plant. “Mrs Robinson” has been examined by her occupational physician. She has been on sick leave for 2 months due to LBP with sciatica. The first episode of sick leave due to LBP occurred 4 years ago and lasted 6 weeks. Her current treatment consists of anti-inflammatory drugs during the first 2 weeks and physical therapy after the sixth week, but she is still suffering from pain. Physical examination by the occupational physician shows a flat lordosis, increase of pain and restriction of mobility in lumbar flexion, but no clear peripheral neurological signs. X-ray findings were obtained from the medical record of the general practitioner: mild spondylosis, slight signs of protrusion (but no prolaps or herniation) of intervertebral disc and slightly reduced disc height at L4–L5 and L5–S1. The occupational history shows that “Mrs Robinson” has been working for 6 years as a forklift driver; she has no relevant WBV exposure in the past. The average duration of driving during a typical working day is 6 h. Recently performed vibration measurements on her vehicle showed an average acceleration level of about 1 m/s^2 ($a_{w,r.m.s.}$).

At the end of the consultation, “Mrs Robinson” asks her occupational physician: “Doctor, do I have an occupational disease?”

3. RESULTS

Whether “Mrs Robinson” is suffering from an occupational disease is not a simple straightforward question to answer. On the one hand, this will depend on the definition and system of “occupational disease” that is used, and on the other hand on the clinical diagnostic criteria and the exposure criteria that are applied for recognition.

3.1. OCCUPATIONAL DISEASE DEFINITIONS AND SYSTEMS IN GENERAL

According to the ILO Encyclopaedia of occupational health and safety, occupational diseases “cover all pathological conditions induced by prolonged work, e.g., by excessive exertion or exposure to harmful factors inherent in materials, equipment or the working environment” [18]. This is more a general description than a medical definition and this description is too vague to appear in legal documents.

However, an attempt to present a general definition of occupational diseases may be “a sterile exercise in semantics” [19]. Comparison of occupational disease systems from a number of European countries shows that the definition of what an occupational disease is, varies according to the main purpose of its use: collection of epidemiological or statistical data, preventive purposes, or compensation of injured workers. In the Netherlands, every occupational physician is obliged to report observed or probable cases of occupational diseases to the Netherlands Centre for Occupational Diseases. An occupational disease, herein, is defined in the Labour Conditions Act as “a disease or disorder caused by a load, exposure, or burden which predominantly took place in the work or working conditions” [20]. This definition is rather broad but the purpose of this reporting and registration system is “only” to signalize and identify trends in the prevalence and the prevention of occupational diseases. It is not intended for compensation purposes, as the Dutch social security system in general does not differentiate between a “*risque social*” and a “*risque professionnel*”. If financial compensation is the main purpose, a more strict definition and

more strict criteria are usually applied. In countries offering specific compensation for occupational diseases instead of or in addition to a general social security system, the question of cause–effect relationships arises more dominantly, since it has to be established which cases shall benefit from it and which not. In Germany, only diseases due to hazardous influences on groups exposed occupationally to a much greater extent than the general population can be included in the list of occupational diseases and the workers carry the burden of proof. In many countries (e.g., Belgium, Italy, Germany, Denmark, Austria, Spain) recognition was originally based on a list or table (France) of occupational diseases with a more or less restrictive nature: diseases that were not included in this list could not be recognized or compensated. Nowadays, most of these countries have adopted a “mixed” or “open” system; next to the list there is a possibility that diseases which are not included in the list but which in specific cases may have a clear occupational origin can also be recognized. In spite of this more uniform policy, however, two European projects on comparison of the different occupational disease systems in EU countries still show remarkable differences between the countries. The Eurostat project “European Occupational Diseases Statistics” of 1995 reported a large variance in incidence of occupational diseases due to differences in legislation, social insurance systems, procedures and criteria for recognition, level and coverage of occupational health care and the risks itself [21]. A recent report of the “European Forum of insurance against accidents at work and occupational diseases” highlights many disparities between occupational disease systems in terms of reporting procedures (e.g., claims by doctors or victims), recognition conditions (e.g., lists or open systems, occupational origin, criteria, diagnostic procedures), and benefits received (e.g., relation with disability or gravity of the disease, amount of benefit) (cited in reference [20]).

3.2. WBV INJURY AS OCCUPATIONAL DISEASE AND INCIDENCE OF RECOGNIZED CASES

In 1990, the European Commission recommended to the member states a European list of occupational diseases (90/326EEC) to introduce into their national laws, regulations or administrative provisions suitable for compensation and preventive measures [22]. This list includes osteoarticular and angioneurotic diseases of the hands and wrists caused by mechanical vibration but does not include WBV injury. In spite of this, so far four EU countries have established LBP and/or back disorders due to exposure to WBV as an occupational disease and added it to their national list of occupational diseases. Belgium was the first one in 1978, followed by Germany in 1993, the Netherlands in 1997, and France in 1999 (see Table 1). In the Netherlands, recognition is only for preventive purposes.

TABLE 1

EU Countries with official establishment of WBV injury as occupational disease and incidence of recognized cases in 1999

Country	Year of establishment	Incidence in 1999
Belgium	1978	763
Germany	1993	16
Netherlands	1997	10
France	1999	269

In the other countries, recognition can lead to financial compensation for the injured worker. Figures from the different national statistics on occupational diseases show a large variance in the annual incidence of newly recognized cases in the four countries.

During 1999, occupational physicians in the Netherlands reported 10 cases of “low back pain due to whole-body vibration” [23]. However, only a minority of the Dutch occupational physicians report (any) occupational diseases [20, 24].

In Germany, the occupational disease No. 2110 was included in the list as “diseases of the lumbar spine from disc degeneration caused by long-term (mainly vertical) whole-body vibration exposure whilst sitting, which have led to the discontinuation of all work which was or could be responsible for the origin, the deterioration or the recurrence of the disease” [24]. From the establishment of this occupational disease, there were many claims annually but the number of rejected cases is considerable. In 1994, 1111 claims led to six accepted cases [25]. During the years 1996–1998, the annual number of claims totalled, respectively, 1076, 932, and 871, but of these only 55 (1996), 37 (1997), and 14 (1998) cases were recognized [26]. In 1999, the number of recognized cases was 16 (M. BUTZ 2000 Hauptverband der gewerblichen Berufsgenossenschaften, pers. comm.).

The National Illness Insurance Fund in France, CNAM, added “chronic disorders of the lumbar spine due to low and medium whole-body vibration” in 1999 as Tableau No. 97 to the French list of occupational diseases. Between February 1999 and March 2000, in total 269 cases were recognized [27].

Belgium has the longest history of compensation for WBV injury. As part of occupational disease No. 1.605.01 “bone and joint disorders caused by mechanical vibration” disorders of the spinal column were first established as a compensable occupational disease in 1978. It is, after silicosis, the occupational disease with the highest prevalence in the country: a total number of recognized cases of more than 27 000 [29]. For more than 10 years it has been the occupational disease with the highest annual incidence. In 1997, 1157 new cases were recognized and in 1999, 763 (H. DE WAELE 2000 Fonds voor de beroepsziekten, pers. comm.).

3.3. CRITERIA FOR RECOGNITION

Notwithstanding the overlap in the titles or descriptions of this occupational disease, comparison of the applied criteria in the four countries shows remarkable differences.

3.3.1. *Diagnostic criteria*

The diagnostic criteria in use in the different countries are summarized in Table 2.

In general, the diagnosis is based on the specific medical case history, findings from clinical examination and further diagnostic examination (e.g., findings from X-ray or other imaging techniques). Only in the Netherlands, findings from this last category are not required for recognition; cases can be diagnosed by every occupational health physician working in practice [29]. In the other countries, additional expertise is often necessary. In Germany, occupational disease No. 2110 can be diagnosed only after examination by specialists (in orthopaedics, surgery or neurosurgery) with radiological support [24]. In Belgium, a board of physicians with radiological expertise is consulted as part of the recognition process [30].

(Recurrent) low back pain and/or sciatic or radiating pain are the key symptoms in the medical case history. In most cases, this pain will be accompanied by functional restrictions or disability. In Germany this is a “*conditio sine qua non*” for recognition: the disorder has

TABLE 2

Diagnostic criteria in use for recognition of WBV injury as occupational disease

Country	Medical case history	Clinical signs/symptoms	Further examination (X-ray, MRI, or other)
Belgium	LBP [†]	In accordance with pain	Degeneration not conform age
Germany	LBP and withdrawal from occupation	Intervertebral disc-related syndromes	Pathological intervertebral disc-related changes
Netherlands	LBP; > 50% VAS [‡] -score; > 10 items on Roland disability scale	In accordance with pain and disability	Not necessary
France	Sciatic pain or radiating pain upper leg	Herniation of lumbar disc	Herniation of lumbar disc

[†]Low back pain.[‡]Visual analogue scale.

to be so serious that it has caused withdrawal from work. In addition to the medical questioning, the Dutch guideline recommends (but this is not obligatory) that the severity of pain should be evaluated on a visual analogue scale (VAS) and the level of disability on a standardized disability scale.

The signs and symptoms to be found in the clinical examination by the investigating physician are, in the four countries, in general not very well defined. They have to be in accordance with the reported symptoms of pain and disability. The German guideline distinguishes three intervertebral disc-related entities: local lumbar syndrome, mono- and polyradicular lumbar syndrome, and cauda equina syndrome, each with their own set of clinical signs and symptoms [31]. In France, the clinical examination concentrates on neurological symptoms and sciatic pain in the case of a lumbar herniated disc L4–L5, or radicular pain in the upper leg with a herniation L2–L3, L3–L4, or L4–L5. The required radiological, echographic, or MRI-findings in Belgium and Germany are degenerative intervertebral disc-related changes (e.g., spondylosis, spondylarthrosis, disc protrusion or prolapse) which cannot be explained by age only. In France, they should confirm the existence of a lumbar herniated disc.

3.3.2. Exposure criteria

In addition to the diagnostic criteria, the pre-conditions with respect to the exposure to WBV are different (see Table 3). The minimal exposure duration that is required for recognition varies from 1 year (but only in case of daily exposure above 1 m/s²) in the Netherlands to 10 years in Germany. This latter is a guideline, not an absolute indication. Regarding the magnitude of WBV exposure, France is the only country that does not present figures but a restrictive list of tasks with WBV exposure: driving of off-road vehicles, driving of industrial vehicles (e.g., forklifts), and driving of an articulated truck or lorry [32]. In the German system, a work-life dose is estimated in a two-step procedure. The first step is the calculation of the daily exposure as an 8 h frequency-weighted acceleration ($a_{wz, 8h}$); the second step is the calculation of the work-life dose from all days with $a_{wz, 8h} \geq 0.8 \text{ m/s}^2$ or $a_{wz, 8h} \geq 0.63 \text{ m/s}^2$ (in case of shock-type vibration). This work-life dose should be at least $1.45 \times 10^3 (\text{m/s}^2)^2$ to meet the requirements. Furthermore, in Belgium and Germany, only vibrations in the vertical direction are considered for the calculation of the magnitude; in the Netherlands all three directions are taken into account.

TABLE 3

Exposure requirements in use for recognition of WBV injury as occupational disease

Country	Minimal exposure duration	Exposure magnitude
Belgium	5 years	$a_{wz,8h} > 0.63 \text{ m/s}^2$
Germany	10 years (in general)	$a_{wz,8h} > 0.8 \text{ m/s}^2$ or $> 0.63 \text{ m/s}^2$ (shock-type vibration)
Netherlands	1–5 years (depending on magnitude)	Work-life dose $> 1.45 \times 10^3 \text{ (m/s}^2)^2$ $a_{wxyz,8h} > 0.5 \text{ m/s}^2$
France	5 years	Restrictive list of tasks with WBV exposure: use or driving of off-road machinery, industrial trucks or machines, articulated trucks and lorries

$a_{wz,8h}$: weighted acceleration magnitude in the vertical (z) direction.

$a_{wxyz,8h}$: vector/sum of weighted acceleration magnitude in x, y, and z direction.

3.4. THE FATE OF MRS ROBINSON

When the above mentioned diagnostic and exposure criteria are applied to the case of “Mrs Robinson”, this would mean that she probably

- (1) will be reported (and recognized) as having an occupational disease in the Netherlands,
- (2) will have a good chance to be recognized and compensated in Belgium (depending on the judgement of the radiological panel),
- (3) will not be recognized in France because she does not meet the diagnostic criteria (no herniated disc),
- (4) will not be recognized in Germany because she meets neither the diagnostic criteria (no permanent disability yet) nor the exposure criteria (work-life dose not high enough).

4. DISCUSSION

The findings of this review indicate that significant differences exist in the established and applied criteria for WBV-related injury in the four EU countries where such injury currently is established as an occupational disease. Whereas “Mrs Robinson” would get recognition and compensation in one or two countries, she would be rejected in the other ones. Furthermore, the large variance in the annual incidence of this occupational disease in countries with a comparable WBV exposure distribution in the working population confirms the disparity between these countries. This disparity is partly due to differences in the occupational disease systems in general but also caused by the differences in the criteria applied for this specific occupational disease.

In order to stimulate the process of harmonization of occupational diseases legislation in the member countries and to agree on the main characteristics of particular diseases, the European Commission published Information Notices on the diagnosis of occupational diseases in 1994 [33]. Despite the considerable amount of epidemiological evidence, WBV-related back pain or back disorders are not included in this list, in contrast to disorders caused by hand–arm vibration. This may be only a matter of time. However, because of the non-specificity of the main characteristic of WBV injury (LBP), its high prevalence in general, and the extensive population at risk, this will not be an easy decision.

The experiences in the countries with the longest history of establishment of this occupational disease, Belgium and Germany, indicate that "on both sides of the spectrum" severe debate can be expected. Soon after the establishment of the procedures in 1978, the rapidly growing number of recognized cases and the relative lack of clear diagnostic criteria, raised the question among medical and social insurance experts in Belgium as to whether the Belgian decision had not been premature [17]. In 1984, the Technical Board of the Occupational Diseases Fund therefore revised the criteria for recognition: among others the minimal required exposure duration was elevated from 2 to 5 years. However, according to the figures, this probably affected the number of claims only slightly.

In Germany, the discussion concentrates on the high number of rejections. The low number of recognized cases for occupational diseases in general (for all diseases together 24%) have already raised some discussions about the integrity of the German recognition system [34]. The ratio of recognized claims of WBV injury is only 1–5%. In particular, the exposure criteria applied seem to be a hurdle. A study performed by the Institute for Occupational Safety—BIA on claims of mobile machinery operators showed that in 30.7% of all investigated cases, the daily exposure dose was estimated to be above 0.8 m/s² [35]. Additionally, out of the 1000 cases that did meet the daily vibration exposure dose, only 21% reached the required minimum work-life dose. These exposure criteria have also been discussed in Germany during last years. The Central Federation of the Industrial Professional Associations (Hauptverband der gewerblichen Berufsgenossenschaften) itself initiated a longitudinal study on dose–response relationships between whole-body vibration and lumbar disc disease. The conclusion of this study was that the daily reference exposure criterion of 0.8 m/s² is too high because a significant increase of cases of lumbar syndrome was already found to be above a daily reference exposure of 0.6 m/s² [10]. However, so far, this has not lead to a formal revision of the exposure criteria.

In the two other countries, only limited experience with the recognition of WBV injury exists. In the Netherlands, compared to the other countries the less strict criteria did not lead to a large number of reported cases. However, with severe under-reporting of occupational diseases in general, these Dutch figures have only limited value. In France, the existence of a herniated disc is a prerequisite for recognition. This will definitely limit the number of claims but this choice seems to be based on social-economic considerations rather than on scientific evidence.

Of course, recognition of, and compensation for WBV injury as an occupational disease is a last repair. Priority should be given to the development of effective strategies for prevention. On the other hand, the issue is also a moral one. As Harrington states: "In a civilized society, the State has a responsibility to provide financial support for citizens which, in the normal course of earning a living, have been temporarily or permanently disabled by their occupation" [22]. For this purpose, the use of uniform, internationally accepted criteria for recognition of this occupational disease may not only reduce the disparity between the different countries but would also facilitate the reporting and interpretation of epidemiological data that will be collected in the diagnostic procedures to establish the occupational disease.

In the meantime, the answer to the question as to whether our female forklift driver "Mrs Robinson" has an occupational disease depends very much on whether she is actually "Mevrouw", "Fräulein", or "Mademoiselle" Robinson.

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