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ESTIMATION OF THE PREVALENCE OF HAND-ARM VIBRATION SYNDROME IN GREAT BRITAIN

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1. INTRODUCTION

1.1 It is well recognized that prolonged and repeated use of vibrating tools can lead to problems affecting the blood supply and the sensory nerves of the fingers, to which the term Hand-Arm Vibration Syndrome (HAVS) has been applied. In the classic picture a worker is subject to periodic attacks in which one or more fingers or parts of fingers become cold, numb and blanched. These attacks are typically brought on by cold weather but in severe cases they can also occur in warmer weather. Disability in both work and leisure activities can result. Sensorineural symptoms may occur independently of vascular ones, but most epidemiological studies have concentrated attention on the vascular symptoms, or Vibration White Finger (VWF). VWF is a Prescribed Disease (PD) under the Industrial Injuries Disablement Benefit scheme, which means that subject to certain conditions concerning the degree of disability and the nature of the occupation, sufferers can get compensation from the state.

1.2 While vascular effects are episodic, reduced manual dexterity resulting from sensorineural damage may cause persistent disability which is less likely to regress with cessation of exposure. However, sensorineural deficit in the absence of vascular symptoms is not currently admitted as a PD, though it is being considered as a possible addition to the list.

1.3 The present study was undertaken by the Health and Safety Executive as part of a review of the major occupational ill health problems that affect British industry. It derives estimates for the prevalence of HAVS using various sources of data, namely Industrial Injury Benefit statistics, surveys of vibration exposure, studies of the frequency of HAVS in particular industries in the UK and world-wide, and a population survey in which respondents were asked about health problems which they believed to be work-related.

PREVALENCE OF HAND-ARM VIBRATION SYNDROME

2. OCCUPATIONAL EXPOSURE TO VIBRATION

2.1 The Health and Safety Executive (HSE) carried out two sample surveys of exposure to hand-arm vibration in Great Britain (Kyriakides [1], Bednall [2]). Counts were made of the numbers of workers using different types of vibrating tool in different industries. One of the main aims of the surveys was to estimate the numbers of workers in Britain with substantial exposure to vibration who might therefore be considered as at risk of developing HAVS, though it was recognized that the numbers actually getting the disorder would be a good deal smaller. For most industries (apart from construction) the amount of tool usage was broadly categorized into low and high use groups with a fairly low threshold set for 'high use'. This was defined as more than 4 hours/day on at least one day in the week sampled, or more than half an hour per day on at least two days in the week. Construction was sampled on a daily basis, and usage recorded as less than half an hour, less than half a day, or 'all day' (presumably meaning more than half a day). Thus 'high usage' as defined in these surveys could be anything between 2 hours/week (if comprised of an hourly spell on each of two days) and 40 hours or more in a week.

2.2 Obviously the rate at which VWF is likely to develop will vary considerably between such extremes of weekly exposure. During a working week the estimated numbers of workers making high use of vibrating tools were 7500 in mines and quarries, 22,300 in construction ('all day' use), and 132,000 in other industrial sectors. Many workers used more than one type of tool, so that assumptions had to be made in order to quantify the relative usage of the different types. Because of the limited resources, no attempts were made to survey the prevalence of VWF or to measure the vibration characteristics of the tools.

2.3 Apart from some comments about the seasonality of work in different industries there were no indications of how many of the same workers who used vibrating tools in the week surveyed continued such use throughout the year. Kyriakides thought it reasonable to assume that most of the workers who used vibrating tools in the week surveyed continued to do so 'in subsequent weeks', which might mean all or only part of a year. Despite these limitations these surveys provide our best available national estimates of workers exposed to hand transmitted vibration.

3. EPIDEMIOLOGY OF HAVS AND THE DOSE-RESPONSE RELATIONSHIP

3.1 The extensive literature on the epidemiology of HAVS has been reviewed by Griffin [3] and NIOSH [4]. Since workers are not usually suffering from an attack at the time they are seen by a doctor, the diagnosis rests largely on the history of attacks as recounted by the sufferer and the doctor's interpretation of this history. Thus there can be a subjective element in the diagnosis, which may affect the prevalence in different studies, despite the development of standard criteria for staging HAVS and attempts to develop more objective tests. In attempting to quantify the effects of occupation in causing the symptoms of HAVS it must be borne in mind that such symptoms are not uncommon in the general population and can arise from hereditary predisposition or other non-occupational causes. The term Raynaud's disorder is used for the syndrome of blanching and numbness of the fingers, whatever the cause. A survey of patients in five English general practices found that 11 per cent of male respondents to a postal questionnaire and 16 per cent of males attending surgery for any reason had Raynaud's disorder [5]. The NIOSH [4] review of hand-arm vibration found 19 studies which had included unexposed control groups, in which vascular symptoms had a weighted mean prevalence of 5.4 per cent. This latter figure would seem more appropriate to use as a baseline in an industrial context, since it was based on internal comparisons and the same diagnostic criteria as were applied to the work-related cases.

3.2 A model for the relationship between the magnitude of vibration, the years of exposure, and the proportion of workers developing VWF has been developed by Brammer [6,7], and used as a basis for British and international standards for the measurement of hand-arm vibration (BS 6842:1987; ISO 5349-1986). The accuracy of this model has been questioned [3,4,8,9], though it may be noted that the purpose of the standards was to give recommended techniques of measurement, rather than predict how many would develop VWF. One disputed point is whether a frequency weighting should be applied to vibration measurements, and if so, what weighting function should be used. It is plausible that some frequencies may be more harmful than others, but the weighting recommended in the standards was based on subjective feelings of discomfort, in the absence of adequate information on actual harm done by different frequencies. The other main problem concerns the measurement of the time component in vibration dosage. The standards imply that length of exposure during the working day, and working years of exposure should have different functional forms in the calculation of dosage. If this supposition is correct, it implies that time cannot enter the calculation as a simple sum of total hours of exposure over several working years, and the number of days over which the exposure is spread can make

a considerable difference to the result. Also it is not clear how exposure should be calculated if a worker works less than a full week.

3.3 Because of the lack of vibration measurements in the HSE surveys and because of the doubts about the dose-response relationship, it was decided to estimate the total number of cases by the simpler method of multiplying the estimated numbers exposed in different industries by prevalence estimates derived from published industry-based studies.

4. ESTIMATE BASED ON EXPOSURE AND PREVALENCE STUDIES

4.1 The HSE survey results were examined in conjunction with the NIOSH and Griffin reviews of the prevalence of VWF in users of different kinds of tool, in order to estimate roughly how many workers use the most hazardous kinds of tool, and thus how many overall might have developed VWF. As noted above, the threshold for 'high' usage as defined in the HSE surveys was set rather low and the high use group covers a wide range of exposures. Some kinds of tool such as percussive metal working tools, rotary grinders and polishers, pneumatic rock picks, and chainsaws have featured in many reported studies that give estimates of the prevalence of VWF. This probably reflects not only their high levels of vibration but also the length of time for which they are used. By contrast, the infrequency of reports of VWF associated with pneumatic road breakers (one of the vibrating tools most used by public utilities and the construction industry) is possibly due to their intermittent use rather than their inherent safeness [3,10]. However there are some reports of VWF occurring in construction and utility workers, especially those who make more frequent use of vibrating tools because of job specialization. A Dutch investigation [11,12] claimed an increased prevalence of VWF in users of impact tools including road breakers, though the numbers were small and the evidence for a dose-response effect was weak.

4.2 In forming a rough prevalence estimate the public utilities, construction and agriculture sectors were omitted on the assumption that much of their vibration exposure would be intermittent or seasonal, but manufacturing, forestry, mines and quarries, where exposure is more sustained, were included. This should not be taken to mean that there were no cases of VWF in other industries, only that it was difficult to quantify the prevalence, and that it was presumed to be small by reason of low risks or small numbers of workers with significant exposure. On the basis of the HSE surveys the numbers of workers with 'high' exposure were taken to be 93,900 in mechanical engineering

(including vehicle manufacturing), 10,400 in foundries, 8,600 in ship building and repairing (including oil rig construction), 1,800 in manufacturing concrete products, 4,400 users of chainsaws in forestry, and 3,750 in mines and quarries. (The latter figure was halved from the HSE survey figure to reflect the likely number using borers, rock drills and picks).

4.3 Percentage prevalence values were postulated for VWF in the different industries, based on weighted averages of published estimates for the tools most frequently used by them, using the NIOSH and Griffin reviews [3,4]. Studies published since 1970 were used, to reflect recent improvements in the 'anti-vibration' qualities of tools and working practices. Even so, the workplaces included in most of these studies were presumably selected because VWF was known to be especially frequent there, by reason of their heavy usage of vibrating tools or other aspects of the work. Thus imputed risks based on these studies would be likely to be high in relation to the actual risks experienced by most of the 'high usage' workers in the HSE exposure surveys, where high use had been defined fairly broadly. The imputed prevalences ranged from 20 to 50 per cent. These values could only be approximate and were intended only to give an overall estimate of the number of workers that might be affected in all industries. They were not intended to be compared between industries, as the evidence for one industry being more hazardous than another was limited.

4.4 Multiplying the numbers of 'high-user' workers in each of the affected industries by the imputed percentage prevalence and totalling gave a prevalence estimate of 38,400 cases in Great Britain. Assuming that 5 per cent of these had idiopathic or other non-occupational Raynaud's disorder (NIOSH[4]) leaves 32,300 as an estimate of the number of occupational VWF cases. For all the reasons noted above it can only be a very rough estimate. It is more likely to be an over than an underestimate because as noted above, it was based on imputed prevalence estimates derived from studies of groups with high vibration exposure.

4.5 Since the estimate was based on the currently working population it did not include cases of long standing VWF in people no longer exposed.

5. ESTIMATES BASED ON LABOUR FORCE SURVEY AND COMPENSATION

5.1 A supplementary questionnaire on occupational health [13] was added to the 1990 Labour Force Survey (a regular sample survey carried out for the Department of Employment), in which respondents were asked whether they had any illness, disability or

other physical problem which had (in their view) been caused or made worse by work, and if so, what. By grossing up the responses it was estimated that there were a total of some 7,300 cases of VWF in England and Wales, with a 95 per cent confidence interval of 4,100 to 12,000, the width of the interval indicating that an appreciable sampling error was possible.

5.2 In order for a claim for Industrial Disablement Benefit for a Prescribed Disease (PD) to be entertained, the claimant's present or past employment in a relevant and prescribed occupation must be verified, and medical experts must confirm that the disease is present and is thought to be caused by the occupation. Then, in order for a pension or lump sum to be granted, the claimant's degree of disability must be assessed at a minimum of 14 per cent, either from one PD or from a number of PDs aggregated if he suffers from more than one. (However this 14 per cent rule did not apply to claims entered before 1 October 1986). Numbers of assessed cases of PDs can thus be taken as absolute lower limits for the numbers of cases of occupational ill health.

5.3 Under the terms of this scheme VWF is defined as episodic blanching occurring throughout the year, affecting the middle or proximal phalanges of any three digits on one hand. (Lesser requirements apply if any fingers are missing). VWF was prescribed in 1985, and numbers of new assessed cases have risen rapidly to some 5400 in 1990-91 (including cases ineligible for benefit because of less than 14 per cent disability), becoming the most common prescribed disease. Numbers of new VWF cases have overtaken those for noise induced hearing loss, which still remains the second most frequent PD. Annual numbers of cases of VWF were as follows:

Year Assessed	Assessed Cases
85/86	641
86/87	1366
87/88	1673
88/89	1056
89/90	2601
90/91	5401

Future figures may continue to rise before settling to a stable level, and there is probably a sizeable pool of pre-existing cases from which the currently assessed cases are being drawn. These assessed cases will on average be the more severe cases, though as with other prescribed diseases the extent to which VWF is commonly recognized as an occupational disease in the workplace, and the level of awareness among GPs may affect the likelihood of

sufferers applying for benefit. Anecdotal evidence suggests that some workers claim Industrial Injury Benefit in order to substantiate claims for civil damages against their employers, even if they do not qualify for state benefit because of the 14 per cent rule.

5.4 Such a hypothesis could explain why the majority of assessed cases have insufficient disability to qualify for benefit under the current 14 per cent rule. The numbers of assessed cases who get benefit under this rule are quite small, peaking at 137 in 1987/88 and declining sharply to 31 in 1990/91. However the analysis of the numbers of assessed claims in the table above is complicated by the fact that up to 1988/89 they included claims entered prior to October 1986 and therefore not subject to the 14 per cent minimum. Numbers of such old cases who would have anyway qualified under the new rule were not readily available.

5.5 A minimal prevalence estimate for VWF was obtained by adding the numbers of assessed cases from 1985-86 to 1990-91, assuming that over this period few of those included would have either died or totally recovered. This gave a total of approximately 12,700, somewhat larger than the LFS estimate noted above, though roughly equal to the upper 95 per cent confidence bound. If respondents to the LFS had entered or were considering entering a claim for compensation one would certainly expect them to have responded positively in the survey, even if their claim had been disallowed for any reason.

6. CONCLUSION

6.1 On the basis of the PD figures and the LFS one can say that a figure of 13,000 represents a likely lower bound for the number of severer cases of VWF (likely to be revised upwards if PD figures continue at similar levels). The estimate of 32 thousand from industry-based studies being probably an over estimate, one might guess at a total prevalence figure of around 20 thousand. In making any use of such a figure one must bear in mind all the limitations of the data sources that have been noted above, and the fact that it corresponds to the approximate mid point of a range of estimates whose highest and lowest values differ by a factor of four. In order to estimate the total prevalence of HAVS, a small figure might be added to the 20,000 to allow for cases of sensorineural disability without vascular symptoms, but it is difficult to quantify this. The probable size of such an adjustment (at most 5 per cent (McCaig [14])) being less than the uncertainty attaching to the VWF estimate, it would probably be inappropriate and unnecessary to apply such a correction.

7. REFERENCES

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