

A follow-up study of vibration-induced white finger due to chain-saw operation

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FUTATSUKA M, UENO T. A follow-up study of vibration-induced white finger due to chain-saw operation. *Scand J Work Environ Health* 12 (1986) 304–306. A longitudinal study was undertaken to evaluate changes in the prevalence of vibration-induced white finger (VWF) among a population of Japanese state forestry workers during the period 1956–1980. The peak prevalence was 62.6 %, determined for the cohort beginning chain-saw use in 1958–1959. Beginning with the 1968–1969 cohort, the prevalence decreased significantly. During the study period the prevalences in this cohort were approximately 10, 20, 30, and 40 % after 2, 4, 7, and 12 years of exposure, respectively. The incidence increased gradually after 1960, and the peak value (5–6 %) was reached in 1966. The latency interval for the development of VWF averaged 6.4 (SD 3.7) years (6 000 to 7 000 h). The prevalence of VWF after the end of exposure fell to 50.2 % in the cohort after more than 12 years of observation.

Key terms: longitudinal study, VWF.

There have been numerous reports of vibration syndrome among forest workers using chain saws in several countries since the 1960s. The prevalence of vibration-induced white finger (VWF) among forest workers in the late 1960s and early 1970s was 30 to 60 % in Japan (4). Similar prevalences have been reported during the same period from European countries (3, 5, 7).

Since the late 1970s, technical improvements in the motor and the introduction of devices to dampen vibration have reduced the acceleration of chain-saw handles from 20 G to about 2–3 G (9). There is only a small number of long-term longitudinal studies of the changes in vibration conditions and their effects (6).

A longitudinal study was undertaken to estimate the changes in the occurrence of VWF during 1956–1980 among a population of Japanese state forestry workers. Preliminary reports from the survey were published in 1969 and 1976 (1, 2).

Subjects and methods

The study has been carried out in Kyushu, south-western Japan, since 1965. The present investigation took the form of a survey of the 1 456 workers in the national forests in this area.

The possible occurrence of VWF was certified from the responses of each subject on a questionnaire. The responses were verified in comparisons with administrative inquiries and medical records. Of the subjects, 1 000 (74.1 %) were examined by us using some ob-

jective measurements, including finger plethysmography and skin temperature measurements.

The changes in the acceleration levels of chain-saw handles, as reported by the Japanese Ministry of Agriculture and Forestry, are shown in figure 1. The symbols in this figure represent different chain-saw models.

Among the subjects with VWF a life-table analysis of the VWF prevalence was carried out to describe the natural course of VWF from the time the use of chain saws ceased.

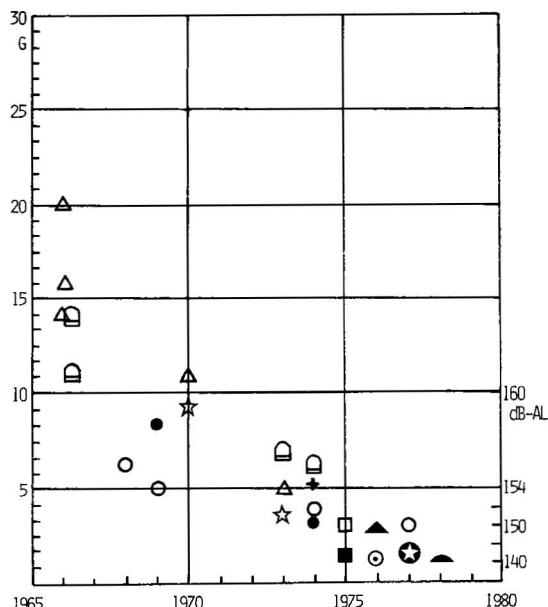


Figure 1. Changes in the acceleration level of chain-saw handles from 1965 to 1980.

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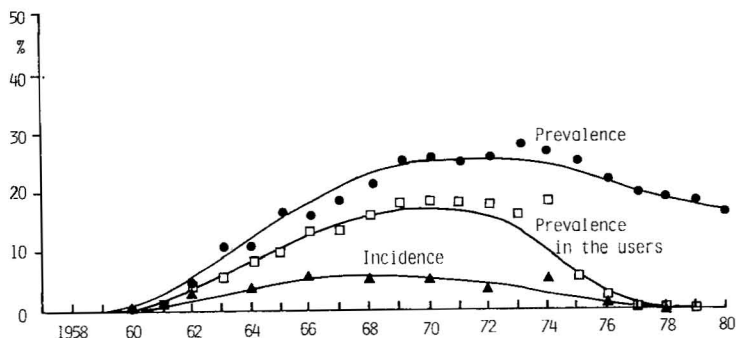


Figure 2. Change in the prevalence and incidence of vibration-induced white finger (VWF) over time.

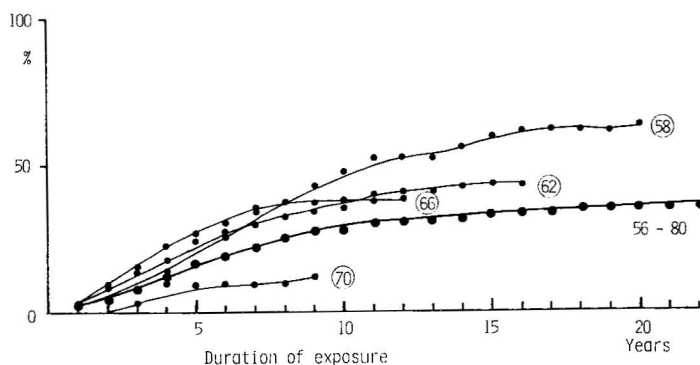


Figure 3. Prevalence (y-axis) by duration of exposure (x-axis) in each cohort. The numerals in the circles represent the year (eg, 58 = 1958) in which chain-saw use began.

Results

Figure 2 shows the change in prevalence over time. The prevalence increased gradually after 1960, the peak value (28.1 %) being reached in 1973, and decreased markedly around 1975. In 1980 the prevalence was 16.8 %.

As shown in figure 2, the peak value of the incidence (5.8 %) was reached in 1966. The incidence decreased to less than 1 % after 1976. Primary Raynaud's phenomenon was observed in 0.5 to 2 % of the adult male population in the rural area of this region.

The peak prevalence for the groups formed according to the time when chain-saw use was begun was 62.6 % in 1958–1959 (figure 3). The prevalence was significantly lower in groups that began chain-saw use in 1968–1969 or later. In the group that began chain-saw use in 1972–1973, only three new cases occurred among 185 subjects (1.6 %). In earlier groups (ie, those who began use at the earlier dates), the prevalence reached a peak five years later, but was 10 to 15 % higher than that of later groups. The prevalences were approximately 10, 20, 30, and 40 % for 2, 4, 7, and 12 years of exposure, respectively.

The cumulation curve of the latency period was divided into the following three groups: short (0–5 years), medium (5–11 years), and long (≥ 12 years) duration of exposure. In this population 85 % of the VWF cases had a latency period of less than 10 years. VWF occurred, on the average, after 6.4 (SD 3.7) years (6 000–7 000 h) of professional chain-saw use with

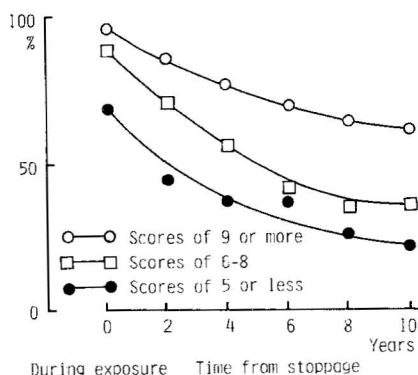


Figure 4. Prevalence (y-axis) of vibration-induced white finger (VWF) according to the VWF scores after the cessation of chain-saw use.

a median value of 5.4 years (5 000–6 000 h) of use.

The cumulative prevalence of VWF after the cessation of chain-saw use leveled off to a final value of 50.2 % after more than 12 years of observation. Regarding the prevalence of VWF, the vibration exposure did not differ between subjects with and without VWF. There was a pronounced tendency ($p < 0.05$) for the prevalence of VWF to increase as the exposure to vibration after the onset of VWF lengthened (figure 3).

In all the cases a reduction in the VWF score, determined using the method of Taylor et al (8), was observed during the study periods. After 10 years of ob-

servation the prevalence of the different degrees of VWF severity, determined by the VWF score, depended significantly on the severity at the time the use of chain saws ceased, as shown in figure 4, being 22.1 % for the cases with scores of 5 or less and 60.8 % for those with scores of 9 or more.

Discussion

Historically the vibration syndrome is a better documented disease entity among the users of chain saws than among the users of other vibrating tools. In Japan the mechanization of forestry has proceeded since 1955, as it has in many countries. The number of chain saws employed in the state forest in 1954 was 106; in 1980 there 270 000 chain saws in use in state and private forestry. The reduction in vibration level in the antivibration (A-V) saws that were introduced in 1970—1975 is shown in figure 1. Furthermore, the reduction to 2 h of chain-saw operation per day was adopted in the state forest between 1970 and 1975.

From the results of the present study, it seems that the reduced exposure to vibration and the reduction in the level of vibration have lowered the incidence of VWF. The larger the vibration level, the greater the difference in duration of latency periods from that of the draft of the International Organization for Standardization. The main reason for this occurrence was that the subjects have been exposed continuously to different vibration levels as chain saws have improved. The results of this study should be recognized because many workers have been operating vibrating tools continuously in this manner.

The cumulation curve of the latency period observed in this study seems similar to the time course of an audiometric pattern in a noise-exposed population. Some differences in susceptibility to vibration in the subjects may be reflected in these results. It is suggested that, in the hiring and management of personnel who

use vibrating tools, tests should be developed to detect susceptible subjects to help prevent vibration hazards.

The reversibility of VWF depends on its severity and, in our study, was influenced by the length of exposure to vibration after VWF had occurred. These results suggest that a prolonged period is required before the abnormal reactivity of the peripheral circulation subsides and the pathological changes in the vessel walls regress. It should be emphasized that early detection and treatment seems to be the most effective measure against irreversibility.

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