The Identification of Sleeping Hours in a *Karoh-Shogai* Case with Matching Objective Data

By

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Based on objective data concerning a *Karoh-shogai* (over-fatigue disorder) case, we discussed the identification of overtime work hours and sleeping hours for assessing “the accumulated fatigue” leading to industrial accidents. The victim of *Karoh-shogai*, a 40-year-old male, was a researcher engaged in a private research institute. He worked from 9:00 to 15:00—six obligatory hours—to allow time for child care. The victim suffered left putamen hemorrhaging on July 13, 2006.

In order to calculate the overtime hours worked and sleeping hours, we used e-mail records from the victim’s work laptop computer, tracking when e-mails were sent and when files were created and updated. We also used the parenting diary, nursery school attendance records, and cell-phone bills, in which the corresponding times were noted. The overtime hours were calculated in accordance with four standards in terms of the hours worked (WA, WB-8, WB-7 and WB-6), and sleeping hours were calculated by three standards in terms of sleeping duration (SA, SB and SC).

As a result, under the three standards of calculation WB-8, WB-7, and WB-6, the estimated number of hours of overtime worked met the standards for the recognition of industrial accidents. The sleeping hours met the standards for the recognition only as to the SC standard. It has been established that not only the quantity of sleep, but also the quality of sleep was an essential element. Therefore, even a sleep lasting for five hours or longer may be insufficient in terms of its quality for some reasons, including cases of “sleep apprehension”. It would, however, be difficult to determine such decrease in quality using the objective data adopted in the present analysis.

In conclusion, it is suggested to first analyze the overtime hours worked before analyzing sleeping hours in assessing “the accumulated fatigue” leading to suicide or death from over-fatigue.

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Key Words: Case of *"Karoh-shogai"* (over-fatigue disorder); Identification in Sleeping hours and Hours of overtime worked; Objectiveness; Methodology

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I. Introduction

The standards for recognition of work-related cerebral and cardiovascular diseases in Japan\textsuperscript{1} were revised in 2001. These new recognition standards clarify working conditions and living conditions likely to lead to "the accumulation of fatigue" ending with onset of cerebral-vascular disease (strokes) and coronary heart disease (heart attacks). These diseases are the major medical cause of occupational sudden death translated into Karoshi.

More specially, working conditions are determined as hours of overtime work and living conditions are assessed in terms of hours of sleep. Hours of overtime work month are specified as 80 hours or more on average from two to six months prior to the onset and over 100 hours just before the onset. Meanwhile, averaged hours of sleep are specified as five or less.

Accordingly, when workers' compensation is actually demanded, an inspector from the Labour Standard Inspection Office will review a case about these conditions first. Cardiovascular diseases will then be recognized as overwork-related without doubt if details reflect the above conditions in documents submitted by the applicant.

However, it has been pointed out that it is particularly difficult to assess working conditions\textsuperscript{2,3} with quantitative analysis for Karoshi, since both working and living conditions of victims are identified by interviewing the bereaved family members. It is doubtful that these conditions given through interview and response process are objectively accurate. This problem appears to complicate the clarification of mechanism of death-by-overwork. Since these traumatic events undoubtedly result in the loss of earnest and responsible workers, it is our view that these events should be classified accordingly as industrial accidents.

However, in analysis of the cause of death-by-overwork, clarifying its mechanism is a separate issue from judging it. Confusing these two issues makes it impossible to explain the fact that workers can fall cerebral-vascular disease, cardiovascular disease and death from overwork, even when their averaged overtime work is less than 80 hours each month or their averaged sleeping hours is more than six a night.

In our previous reports\textsuperscript{3,4}, we described a case of Karoh-shogai overworked into a cerebral hemorrhage. Karoh-shogai can be translated quite literally from Japanese as "one of cardiovascular diseases from over-fatigue as a result of overwork." We selected this case because of the objective data obtained which was convenient to strict analysis, although this case was unusual in that the victim had been availing himself of the reduced work-hour system for child rearing. We investigated working and living conditions of the victim in accordance with the standards for clarification of industrial accidents as described above, and examined over-fatigue conditions leading to the cerebral hemorrhage. In the course of analysis, unexpectedly it was more difficult to identify the sleeping hours than the number of overtime work.

Therefore, in the present report, we described the process of our analysis in detail with additional discussion.

II. Methods

A. Profile of the victim

Victim, a 40-year-old male, was a researcher with a position at a private research institute. He worked from 9:00 to 15:00—six obligatory hours—to allow time for child care. The victim suffered left putamen hemorrhaging (1 cc) on July 13, 2006. Victim lived with a partner (aged 39 years) and a child (aged 3 years). Victim shared housework and childcare duties with his partner. His partner was generally responsible for transporting the child to the nursery school, but often returned home later than 23:00 due
April 20th (Friday)

A

\[ \text{Wake up} \]

7:00

\[ \text{Breakfast} \]

7:30

\[ \text{Sandwich, Raisin bread, Tomato of the curry} \]

19:35

\[ \text{Wheat noodle with a raw egg} \]

Pineapple

Grape

Watermelon

The record about the schedule of appearances at nursery school

<table>
<thead>
<tr>
<th>Class</th>
<th>3rd/Mon</th>
<th>4th/Tues</th>
<th>5th/Wed</th>
<th>6th/Thurs</th>
<th>7th/Fri</th>
<th>8th/Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4月</td>
<td>3日/月</td>
<td>4日/火</td>
<td>5日/水</td>
<td>6日/木</td>
<td>7日/金</td>
</tr>
<tr>
<td>B</td>
<td>4月</td>
<td>3日/月</td>
<td>4日/火</td>
<td>5日/水</td>
<td>6日/木</td>
<td>7日/金</td>
</tr>
</tbody>
</table>

Overtime childcare

Fig. 2 The difference of the handwriting written by the victim (B) and his partner (A) on the schedule of appearances at nursery school

to unremitting overtime work requirements. This meant that Victim was often responsible for going to the nursery school to pick up the child and prepare the evening meal, for feeding and bathing the child, and seeing the child off to sleep. Incidentally, the detailed descriptions of the victim with regards to characteristics, health, working and living conditions were reported elsewhere 3,4.

B. Objectivity of documents

To identify Victim’s working and living conditions, we obtained the laptop computer he used
for work. We also gained access to his pocket diary, parenting diary, schedule of appearances at nursery school, and call invoices for his cellular phone. We analyzed these objective documents during the six months described in the standards defining industrial accidents involving work-related cerebral and cardiovascular diseases. We could distinguish handwriting of the victim or his partner because there were time stamps in the parenting diary (Fig. 1) and the schedule of appearances at nursery school (Fig. 2).

C. Hours of overtime work

In order to calculate the hours of overtime work, we used e-mail records from the victim's work laptop computer, noting when e-mails were sent and when files were created and updated. We also used the parenting diary, nursery school attendance records, and cell-phone bills, in which the times were noted. The victim used his personal phone for work purposes, as no cellular phone had been provided by the employer.

We then created a database by organizing these data, which covered the six months before the onset by day using FileMaker Pro®. Two procedural standards were used to calculate the hours of overtime work. First, we applied the "WA" objective standard. When using this standard, only time stamps that had been input into the database were used. The second standard, referred to as "WB," was semi-objective. In practice, the times input into the database indicate the times when work was finished. Then, we established corresponding start times by uniform subtraction in accordance with a given standard, i.e., to find the start time of e-mail creation, two minutes were subtracted from the objective standard to arrive at duration of e-mail creation, as an assumptive rule. For file-creation and update times, we subtracted ten minutes from the objective standard as an additional assumption. We also calculated the differences between the total number of actual working hours (calculated based on the database description) against a series of theoretical work days; the difference relative to an eight-hour work day as stipulated in the Labor Standards Law in Japan (WB-8), the difference relative to the official seven-hour work day of the victim's workplace (0900–1200 and 1300–1700) (WB-7) and the difference relative to the contractual six-hour day (0900–1500) applicable to the victim as a beneficiary of the reduced working hour system for child rearing (WB-6). The method of calculation for overtime hours currently accepted by the Labor Standards Inspection Office in the recognition of industrial accidents corresponds to method WB-8 in the present paper.

In addition, although the victim's commuting time was not included in the calculation of working hours, he testified that he spent three hours per day commuting to and from work and that he read work-related materials during such commutes. The victim went on 17 business trips during the six months under study, and this travel time was included in the working hours. All of the working hours described during holidays and paid holidays (including sick leaves) were calculated as hours of overtime.

D. Sleeping hours

Sleeping hours were calculated in accordance with three standards, beginning with the objective standard (SA). In a manner similar to that adopted in the calculation of number of hours of overtime work, we calculated sleeping hours using only times found in e-mail and file records. For calculation under the second, semi-objective standard (SB), the time of rising and bedtime were taken into account in addition to the semi-objective standard of hours of overtime work, i.e., we considered it unlikely that rising or bedtime would take place immediately after or before sending an e-mail, or creating or updating a file.

Thus, to estimate the time of rising, an e-mail indicated as sent at 05:10, would lead to an as-
Fig. 3 The overtime work hours prescribed by four kinds of standards

III. Results

A. Hours of overtime work

Fig. 3 shows the change in the four kinds of hours of overtime work (WA, WB-8, WB-7, and WB-6) during the six months before the onset, calculated based on the two standards employed. The numbers of hours of overtime work relative to WA during the six months before the onset were 59.2, 24.6, 40.1, 90.3, 88.1, and 92.9, in order. For WB-8, the figures were 87.6, 43.8, 85.8, 135.0, 135.2, and 141.1, in order. Thus with WB-8, hours of overtime work reached the recognition standard, with the exception of the month five months prior to the onset. With WB-7, the numbers of hours of overtime work were 103.9, 57.7, 105.0, 150.5, 150.8, and 156.1, in order. With WB-6, the figures were 119.9, 74.0, 124.9, 166.5, 150.8, and 175.6, in order.

B. Sleeping hours

Fig. 4 shows the change in sleeping hours dur-
ing the six months before the onset, calculated based on the three standards adopted. Under the SA standard, the average hours of sleep per night from six months before the onset through the month prior to the onset were 6.4, 10.8, 10.3, 10.7, 10.4, and 9.9, in order. Under the SB standard, the figures were 6.4, 8.8, 8.4, 8.8, 8.5, and 8.1. Applying the SC standard, the hourly averages were 4.7, 6.5, 5.4, 5.5, 5.3, and 5.1, approaching the periods of sleep qualifying under the standards for the recognition of industrial accidents.

IV. Discussion

In the present study, we examined the process of identifying hours of overtime work and hours of sleep for a case of over-fatigue of a white-collar worker for which a sufficient amount of objective data were available.

At first, assuming that we will face increasing reports of over-fatigue among white-collar workers that are similar to the present case, we will discuss the sample size of the objective data analyzed in the present case. Since a variety of cases are conceivable—particularly in preliminary studies of suicide or other deaths from overfatigue—we feel it is important to describe the extent of the victim’s workload. The data for the victim analyzed in the present case are as follows: the victim sent 1,174 e-mails during the six months before the onset; created and updated 2,018 files during the same period; and engaged in 117 work-related cell-phone communications. Thus, if the number of e-mails is considered to correspond directly to the workload, the extent of the workload in the present case is approximately a quarter of that in the Konica Minolta case\(^5\), which was reported in the newspapers as a sudden death from work-related cardiovascular disease.

At a WA value for hours of overtime work, we used, without modification, time records for
sent e-mails, file creation and update times, and starting times of calls made in relation to work on a cell-phone bill. Since the e-mail and file times indicated the times at which tasks were completed, we took working time into account and subtracted two minutes to arrive at the time of e-mail creation and allowed ten minutes for the creation and updating of files for purposes of estimation. As a result, under the standards of calculation WB-8, WB-7, and WB-6, hours of overtime work fulfilled the standards for the recognition of industrial accidents. Although hours of overtime work during the month prior to the onset did not reach 100 hours under the WA standard, the figure nevertheless exceeded 80 hours on average for each of the three months prior to the onset. Under all of the standards, increasing trend in hours of overtime work was seen during three months prior to the onset.

On the other hand, even under the SB standard, hours of sleep were greater than five, the required number under the recognition of industrial accidents. The SC standard was the only one under which the sleeping hours fulfilled the standards for recognition. Since this was a case of Karoh-Shogai, the victim himself was interviewed under the SC standard. Obviously, proof will be more difficult if records, such as a diary, are not available in cases of suicide or other death from over-fatigue, where the victim cannot be interviewed. An approximately two-hour difference in sleeping hours was noted when assessed by the SB and SC standards. It is difficult to bridge this gap with objective data. Furthermore, it has been established that not only is quantity of sleep (i.e., the hours spent sleeping) important, but also quality of sleep (or sleep architecture) is an essential element. Therefore even sleep lasting five hours or longer may be insufficient in terms of quality for some reasons, including cases of "sleep apprehension". Moreover, it has been reported that working just before bedtime decreases the quality of sleep. It would, however, be difficult to determine such decrease in quality using the objective data adopted in the present analysis.

Based on the foregoing, we must first analyze hours of overtime work before analyzing sleeping hours, to assess "the accumulated fatigue" that leads to suicide or death from over-fatigue. Particularly if data such as e-mail records and times of file creation and updates are available for calculating hours of overtime work, an analysis of the processes leading to an excessive workload is made possible, allowing determination of the degree of over-fatigue and thereby enabling clarification of the mechanism of Karoh-shi(as over-fatigue death), Karoh-jishi(as suicide from over-fatigue), or Karoh-shogai.

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Note
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