

## KAROSHI DUE TO OCCUPATIONAL STRESS-RELATED CARDIOVASCULAR INJURIES AMONG MIDDLE-AGED WORKERS IN JAPAN

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The relative risk of cardiovascular diseases among people exposed to stressful situations has been discussed, especially in relation to sudden deaths occurring among middle-aged workers. As the occupational stress accounting for such cases is most likely to be induced by overload (*karo* in Japanese) situation, the causation of such death from overload (*karoshi*) has attracted wide attention. In Japan, the problem of *karoshi* has come to be known since the period of the first oil crisis in 1974<sup>1)</sup>. Thereafter, an increasing number of *karoshi* cases have been reported as the movement for workers' compensation claims as to stress-related diseases such as sudden heart attacks or strokes among middle-aged workers is gaining impetus.

As a background to this increase in the number of reported cases of fatal cardiovascular and cerebrovascular injuries, the working conditions in the current Japanese economy would need to draw particular attention. It is said that Japan is among the economically richest and the technologically most advanced countries in the world, gross national product per capita exceeding that of the United States. This high growth of the economy is apparently relevant to the outstanding levels of some general health indicators of the Japanese population, such as average life expectancy or infant death rates which are comparable with or better than those of the Nordic countries. Contrary to these successful phenomena, concern is growing that many workers suffering from mental and physical strain, including those in middle-aged and elderly groups, as a result of the accelerated technological and economic developments.

This particularly stressful situation of certain workers in Japan may be evidenced by still prevailing long hours of work and associated heavy workload in the collectively-minded, company-oriented society. As an ILO report mentions<sup>2)</sup>, Japanese workers continue to work the greatest amount of working time of any major industrialized countries. On the average in the manufacturing industry, they work as much as 400 or more hours a year longer than their counterparts in Germany or France, 300 or more than those in the Nordic countries or the United Kingdom, and 200 more than those in the United States. In her recent book discussing the richness of a society<sup>3)</sup>, Teruoka stated: "Japan is economically a big country, but not a rich one at all. Many workers are strained for long hours working a heavy workload, though their companies are economically growing". This situation continues.

Recent *karoshi* cases dealt with by the author are reported with the view to discussing the factors accounting for such fatal cases. The association between overworking situations and an increased risk of cardiovascular injuries will be examined.

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### Some cases of *karoshi*

Following are some cases of *karoshi* about which I was consulted with respect to the application of workers' compensation.

#### Case 1 (A system director of a large electronic machinery manufacturing company)

A director of a system managing department died of cerebral bleeding at age of 44, directly after a difficult talk with customers in a hotel where he was staying on a business trip. Only one week ago, he had been promoted the director's post from a chief of a section in the department, deal with many troubles of customers. His widow told that in this section, he had every day continued his own work with other colleagues by providing technical support to customers until midnight. In addition to usual duties, as his abilities were recognized by his supervisors, he used to often attend business receptions which involved alcohol drinking. He had often complained to her of severe fatigue due to work.

#### Case 2 (A sales manager of a loss insurance company)

He died of subarachnoidal bleeding at age 42. One and a half years before the death, he had been transferred to a small branch to increase the sales accounts. There he challenged to increase his sales accounts three times within three years overcoming the severe competitiveness in his field. Immediately after a special campaign to attain his goal, he was suddenly attacked by the rupture of cerebral aneurysm and died at midnight at his house his complete success in business.

#### Case 3 (A section chief of a branch office of rice wine (*sake* in Japanese) sales store)

He died of an acute heart failure at age 51, at midnight in his house. He had been working in a middle-sized class company which employed 120 men and women. Five years ago, his company had introduced an office computerization system with online networks for controlled stock management and sales accounts. Thus he had to engage in data input work with other clerical workers as a responsible person in this new section, in addition to his usual sales management work. In so doing, he was worried with many troubles of machinery and claims by other workers about the operating methods, so that he himself suffered from a writer's cramp apparently caused by the overuse of the upper limbs. Moreover, one and a half year before death, his physical and mental stress increased because his company's sales accounts rapidly declined due to contract troubles with a big firm. He was obliged to make his special efforts for sales managing usually until late evening. His health conditions, tarnished with hypertension, gradually became to worse, and there were several incidences in which he complained of chest pain. His doctor advised him to take rest, but he did not do so until he died.

#### Case 4 (A salesman of a textbook company)

He died of acute myocardial infarction at age 42. He had been appointed to a chief of sales promotion section in a textbook company only six months ago. His work used to be very busy and stressful, combined with frequent long-distance business trips to increase sales accounts. He was obliged to stay at distant hotels spending more than half of a month. In these business trips, he visited, driving a rental car, many book stores and schools promoting the adoption of his company's textbooks. One month before his death, in a cold climate he was conscious of dull chest pain at a store of his customers. Since this event, he often complained of the

same pain to his wife, but he did not take rest and did try to have a medical examination for the reason of busy work. Just in the morning of the day he died, he awoke with a severe continuous chest pain in his house and hurried up to a clinic nearby, in which a physician advised him to be taken to hospital. But he went to his office for presenting a report of his sales accounts which he was felt indispensable, ignoring the medical advice. About ten hours later, he was found dead in his office toilet by one of his colleagues.

**Case 5** (A worker of an electric machinery product factory)

He died of cerebral bleeding at age 40. He had been working in a rural factory as a forklift operator. One month before the death, he was ordered to go to a mass sales store of household electric appliances near the Tokyo metropolis as one of those workers who were delegated for the sales of the excessive stocks in his factory. This sales campaign used to be system was carried out every summer in his company for the dual aims of selling out stocks and effectively using manpower, and most workers dispatched to big cities such as Tokyo, Osaka and Nagoya, regardless of their likes or dislikes. As a diligent worker's favour of his company, he willingly applied for this task, regretting his previous non-participation because of his wife's illness.

Five days before the death, he travelled to Tokyo, and stayed in a small hotel. The next morning he began his sales work at a big store, although he had no experience in such work with poor knowledge he had learned through one-day training. One of his colleagues, who was delegated to another store and staying with him, told that during the night he could not sleep and worried about his role conflicts and business responsibilities. Three days later, he suddenly complained of severe headache and nausea during working time, and his supervisor in this store took him to a hospital. He was diagnosed to have slight common cold and fatigue. But in the night of that day, he was attacked repetitively by heavy headache and vomiting at his hotel, and died.

**Case 6** (An operator of an electric metal plate factory)

He was a subblind worker, and died of subarachnoidal bleeding at age 54. On the day of his death, he came back home late at night due to overtime work, and complained of severe headache to his family. Next morning his headache was aggravated with vomiting and died subsequently. An investigation of his overload situation showed that about one month ago, a new robot machine had been introduced in his factory to cut steel plates speedily and precisely, and that he had been intently trying to acquire skills of the new operating methods until late at night by overtime work in spite of his handicap and aging.

**Case 7** (A truck driver transporting for long distances)

He died of cerebral bleeding at the age 49. He had been engaged in a famous transporting firm for twenty years as a truck driver. His usual running duties with a colleague amounted to about 600 kilometers per one shift which lasted for two nights and three days, corresponding to 10,000 kilometers per month with about 70 overtime hours. Though he used to have no health problems when he was young, he was found to have slight hypertension at a periodical health examination six years ago. This gradually grew worse in a few years to a stage with cardiac hypertrophy and proteinuria. But his working conditions never improved, and conversely, both driving distances and overtime hours increased. The day before his death,

he and his colleague started from their base at noon with 50 drum cans each weighing 200 kg. They continued to run all day and night, arrived at the destination next morning, and unloaded drum cans spending only 30 minutes in a hurry. On his return way, he suddenly fell unconscious and died. In this long-distance duty, ran about 1,000 kilometers on one way, and he was at the steering wheel of the truck for about eleven hours.

These examples represent the typical cases of *karoshi* in Japan. They are characterized by the following common features.

- 1) Most of the victims were middle-aged male workers who suffered fatal and sudden cardiovascular injuries or cerebral bleeding.
- 2) They were very diligent and enthusiastic in their work, and were consequently obliged to ignore their regular and healthy habits and even the need of health care.
- 3) It was shown that before attacks their workload had gradually increased, and that their fatigue progressively accumulated while their basic ill health such as hypertension and arteriosclerosis, aggravated.

#### **Characteristics of *karoshi* cases referred to the “*karoshi* hot line” for consultation**

A *karoshi* hot line was established in summer of 1988 by a voluntary group of lawyers and physicians to offer advice on filing for compensation in stress-related cases. The service has received about 1,800 inquiries during the last two years. In the Tokyo area alone, 158 cases of cardiovascular and cerebral attacks were consulted. Ninety-eight cases of these 158 cases were interviewed for obtaining precise informations about the occupational background and physical conditions which contributed to these attacks. These results are summarised as follows.

##### **1. Outline of 158 cases referred to the Tokyo hot line**

The cases referred were comprised of 154 male and 4 female victims. The majority of these victims were in the age group from 40 to 54 (100 cases, 63.2%), followed by those in their late fifties and thirties. Of the kinds of diseases, among cerebrovascular attacks, subarachnoidal bleeding accounted for 44 cases, cerebral bleeding for 32 cases and cerebral infarction 12 cases, among heart attacks and other diseases, acute cardiac failure accounted for 40 cases, acute myocardial infarction 28 cases and aortic rupture 2 cases, are involved.

##### **2. Working conditions before the attack of 98 cases interviewed**

To know the working conditions before each attack was triggered, we interviewed those concerned victim such as family members, colleagues, subordinates, union officials and supervisors. Such information was collected for 98 victims.

##### **1) Kinds of jobs**

Table 1 shows the kinds of jobs of the victims. The number of white-colour workers was slightly more than that of blue-colour workers.

In the white-colour group, more than half consisted of sales managers, most of whom had supervising titles such as chief or director. Most engineers belonged to important sections of their companies, and were usually engaged in technical services to customers. Their fields of business were trading, construction, electric machinery, information services and other business

Table 1 Job contents of interviewed *karoshi* cases  
(Number of cases classified by diseases)

	Cerebrovascular attacks	Heart diseases and others	Total
White-colour workers	35	26	61
Sales managers	18	13	31
Engineers	9	5	14
Personnel managers	2	3	5
Public servants	2	1	3
Teachers	1	2	3
Others	3	2	5
Blue-colour workers	19	18	37
Factory operators	9	7	16
Construction workers	2	5	7
Drivers	3	3	6
Baggage carriers	2	0	2
Guard men	2	0	2
Others	1	3	4
Total	54	44	98

Table 2 Distribution of working hours per week among the *karoshi* victims

	Less than 49 hours	50-69 hours	70-99 hours	More than 100 hours	Unfixed or unknown
Number of cases	13	22	32	21	10
per cent	13.2	22.4	32.7	21.4	10.2

firms. In the cases of public servants or teachers, they were as a rule characterized by very stressful circumstances and heavy responsibilities concentrating on them.

On the other hands, in the blue-colour group, many of them were factory operators, construction workers and drivers. It should be noted that the latter two jobs are already reported to have higher mortality rates due to cardiovascular diseases<sup>4-6)</sup> in Japan.

## 2) Working hours of the victims

The working hours per week worked by the victims for the period of two or three months before the attack are shown in Table 2. The Japanese Labour Standards Law stipulates that normal working hours showed be eight or less hours per day and forty three or less hours per week except overtime. Though not stipulated in the law, the system of two holidays per week are introduced in many companies. On the contrary, 76.5 per cent of the victims had been working for more than fifty hours a week, about half of them working for more than seventy hours per week.

## 3) Suggested factors leading to the attacks

Factors at work suspected of triggering these attacks as mentioned by the victim's concerned are shown in Table 3. Most of them answered that the victim had been working from early morning until late at night, even without taking a holiday. Their views were consistent that attack had been caused by the overwork. As the results about these suspected factors indicate,

Table 3 Contents of heavy workload suspected of triggering the attacks as suggested by the concerned of the *karoshi* victims

Number of cases	White-colour workers 61		Blue-colour workers 37		Totals 98	
	Cases	%	Cases	%	Cases	%
Long-hour work including excessive overtime and holidayless work	42	68.9	20	54.0	62	68.3
Career development	15	24.6	1	2.7	16	16.3
Re-assignment or changes of workplace	12	19.7	7	18.9	19	19.4
Assignment to a new workplace without family	6	9.8	3	8.1	9	9.2
Excessive bussiness trips	15	24.6	4	10.8	19	19.4
Urgencies to comply with work norms	9	14.8	2	5.4	11	11.2
Excessive night work	4	6.6	9	24.3	13	13.3
Insufficient manpower support	11	18.0	10	27.0	21	21.4
Job troubles	9	14.8	0	0.0	9	9.1
Accidental events within 24 hours before the attack	18	29.5	7	18.9	35	35.7
Accidental overwork within 7 days before the attack	4	6.6	1	2.7	5	5.1

Notes: Table shows the results of plural choices by each individual case.

about two thirds of these factors consisted of the complex working time issues including long hours of work (more than 70 hours per week), excessive overtime (more than 60 hours per month) and holiday work (more than 3 days per month). Moreover, it was suggested that these long working hours accompanied with other stressful factors such as career development, excessive business trips, insufficient manpower, changes of work places and urgency to comply with work norms. Especially, among the white-colour workers involved, the problems of career development, business trips, stringent norms and job troubles seemed to have influenced to their health conditions. Among the blue-colour workers, midnight work and work associated with manpower insufficiencies seemed to have likewise influenced their health before the incidence.

With respect to stress-induced illnesses, the Ministry of Labour has provided two notifications which are to apply to workers' compensation. The first rule is to find a physically or mentally accidental event within twenty-four hours before the onset of the attack in question, and the second is to identify continued heavy work preceding the attack for one week. Actually, according to these rules, the Ministry approved only 81 cases (less than ten per cent) of 830 claims submitted concerning *karoshi* in 1988. Of our interviewed cases, according to the first rules 35.7 per cent of the victims, and to the second 5.1 per cent were estimated to be satisfied. But in these victims only one case was officially compensated in this two years.

#### 4) Characteristics of the victims work according to Karasek's extended model

To evaluate the relationships between job stress and the observed incidence of *karoshi*, Karasek's extended model<sup>7)</sup>, proposed for use in epidemiological stress surveys of ischemic heart diseases, was applied by means of retrospective self-judgement through interviews. In this method, work characteristics were judged in the following three dimentiones; the degree of psychological job demands, the degree of decision making and the degree of social support. The results are shown in Fig. 1 (p. 26). It was suggested that the victim's work characteristics before the attack consisted of a higher degree of work demands and lower social support,

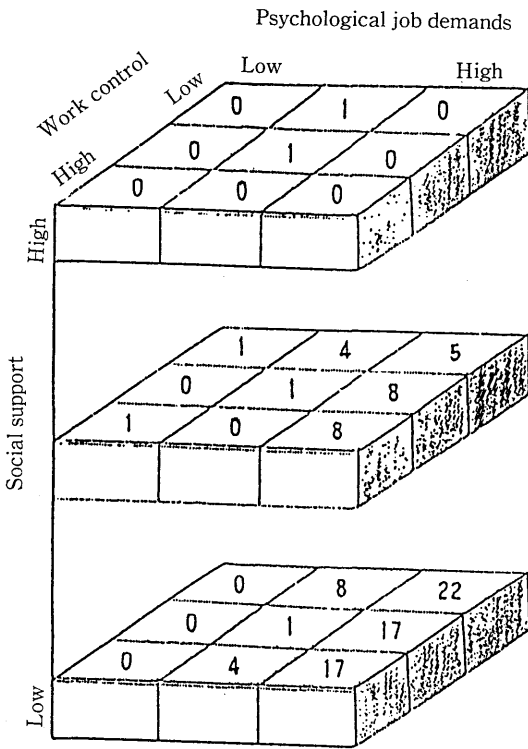


Fig. 1 Work characteristics of *karoshi* victims evaluated in three dimensions according to Karasek's extended model.  
 Notes: Figures show the number of corresponding cases

whereas the degree of work control comprised wide spectra from a higher to lower degree.

This would mean that both high latitude for work control, with high responsibility for outputs, and intensifies with control, as in the case of strictly paced work, can be relevant to such cardiovascular events. More directly relevant, however, would be a high degree of work demands and the lack of social support. Especially, high work demands and low social support, as observed in the interviewed cases, seems to be most associated with the incidence of the attacks.

### Discussion

Uehata<sup>8)</sup> described *karoshi*, or death due to overwork in Japanese as a socio-medical term corresponding fatal incidence and associated work disability due to cardiovascular or cerebrovascular attacks which could occur on the basis of aggravating hypertensive or arteriosclerotic diseases, triggered by heavy workload. In other words, as stated by Hosokawa<sup>9)</sup>, *karoshi* represents the fatal states resulting from the collapse life-maintaining

functions caused by a breakdown of physiological and biochemical rhythms by overfatigue. But little is known of the medical mechanism how overfatigue gives rise to the developments leading to *karoshi*. About this problem, it was suggested<sup>9)</sup> that work-oriented working styles among the Japanese middle-aged, as demonstrated in the case of above-mentioned examples, compounded with unhealthy daily life habits such as heavy smoking, alcohol abuse, irregular and unbalanced diet patterns, shortage of sleep and others, could result in accelerating their aging process and susceptibility to diseases. Although similar problems may be commonly found among workers in different countries, *karoshi* cases now increasing in Japan have special features in relation to the victims' working styles, characterized by long working hours and aggressive pursuit of work norms for the benefit of their companies in the face of rapid technological progress and increased use of information technics.

Of the relationships between occupational stress and ischemic heart diseases, Karasek<sup>10)</sup> reported that psychological work demand and the work's latitude for decision making on the job may be associated with psychological stress and coronary heart disease. On the other hands, Jenkins<sup>11)</sup> mentioned of Type A<sup>12)</sup>, defined as a coronary-prone behaviour pattern characterized by extremes of competitiveness, striving for achievement and aggressiveness, and suggested that people having this particular behaviour pattern could often be so deeply involved and com-

mitted to their work that other aspects of their lives were relatively neglected. Cooper<sup>13)</sup> introduced in his review that there were many stress studies suggesting an association of stress stimulations with heart diseases. He mentioned various types of stress sources at work as revealed by these studies, such as quantitative and qualitative overload, role ambiguity or conflict, over- and under-promotion, impact of poor relationships with reference to these stress sources. Those characteristically seen in the case of Japanese workers including firstly quantitative overload by excessive overtime work and secondly Type A-like aggressive working styles respecting norms which often they themselves selected and resulting from employee training and management policy.

A particular attention is drawn to the rather high incidence of *karoshi* cases among Japanese middle-aged workers due to cerebrovascular attacks. This seems to be in contrast with arguments in Western countries concentrating on heart diseases, and may reflect relevant morbidities and mortalities among the Japanese population. A WHO expert committee report<sup>14)</sup> of work-related diseases stated that acute stress was associated with an increase in catecholamines and a transient increase in blood pressure, but that it was important to determine whether chronically repeated, short-term stress might result in sustained hypertension. This suggestion might give an important clue in clarifying the incidence of *karoshi* among Japanese workers.

Additionally, LaDou<sup>15)</sup> indicates that new types of claims for workers' compensation insurance, called cumulative injury, are increasing in the United States, and that these include coronary heart disease, stroke, hypertension and mental health problems resulting from emotional stress at the work place. A similar trend is found not only in United States but in Germany<sup>16)</sup> and Sweden. Theorell<sup>17)</sup> notes that in Sweden, the work compensation law is formulated in such a way that the burden of proof is on the employer who has to prove that the evidence is clearly against an association. In Japan, there are no consistent rules for application of workers' compensation to *karoshi* cases except the very restricting notifications which are used to eliminate as many claims as possible. The situation continues while long working hours as revealed in most of *karoshi* cases still prevail in many occupations. Concerning the causes of excessive overtime in Japan, Fujimoto<sup>18)</sup> states that the management-labour agreements about overtime work according to a provision in the Labour Standards Law of Japan make unrestricted overtime work possible. For the prevention of *karoshi*, the following two measures must thus be taken into account: one is to uniformly restrict overwork per week and per day by law, and another is to establish a fair rule regarding workers' compensation so as to approve appropriately the claims of occupational stress-related injuries with a view to promoting their preventing measures.

### Summary

Among the workers' compensation claims in Japan, fatal cardiovascular attacks among middle-aged workers such as strokes, myocardial infarction or sudden cardiac failure, generally called *karoshi* meaning death by overwork, have come to be serious problem. Seven cases of *karoshi* applying workers' compensation and ninety-eight cases which contacted a *karoshi* hot line service were reviewed. As a result, it was shown that the work characteristics of these cases mostly consisted of long-hour styles stirred up by various types of increased job demands, such as ex-



cessive efforts for sales enlargement and rapid technological developments. Thus, under these stressful working conditions, physical and mental stress had led to gradually accumulating fatigue and aggravated the victims' hypertensive or sclerotic conditions. As causative factors of these fatalities, particular attention was drawn to sustained overtime work and daily life habits neglecting rest and health care opportunities.

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#### References

- 1) Uehata, T. : A study on occupational stress factors triggering cardiac and cerebrovascular attacks : J. Sciences of Labour, 58, 277-293, 1982 (Japanese).
- 2) International Labour Office : Working Time Issues in Industrialized Countries : SWTI/1988/6. International Labour Office, Geneva, 1989.
- 3) Teruoka, Y. : Yutakasa to wa Nanica? (What is the abundant?): Tokyo, Iwanami Shoten, 1989 (Japanese).
- 4) Kaneko, S. : The specificity of cancer and cerebrovascular diseases on construction of small-scale enterprises : Showa Med. J., 46(6), 783-796, 1986 (Japanese).
- 5) Uehata, T., Abe, M., Chida, T. et al. : A Study on mortality and cause of death among cabworkers, Japanese J. Trauma. and Occup. Med., 33(2), 91-97, 1985 (Japanese).
- 6) Hatano, S., Uehata, T., Hattori, M. : Stress and cardiovascular disease : J. UOEH, 11 (Supplement), 39-47, 1989.
- 7) MONICA psychosocial optional study by MOPSY, 1988 (material).
- 8) Uehata, T. : A study of Karoshi in the field of industrial health : Bullet. Social Medicine, 8, 35-50, 1989 (Japanese).
- 9) Hosokawa, M. : Karoshi, Work and Health, 98, 12-16, 1990 (Japanese).
- 10) Karasek, R., Baker, D., Marxer, F. et al. : Job decision latitude, job demands and cardiovascular disease : Am. J. Public Health, 71(7), 694-705, 1981.
- 11) Jenkins, C. D. : Psychologic and social precursors of coronary disease : New Eng. J. Med., 284(6), 307-311, 1971.
- 12) Friedman, M, Rosenman, R. H. : Association of specific overt behavior pattern with blood and cardiovascular findings : JAMA, 169, 1286-1296, 1959.
- 13) Cooper, C. L., Marshal, J. : Occupational sources of stress, a review of the literature relating to coronary heart disease and mental ill health : J. Occup. Psychol. 49, 11-28, 1976.
- 14) WHO Expert Committee, Identification and control of work-related diseases : (WHO Tech. Rep. Series, 714), Geneva, WHO, 1985.
- 15) LaDou, J. : Cumulative injury in workers' compensation : Occupational Medicine, 3(4), 611-619, 1988.
- 16) Naeve, W. : Der Coronartod und seine rechtsmedizinische Begutachtung im Rahmen der sozialen Unfallversicherung : Unfallversicherung, November 1982 : 694-696, 1982.
- 17) Theorell, T. : Stress and work compensation : Work & Stress, 2(1), 3-5, 1988.
- 18) Fujimoto, T. : Nihon no Rodou Jouken (Working conditions of Japan) : Tokyo, Shin Nihon Shuppan, 1984 (Japanese).

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