



Compensation for Work-Related Cerebrocardiovascular Diseases

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The purpose of this study was to discuss the history of, and concerns regarding, the newly amended criteria of occupational cerebrovascular or cardiovascular diseases (CCVDs). Since the early 1990s, CCVDs have been the second most common occupational disease, despite fluctuations in their criteria. The first issue was the deletion of cerebral hemorrhage on duty as a recognized occupational disease in 2008. The second issue was the obscurity regarding definitions of an acute stressful event (within 24 hr before disease occurrence), short-term overwork (within 1 week), and chronic overwork (for 3 or more months). In this amendment, chronic overwork was defined as work exceeding 60 hr per week. If the average number of weekly working hours does not exceed 60 hr, night work, physical or psychological workload, or other risk factors should be considered for the recognition of occupational CCVDs. However, these newly amended criteria still have a few limitations, considering that there is research evidence for the occurrence of disease in those working fewer than 60 hr per week, and other risk factors, particularly night work, are underestimated in these criteria. Thus, we suggest that these concerns be actively considered during future amendment and approval processes.

Keywords: Myocardial Infarction; Cardiovascular Diseases; Stroke; Overwork; Workers' Compensation; Korea

INTRODUCTION

On November 24, 1990, the *Kyunghyang Shinmun* newspaper printed the first report on *karoshi* (death from overwork) in Korea. According to the article, Mr. Ishii of the Japanese company Mitsui & Co. Ltd., who had been on overseas business trips for 103 days during a 10-month period, suddenly died of acute heart failure and his family claimed workers' compensation for his death (1). Since then, interest in death from overwork has increased in Korea. The Supreme Court ruled that death from overwork due to frequent drinking parties with clients was an occupational disease (OD) in 1991, demonstrating the first recognized case of *karoshi* (2). The Korea Workers' Compensation & Welfare Service (COMWEL) lost court cases for 825 cases of death from overwork that were not approved as ODs from the Industrial Accident Compensation Insurance (IACI) claims between 1992 and 1994, and the government's rate of losing suits in these litigations reached 68% (3). As these problems were continuously pointed out, cerebrovascular or cardiovascular diseases (CCVDs) were added to the OD lists in the Enforcement Regulations of the Industrial Accident Compensation Insurance Act (ER-IACIA) in 1995. Finally, CCVDs became one of the ODs recognized by the IACI (Table 1) (4).

Approval of CCVDs as ODs increased rapidly beginning in 1995, reaching a peak in 2003 before starting to decline again. In fact, the compensation for CCVDs rapidly fell again until the

IACIA was revised in 2008 (5). The rapid increase and decrease in the work-related CCVDs were related to the changes in the legally approved criteria rather than the actual occurrence of CCVDs. The issue most deeply related to these changes was the criteria for approving cerebral hemorrhage during work as an OD unless there was obvious evidence that this medical condition was not work related. As a result, the approval rate of cerebral hemorrhage was excessively high, while the approval rates of cerebral infarction and cardiac infarction were excessively low, which became an issue (6).

According to the current Enforcement Decree of the IACIA (ED-IACIA), work-related CCVDs include intracerebral hemorrhage, subarachnoid hemorrhage, cerebral infarction, myocardial infarction, and dissecting aorta caused by the experience of a sudden stressful accident, rapid environmental change, short-term mental and physical overwork, or increased stress and chronic mental or physical overwork concerned with duty (7). Thus far, clauses on overwork or stress have been obscure, and the approval rate of CCVDs has differed on the basis of the definition of overwork or stress. The Ministry of Employment and Labor (MOEL) recently presented criteria about overwork for the judgment of the relationship between CCVDs and work. However, these criteria may cause some controversy, as they were determined through an agreement between labor unions, an employers' federation, and the government.

In this paper, we investigate the changes and problems of the

criteria for approving work-related CCVDs and identify the meaning, problems, and realistic application measures of the recently revised overwork criteria.

PROBLEMS WITH KOREAN CRITERIA FOR APPROVING OCCUPATIONAL CEREBROVASCULAR OR CARDIOVASCULAR DISEASES

Cerebral hemorrhage during work

One of the first problems regarding the criteria for approving occupational CCVDs was related to the occurrence of a cerebral hemorrhage during work. This clause, which has existed since the criteria for approving occupational CCVDs were legislated in 1995, classified most occurrences of cerebral hemorrhage as ODs (4, 6). Although the criteria stipulated that cerebral hemorrhage occurring while not on duty will be approved if relevance with work is acknowledged, the approval rate of cerebral hemorrhage during work or in the workplace was much higher than the strength of a causal relationship (8). The approval rates of occupational CCVDs continued to rise until 2000 before falling again. This occurred due partially to slight changes in the approval rate of cerebral hemorrhage but was mainly the result of the sharp declines in the approval rates of cerebral infarction and cardiac infarction. However, the number of CCVD patients making claims to the IACI sharply rose; therefore, the cases approved as OD continued to increase (Table 2) (9).

Although the number of cases of occupational CCVD was, relatively, very small, the insurance benefit amount related to

the CCVDs increased each year, as CCVDs require long-term care and most cause high levels of disability (10). In 2008, the total number of industrial accident victims was 95,806 and the number of occupational CCVD cases was 1,207, accounting for only 1.26% of the total victims. However, the total IACI benefit for all disabilities was KRW 3.42 trillion and the total paid to individuals who experienced CCVDs was KRW 325 billion, accounting for 9.5% of all workers' compensation (11). As the cost of industrial accident compensation for occupational CCVDs increased, the burdened COMWEL applied more stringent approval criteria. Thus, since 2000, the approval rates of occupational CCVDs have continued to diminish (9). Although the total approval rate of CCVDs continued to fall, a high approval rate of cerebral hemorrhage during work continued until 2007 (Table 3). Ultimately, the approval rates of diseases other than cerebral hemorrhage during work continued to decline (6).

Disputes regarding the criteria used for approving cerebral hemorrhage during work as a disease on duty continued. Ha and colleagues suggested excluding work performance attri-

Table 2. Approval rates of cerebro- or cardiovascular diseases by year (2000-2004)

Year	Claims	Approved cases	Approval rate (%)
2000	1,277	1,006	78.8
2001	2,041	1,522	74.6
2002	2,642	1,806	68.4
2003	3,051	1,930	63.3
2004	3,298	2,017	61.2

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Table 1. First legal criteria for occupational cerebro- or cardiovascular diseases, 1995

Cerebrovascular or cardiovascular diseases	
A.	Cerebral hemorrhage, subarachnoid hemorrhage, cerebral infarction, hypertensive brain disease, angina pectoris, or myocardial infarction during employment resulting from the following causes is an OD. (1) Sudden and unpredictable changes of work condition and psychological strain, excitement, fear, fright, etc., to induce a definite physiological change for an employee (2) Chronic overwork such as the increase in the amount of work, working hours, or work intensity, and the change of responsibility or work conditions to induce physiological or mental overload (3) Cerebral hemorrhage or subarachnoid hemorrhage occurring on duty, or medically proving that the reason of death was not related to a natural aggravation of the disease
B.	In A (1), the "sudden and unpredictable changes of work condition" are defined as overwork to induce a definite effect for the normal function of the cerebrovascular or cardiovascular system.
C.	In A (2), "chronic overwork" is defined as the increase in workload or working hours by more than 30% for 3 days before the occurrence of the diseases or the changes in the amount of work, working hours, work intensity, responsibility, or work condition for 1 week before the occurrence of the diseases such that the replacement worker also finds it difficult to adjust to the new responsibilities.

Table 3. Approval rates of cerebro- or cardiovascular diseases according to the disease category by year (2005-2007)

Diseases	2005			2006			2007		
	Claims	Approved	Approval rate	Claims	Approved	Approval rate	Claims	Approved	Approval rate
MI	485	201	41.4	508	159	31.3	429	120	28.0
SH	340	241	70.9	458	311	67.9	428	288	67.3
CH	1,331	985	74.0	1,071	752	70.2	981	679	69.2
CI	1,047	302	28.8	1,003	161	16.1	921	176	19.1
Other	181	70	38.7	161	47	29.2	147	46	31.3
Total	3,384	1,799	53.2	3,201	1,430	44.7	2,906	1,309	45.0

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butes from the approval criteria; however, this was not applied (12). Ultimately, the clause regarding cerebral hemorrhage during work was deleted when the IACIA was fully revised in July 2008.

LONG WORKING HOURS AS A CRITERION FOR APPROVING WORK-RELATED DISEASE

The criteria enforced by the 1995 IACIA in Korea defined the causes of occupational CCVDs as rapid stressful events and chronic overwork. Although the legal definition of an occupational CCVD was changed through the revision of the act, the viewpoint regarding stress and overwork as the causes of CCVDs has remained in IACIA.

In the initial regulations, the definition of overwork only included chronic overwork, defined as a workload increase of more than 30% of usual work for 3 or more days. Another criterion for chronic overwork was that the workload, intensity of work, job responsibility, or working environment changed to the extent that ordinary people would have difficulty adapting to it within 1 week of CCVD occurrence. However, this definition was obscure, causing the former (first definition) to be used mainly for the judgment of an occupational disease. The first definition, however, had its own contradiction. For example, if a person, who usually works for 8 hr a day for several months, worked 12 hr a day from 3 days before CCVD occurred, this case could be approved as an OD according to the regulation. However, if a person usually worked 12 hr a day continuously before the CCVD occurred, this would not be approved as an OD because the number of working hours did not increase by more than 30%.

Because there were no objective criteria for the determination of whether the work environment changed to the extent that ordinary people would have difficulty adapting to it, these criteria could be differentially applied according to one's perspective. Accordingly, the overall approval rate of CCVDs fell when the overwork criteria were strictly applied in reaction to the issue of approving cerebral hemorrhage during work as an OD (Table 3).

REVISED, BUT INCOMPLETE CRITERIA

The IACI Act was fully revised in 2008, 44 yr after it was enacted. Along with other systems, the criteria to approve occupational CCVDs were revised (13). The key points of the Act's revision are as follows: First, the approval for cerebral hemorrhage during work was removed. Second, the criteria for stress and overwork were divided into *acute stressful event*, *short-term overwork*, and *chronic overwork*.

The purpose of the revision was to protect workers with chronic overwork who had CCVDs while not on duty by clarifying the

Table 4. Approval rate change of cerebro- or cardiovascular diseases by year (2007-2010)

Items	2007	2008	2009	2010
Claims	3,236	3,103	2,909	2,780
Approved	1,302	998	454	401
Approval rate (%)	40.2	32.2	15.6	14.4

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overwork criteria (14).

However, the revised criteria were incomplete. The Enforcement Regulations of the IACI Act divided the criteria for approving CCVDs into (1) the experience of an acute stressful event, (2) short-term overwork, and (3) chronic overwork. The following specific criteria for overwork or stress were presented in a notification from the Ministry of Labor:

- 1) CCVDs occur within 24 hr after an acute stressful event takes place.
- 2) Short-term overwork is defined as a 30% or more workload or an increase in the number of working hours within 1 week before the disease occurs, or a change in the workload or working hours to the extent that ordinary people have difficulty adapting to it.
- 3) Chronic overwork is defined as having an excessive workload for 3 or more months consecutively (15).

These criteria made it easy to understand acute stressful events and short-term overwork, as these definitions were relatively clear. However, the definition of chronic overwork continued to be obscure, making objective application difficult.

On the basis of the 2008 revision, the approval rates of CCVDs as an OD rapidly plunged, most likely due to the deletion of cerebral hemorrhage during work as an OD and the obscurity of the term "chronic overwork" (Table 4) (6).

To address the obscurity of chronic overwork, the Labor Ministry commissioned research, which suggested that the chronic overwork criteria include working for 52 or more hours on average per week for 3 or more months. However, this definition ultimately was not accepted for use in the criteria by employers (14).

REVIEW OF OCCUPATIONAL CARDIOVASCULAR DISEASES

Even though occupational cardiovascular diseases due to overwork and stress are the second most common ODs in Korea, the only countries to consider cardiovascular diseases as ODs are Korea, Japan, Taiwan, and the Philippines. In the US, some states regard cardiovascular diseases as ODs when they occur while a person is on duty. European countries including the UK and Germany, with the exception of Austria and Romania, do not list cardiovascular diseases in their list of ODs (12, 16). Consequently, the only other countries available for comparison

are Japan and Taiwan. Concerned with the criteria for chronic overwork, which is a major issue in the recent revision, it is important to examine whether the criteria presented in 2008 were presented on the basis of a scientific foundation.

Many researchers have addressed job stress, number of working hours, and shift work as risk factors for occupational cardiovascular diseases (17, 18). According to the recent British Whitehall II Cohort Study results, the hazard ratio of coronary heart disease was 1.56 in the case of 3-4 hr of overwork a day (19). The results also revealed the risk of coronary heart disease rose 1.67 times (95% CI = 1.10-2.55) for workers working for 11 or more hours a day, even with the Framingham risk score adjustment, as compared to those working for 7-8 hr a day (20). If the physical fitness level of those working more than 45 hr per week was low, the risk of death due to ischemic heart disease (IHD) was high, at 2.28 (95% CI = 1.10-2.73) (21). In a case-control study that targeted patients visiting emergency rooms in Korea, the odds ratio of CCVDs was 1.73 (95% CI = 1.03-2.90) for those whose average number of weekly working hours was 48.1-52 hr, as compared to those whose number of weekly working hours was 40.1-48 hr during the past 3 months. The odds ratio of those whose average number of weekly working hours was over 52 hr was the highest, at 3.46 (95% CI = 2.38-5.03) (22).

Recent cohort studies for correlations between night work and cardiovascular diseases reported a relatively consistent increase in the risks associated with night work (23-25). In a cohort study released in Japan, the possibility of death in the shift work group due to ischemic heart disease (IHD) was 2.32 times higher (95% CI = 1.37-3.95) than in those who did not engage in shift work. If a person has well-known risk factors for heart disease including high blood pressure, overweight, habitual drinking and smoking, and age, he/she is more vulnerable to

death from cardiovascular diseases when engaging in shift work (26). Moreover, if rest is insufficient, such as insufficient sleeping time or the lack of holidays, the possibility for developing cardiovascular diseases increases (27, 28).

Although the results of these cohort studies inconsistency, they provide a consistent picture that the development of cardiovascular diseases and the resulting death may increase even in the case of individuals working less than 60 hr per week. If a person is engaged in night work, the risks may increase. Moreover, the relationship between work and cardiovascular diseases should also be judged on the basis of the lack of sleeping time/rest, elements of personal physical strength, and/or consideration of conventional risk factors.

NEW CRITERIA IN KOREA

Discussions to clarify overwork criteria have continued since 2008. In June 2013, the Employment and Labor Ministry finally released an updated notification regarding these criteria (Table 5) (29). According to this notification, the definitions of an acute stressful event and short-term overwork are the same as in the previous notification (30). However, the following two specific guidelines regarding disease approval based on the chronic work burden were presented:

- 1) The correlation between work and CCVD occurrence is strong if the weekly average work time exceeds 60 hr (64 hr on average for 4 weeks prior to disease occurrence) for 12 weeks before CCVD occurrence.
- 2) The correlation between work and CCVD occurrence gradually increases as the work time becomes longer, even when the weekly average work time does not exceed 60 hr (64 hr on average per week for 4 weeks before disease oc-

Table 5. The recent criteria for the recognition of occupational cerebro- or cardiovascular disease according to Schedule 3 of the Enforcement Decree of the Industrial Accident Compensation Insurance Act (before July 2013) and a notification from the Ministry of Employment and Labor

<p>Enforcement Decree of the Industrial Accident Compensation Insurance Act</p> <p>1. Diseases of the cerebro- or cardiovascular system</p> <p>Intracerebral hemorrhage, subarachnoid hemorrhage, cerebral infarction, myocardial infarction, and dissecting aortic aneurysm caused or aggravated not by natural progress but by the following work-related causes.</p> <ol style="list-style-type: none"> 1) Sudden and unpredictable changes of work condition and psychological strain, excitement, fear, fright, etc., that induce definite physiological changes in the employee 2) Short-term overwork such as an increase in the amount of work, working hours, or work intensity, and the change of responsibility or work conditions that induces physiological or mental overload 3) Chronic overwork such as the increase in the amount of work, working hours, or work intensity, and the change of responsibility or work conditions that induces physiological or mental overload
<p>Notification from the Ministry of Employment and Labor</p> <ol style="list-style-type: none"> 1) CCVDs occur within 24 hr after an acute stressful event takes place. 2) Short-term overwork is defined as a 30% or more workload or an increase in working hours within 1 week before the disease occurs, or workload or working hours change to the extent that ordinary people have difficulty adapting to it. 3) Chronic overwork is defined as having an excessive workload for 3 or more months consecutively. The judgment for chronic overwork should be totally considered workload, working hours, work intensity, responsibility, holidays, shift or night work, the intensity of mental tension, sleeping hours, work environment, age, sex, and health status. The following clauses about working hours had to be considered: <ol style="list-style-type: none"> a. The correlation between work and CCVD occurrence is strong if the weekly average working hours exceed 60 hr (64 hr on average for 4 weeks prior to disease occurrence) for 12 weeks before CCVD occurrence. b. The correlation between work and CCVD occurrence gradually increases as working hours become longer, even when the weekly average working hours do not exceed 60 hr (64 hr on average per week for 4 weeks before disease occurrence) for 12 weeks before CCVD occurrence. In the case of night work, a greater physical and mental burden may occur.

currence) for 12 weeks before CCVD occurrence. In the case of night work, a greater physical and mental burden may occur.

This revision provides quantitative judgment criteria regarding chronic overwork. In a 2008 study commissioned by the Labor Ministry, Won and colleagues suggested the chronic overwork criteria to be working an average of 52 hr or more per week for 3 months (13). Likewise, in 2011, Gwon et al. reported that the correlation between work and CCVDs increased in proportion to the number of working hours exceeding 52 hr on average per week as a criterion of chronic overwork in the Committee on Occupational Disease Judgment of the COMWEL (31).

The new criteria, however, had an issue in another context. Because the maximum number of working hours of a worker per week, based on the Labor Standards Act, is 52 hr, the revised number of working hours as the overwork criterion, 60 hr per week, does not violate the law. However, considering that the number of legal working hours does not include working hours during the weekends or holidays, the new criteria imply that workers have to work 8 hr on every weekend in addition to their recent weekly working hours. When calculating the number of working hours to judge overwork, the lunch break and break time are excluded. Consequently, when incorporating an hour's lunch break and break time, a worker's overwork would only be approved if he/she works 11 hr every day, including Saturday.

ISSUES FOR PRACTICAL APPLICATION

The new criteria seem to have a few limitations; thus, the following should be considered while applying them:

First, in cases where the average number of working hours exceeds 60 hr per week, CCVD could be approved as an OD without considering workload, intensity of work, job responsibility, break time, actual working hours, and/or mental tension. That is, if the average number of working hours is 60 or more hours per week, the number of hours is sufficient to be regarded as overwork, except in a few cases with very low workload or strength.

Second, when the average number of working hours does not exceed 60 hr per week, a comprehensive judgment is required in consideration of the workload, intensity of work, job responsibility, holidays and leaves, period of closure, work type (e.g., shift work and night work), mental tension, sleeping time, and working environment.

These considerations, however, may be vague; thus, the authors suggest that the following two conditions be considered while judging chronic overwork in cases where the average number of working hours does not exceed 60 hr per week.

First, the average number of working hours per week must exceed 90% of the criterion, which in this instance means that the average number of working hours needs to exceed 54 hr per

week for 3 or more months.

Second, chronic overwork should be considered when the workload, intensity of work, job responsibility, and mental tension are higher than the average in the same industry; night working hours exceed 30% of the total working hours; or the number of off-duty days is less than 4 days a month.

Although this suggestion is not legally binding, the authors think that it has medical validity on the basis of previous research. Consequently, we recommend that the two conditions mentioned above be considered when judging overwork related to CCVDs. In addition, we hope that these conditions will eventually be reflected in the continual revision process of the criteria for approving work-related diseases through various social communications and agreements. The government and COMWEL should also try to make the recognition of and understanding about the association between the number of working hours or other working conditions and CCVDs easier for the professionals of the Committee on Occupational Disease Judgment.

DISCLOSURE

The authors have no conflicts of interest to disclose.

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