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Original Article

Sociodemographic and work-related factors influencing long working hours among cardiovascular surgeons in Japan: a cross-sectional study

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Abstract: The maximum limit on overtime working hours for physicians will be applied from 2024. To explore sociodemographic and work-related factors influencing overtime work among cardiovascular surgeons (CS) in Japan. This cross-sectional study included 607 CS who responded to an online survey. Working hours were categorized into ≤60 hours, 60–79 hours, and ≥80 hours per week according to Japan Ministry of Health, Labour and Welfare. Adjusted odds ratios (aOR) were calculated using a multinomial analysis with stepwise reduction after adjustment for potential confounders. Compared to ≤60 hours, significant factors related to 60–79 hours and ≥80 hours per week were age groups of 30s to 50s versus 60s (aOR: 7.48–3.22 and 23.64–4.87), management with cardiovascular drugs (aOR: 1.87 and 5.80), and postoperative wound management (aOR: 0.47 and 0.16), respectively. Significantly related informed consent for surgery (aOR: 3.29) was seen in 60–79 hours. Contrarily, CS who worked for ≥80 hours took on-duty 5 times or more per month (aOR: 3.89), performed night or holiday calls 20 times or more per month (aOR: 2.26), and attended the intensive care unit (aOR: 3.12). These findings suggest that younger, and some non-surgical work-related factors could influence long working hours among CS.

Key words: Cardiovascular surgeon, Working hours, Cardiovascular surgery, Postoperative management, Task shifting, Occupational health

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Introduction

The Ministry of Health, Labor and Welfare (MHLW) is defining specific systems and other issues that require measures in medical legislation and medical policy regarding the upper limit of working hours for physicians in preparation for the reform of the working style of physicians in Japan from 2024[1]. In 2019, the MHLW highlighted that physicians had the longest working hours among all occupations[2]. It was reported that 40.5% of hospital physicians worked 60 hours or more per week and that 10.5% of hospital physicians worked 80 hours per week. In comparison, physicians across the United States of America reported working an average of 52.2 hours per week[3], and in Germany, the United Kingdom, and France, the Parliament of the European Union has limited the maximum working hours to 48 hours per week[4]. Although, medical care in Japan is supported by the self-sacrificing long working hours of physicians, 3.6% of Japanese physicians report suicidal tendency, 6.5% or more are moderately depressed, and reports of medical accidents are increasing annually[2].

Among surgeons, the Japan Surgical Society has reported that 61.7% of 6,221 surgeons work for more than 60 hours per week and 13.9% of surgeons work more than 90 hours per week[5]. Based on these data, the percentage of surgeons working 60 hours or more per week, stratified by surgical specialty, indicated that cardiovascular surgeons (CS) comprised 71%, and hepatobiliary surgeons and trauma physicians, 65%[4]. In addition, the Japanese Society for Cardiovascular Surgery (JSCVS) reported that 75.5% of 634 CS worked more than 60 hours per week, while 28.0% worked more than 80 hours per week[6]. These studies revealed that Japanese CS experience harsher working conditions than other surgeons. Although the shortage of surgeons (72.8%), excessive emergency surgeries (69.4%), and a high risk of lawsuits (67.7%) were the reasons reported for these long working hours[7], there are no reports on the sociodemographic and work-related factors related to working hours among CS. This study aimed to explore the relationship between long working hours and sociodemographic factors and working environment of CS in Japan.

Subjects and methods

Design and participants

A cross-sectional study employing an online survey was conducted among 3,071 CS who were registered with the JSCVS across Japan and abroad for one month starting December 1, 2018, entitled "Working environment of CS in Japan". The JSCVS provided informed consent forms via the web-based interface, and informed consent was obtained when the participants answered the questionnaire. Since the participants were not incentivized to complete the survey, it was registered anonymously and the section regarding their place of work was removed, and 634 respondents (response rate, 17%) finally agreed to complete the questionnaire.

Questionnaire content

The questionnaire included 1) sociodemographic variables, such as age, sex, family, income, position, affiliation and specialty conditions; 2) outpatient services, ward operations, postoperative management, and involvement in medical affairs by CS; and 3) working hours, including working hours at hospitals, overtime work, and duty calls. The JSCVS developed questions specifically for this survey. On-call hours were limited to hours worked when actually called to the hospital.

Definition of long working hours

The Labor Standards Act stipulates that, as a general rule, the working hours per week should not exceed 40 hours. For physicians, the MHLW stipulates that the standard overtime working hours should be no more than 960 hours per year, including holidays, or 60 hours per week. Working hours were categorized into three groups, 60 hours or less, 60–79 hours, and 80 hours or more, based on the MHLW's recommendations.

Statistical analysis

Of the 634 respondents, we analyzed 607 valid responses; 27 were excluded for the following reasons: 1) respondents did not complete 3 questions regarding average working hours per week, sex, and age in the main workplace; 2) respondents were not CS; and 3) respondents were general practitioners.

Differences between individual sociodemographic and work-related factors of participants among working hours groups were analyzed using the chi-squared test or the Fisher's exact test. Using a multinomial logistic regression analysis to explore factors related to long working hours, we first examined possible independent factors at p-values <0.2 from the previous analysis. Then, all possible independent variables at p-values <0.2 from the previous analysis were further analyzed using a manual backward stepwise method, the remaining factors were reanalyzed after adjusting for potential confounding factors.

All statistical analyses were conducted using SPSS Sta-

tistics 26 for Windows (IBM SPSS, Inc., Tokyo, Japan), using an assumed type I error rate of 0.05.

Ethical considerations

The study protocol was approved by the Board of the Dokkyo Medical University Hospital Ethics Committee in Japan (No R-38-8J).

Results

Participant characteristics

Males accounted for the highest percentage of respondents (n=570, 93.9%). The largest age strata were 40–49 years and 50–59 years (n=188, 31.0%; n=177, 29.2%). Overall, 40.4% (n=245) of respondents were affiliated with a university hospital. The most common category by specialty was "adult cardiovascular surgery" (n=466, 76.8%), and the highest position was "manager" (n=285, 47.0%). Of the study participants, 24.5% (n=149) of physicians worked for 60 hours or less (standard working hours, reference), 47.5% (n=288) worked for 60–79 hours, and 28.0% (n=170) worked for 80 hours or more.

Sociodemographic and work-related factors by working hours per week

Basic attributes were compared for each category of working hours. Variables that were significant relationships ($p<0.05$) included age, marital status, having children, position, ratio of income from major workplaces, percentage of main place of work attributed to the total wage, cardiovascular specialist status, and chief status. In the work-related comparison, significant relationships were found in on-duty, on-call duty, and night or holiday on-call duty (Table 1-1).

No clinical duties in the outpatient clinic showed relationships between the groups. Regarding ward-related work, variables that were significant relationships ($p<0.05$) included medical examination and records, examination orders, venous line insertion, insertion and removal of nasogastric tubes, postoperative wound management, removal of thoracic tubes, management of cardiovascular drugs, and management of hospital discharge. For desk work, variables that were significant relationships ($p<0.05$) included obtaining informed consent for surgery, registration for the Japan Adult Cardiovascular Surgery Database (JACVSD), registration for Diagnosis Procedure Combination (DPC), and correspondence for medical receipts. Postoperative management in the intensive care unit (ICU) was mostly conducted by CS (Table 1-2).

Relationships between average working hours and individual factors

Comparison with the 60 working hours or less group is shown in Table 2-1, which summarizes significant characteristic factors, such as age, marital status, having children, position, annual income, chief of training, on duty, and on-call in workday, in both the 60–79 hours group and the 80 hours or more group, respectively. There was a significant relationship between specialization category, cardiovascular specialist, education, and on duty in other hospital and the 80 hours or more group compared to 60 working hours or less group.

Compared with the 60 working hours or less group, Table 2-2 shows each significant work-related factor, such as clinical work in the ward including in the medical examination and records, examination order, venous line insertion, urethral catheter insertion, insertion and removal of nasogastric tube, postoperative wound management, removal of thoracic tube, management of cardiovascular drugs and hospital discharge; postoperative management including in CS at ICU; desk work in the ward including in informed consent for surgery, and registration for JCVSD and DPC in both the 60–79 hours group and the 80 hours or more group, respectively. There was a significant relationship between medical certificate and registration for NCD and the 60–79 hours group; between blood sampling, ICU physician at ICU, and correspondence for medical receipt and the 80 hours or more group compared to 60 working hours or less group.

Work hours-related independent factors in the multivariable analysis

Table 3 shows the independent factors identified by the multinomial logistic regression analysis with stepwise reduction and reanalysis of these factors following the adjustment for sociodemographic confounding factors including sex, marital status, children, affiliation, number of full-time doctors, annual income, and percentage of main place of work attributed to the total wage. Compared with the 60 working hours or less group, there was a significant relationship with adjusted odds ratio [aOR]: 6.20, 95% confidence intervals [CI] 1.06–36.41 and aOR: 23.64, 95% CI 3.34–167.16 in less than 30 years group, aOR: 7.48, 95% CI 3.01–18.64 and aOR: 19.10, 95% CI 5.05–72.22 in 30–39 years group, aOR: 5.51, 95% CI 2.52–12.04 and aOR: 12.17, 95% CI 3.54–41.84 in 40–49 years group in 50–59 years group, and aOR: 3.22, 95% CI 1.58–6.56 and aOR: 4.87, 95% CI 1.49–15.97 in 50–59 years group for the 60–79 hours group and the 80 hours or more group, respectively.

Table 1-1. Comparisons of characteristics and work-related factors of cardiovascular surgeons among three working hours groups (N=607)

Variables[b]	Category	N[b]	Average working hours (per week)						*p*-value[a]
			<60		≥60 to 79		≥80		
			n	%	n	%	n	%	
Sex	Male	570	143	96.0	268	93.1	159	93.5	0.468
Age, years	<30	26	2	1.3	9	3.1	15	8.8	<0.001
	30–39	142	15	10.1	71	24.7	56	32.9	
	40–49	188	33	22.1	96	33.3	59	34.7	
	50–59	177	48	32.2	93	32.3	36	21.2	
	≥60	74	51	34.2	19	6.6	4	2.4	
Marital status	Yes	539	143	96.6	254	88.8	142	84.5	0.002
Having children	No	118	18	12.2	60	20.9	40	23.7	0.024
	One or two	317	76	51.4	155	54.0	86	50.9	
	≥Three	169	54	36.5	72	25.1	43	25.4	
Affiliation	University hospital	245	58	38.9	111	38.8	76	44.7	0.550
	Public hospital	205	49	32.9	105	36.7	51	30.0	
	Private hospital	155	42	28.2	70	24.5	43	25.3	
Number of full-time doctors	≤5	311	76	51.0	151	52.6	84	49.4	0.904
	6–10	191	49	32.9	89	31.0	53	31.2	
	>10	104	24	16.1	47	16.4	33	19.4	
Position[c]	Manager	285	100	67.1	132	45.8	53	31.2	<0.001
	Middle manager	134	20	13.4	73	25.3	41	24.1	
	General staff	188	29	19.5	83	28.8	76	44.7	
Annual income, Japanese Yen per year	≤10 million	80	12	8.1	28	9.8	40	23.5	<0.001
	>10, ≤20 million	431	103	69.6	217	75.9	111	63.3	
	>20 million	93	33	22.3	41	14.3	19	11.2	
Percentage of main place of work	<50	105	23	15.6	51	17.7	31	18.3	0.022
attributed to the total wage, %	51–70	114	33	22.4	48	16.7	33	19.5	
	71–99	170	46	31.3	93	32.3	31	18.3	
	100	215	45	30.6	96	33.3	74	43.8	
Specialty of cardiovascular surgery	Adult	466	106	71.1	227	78.8	133	78.2	0.134
	Pediatric	71	18	12.1	30	10.4	23	13.5	
	Vascular surgery	70	25	16.8	31	10.8	14	8.2	
Cardiovascular specialist	Yes	492	132	88.6	243	84.7	117	68.8	<0.001

Table 1-1. Continued

Variables[b]	Category	N[b]	Average working hours (per week)						*p*-value[a]
			<60		≥60 to 79		≥80		
			n	%	n	%	n	%	
Chief of training	Yes	319	106	71.1	151	52.6	62	36.5	<0.001
Education time, %	>10	114	34	23.0	56	19.5	24	14.2	0.128
Open heart surgery, cases per year	≤100	164	47	31.5	83	29.0	34	20.0	0.311
	101–300	313	74	49.7	144	50.3	95	55.9	
	301–600	109	25	16.8	49	17.1	35	20.6	
	>600	19	3	2.0	10	3.5	6	3.5	
Vascular surgery, cases per year	≤100	282	72	48.3	135	47.4	75	44.1	0.633
	101–300	277	62	41.6	131	46.0	84	49.4	
	301–600	42	14	9.4	17	6.0	11	6.5	
	>600	3	1	0.7	2	0.7	0	0.0	
On duty, times per month	≤5	506	141	95.3	245	87.3	118	84.2	0.001
	6–15	92	7	4.7	36	12.7	49	15.3	
	>15	3	0	0.0	0	0.0	3	0.5	
On-call in workday, times per month	≤10	354	110	73.8	171	59.4	73	43.2	<0.001
	11–20	82	16	10.7	39	13.5	27	16.0	
	>20	170	23	15.4	78	27.1	69	40.8	
On-call at night or on holiday, times per month	≤10	234	90	60.4	104	36.2	40	23.5	<0.001
	11–20	48	14	9.4	23	8.0	11	6.5	
	>20	324	45	30.2	160	22.7	119	70.0	
Working hours in other hospital, per week	≥10	181	41	28.3	82	29.3	58	35.4	0.310
On duty in other hospital, times per month	≥6	23	2	1.4	10	3.5	11	6.6	0.050

a: Chi-squared test or Fisher's exact test

b: Missing values were excluded (partner=5, children=3, annual income=3, attributed to the total wage=3, affiliation=2, number of full-time doctors=1, cardiovascular specialist=1, chief of training=1, education time=3, open heart surgery=2, vascular surgery=3, on duty=6, on-call in workday=1, on-call at night or on holiday=1, working hours in other hospital=18, on duty in other hospital=9).

c: Manager included in professor, director, and division chief. Middle manager included in lecturer and chief physician. General staff include in staff physician and specialist in specialty.

Compared with the 60 working hours or less group, postoperative wound management (aOR: 0.47, 95% CI 0.23–0.95 and 0.16, 95% CI 0.07–0.41) and management of cardiovascular drugs (aOR: 1.87, 95% CI 1.00–3.47 and 5.80, 95% CI 2.45–13.67) were significantly related both the 60–79 hours group and the 80 hours or more group, respectively. There was significantly related informed consent for surgery (aOR, 3.29; 95% CI, 1.67–7.05) for the 60–79 hours group, and on-duty 5 times or more per month (aOR: 3.89, 95% CI 1.58–9.55), night or holiday calls 20 times or more per month (aOR: 2.26, 95% CI 1.26–4.08), and CS at ICU (aOR: 3.12, 95% CI 1.49–6.51) for the 80 hours or more group, respectively.

Table 1-2. Comparisons of characteristics and work-related factors of cardiovascular surgeons among three working hours groups (N=607)

Variables	N	Average working hours (per week)						*p*-value[a]
		<60		≥60 to 79		≥80		
		n	%	n	%	n	%	
Clinical work in outpatient clinic, yes								
Initial examination at first visit	210	46	30.9	104	36.1	60	35.3	0.537
Examination orders at first visit	420	97	65.1	204	70.8	119	70.0	0.452
Medical examination and record	558	136	91.3	269	93.4	154	90.9	0.410
Reservation for next visit	455	113	75.8	219	76.0	123	72.4	0.652
Blood sampling	15	2	1.3	6	2.1	7	4.1	0.237
Intravenous injection	6	1	0.7	2	0.7	3	1.8	0.483
Venous line insertion	25	3	2.0	11	3.8	11	6.5	0.128
Explanation for examination and hospitalization	205	45	30.2	100	34.7	60	35.3	0.565
Clinical work in the ward, yes								
Medical examination and records	539	118	79.2	259	89.9	162	95.3	<0.001
Examination order	448	86	57.7	220	76.4	142	83.5	<0.001
Blood sampling	50	8	5.4	22	7.6	20	11.8	0.102
Intravenous injection	40	6	4.0	20	6.9	14	8.2	0.302
Venous line insertion	91	11	7.4	49	17.0	31	18.2	0.011
Urethral catheter insertion	96	15	10.1	47	16.3	34	20.0	0.050
Insertion and removal of nasogastric tube	199	33	22.1	92	31.9	74	43.5	<0.001
Postoperative wound management	438	87	58.4	217	75.3	134	78.8	<0.001
Removal of thoracic tube	417	76	51.0	207	71.9	134	78.8	<0.001
Management of cardiovascular drugs	408	67	45.0	199	69.1	142	83.5	<0.001
Preoperative shaving	48	12	8.1	23	8.0	13	7.6	0.989
Patient transport	135	28	18.8	64	22.2	43	25.3	0.379
Management of hospital discharge	401	73	49.0	200	69.4	124	75.3	<0.001
Desk work in the ward, yes								
Informed consent for surgery	530	111	74.5	268	93.1	151	88.8	<0.001
Medical certificate	417	92	61.7	207	71.9	118	69.4	0.093
Documents for patient insurance	295	65	43.6	142	49.3	88	51.8	0.330
Registration for NCD	300	64	43.0	148	51.4	88	51.8	0.191
Registration for JCVSD	275	52	34.9	144	50.0	79	46.5	0.010
Registration for DPC	225	45	30.2	104	36.1	76	44.7	0.025

Table 1-2. Continued

Variables	N	Average working hours (per week) <60 n	<60 %	≥60 to 79 n	≥60 to 79 %	≥80 n	≥80 %	*p*-value[a]
Correspondence for medical receipt	408	87	58.4	195	67.7	126	74.1	0.011
Postoperative management, yes								
Cardiovascular Surgeon at ICU	489	102	68.5	232	80.6	155	91.2	<0.001
ICU doctor at ICU	151	45	30.2	80	27.8	26	15.3	0.003
Cardiovascular Surgeon at High Care Unit	86	21	14.1	51	17.7	14	8.2	0.019

ICU: Intensive Care Unit; NCD: National Clinical Database; JCVSD: Japan Adult Cardiovascular Surgery Database; DPC: Diagnosis Procedure Combination
a: Chi-squared test

Discussion

The results of this study showed that the factors that significantly influenced the working hours of 61–79 hours per week compared those influencing working less than 60 hours per week among CS were age, postoperative wound management, management of cardiovascular drugs, and informed consent for surgery. And age, being on duty five times or more per month, on-call at night or on holiday 20 times or more per month, management of cardiovascular drugs, and postoperative management by CS in the ICU were significant factors for CS working 80 hours or more per week. To our knowledge, this is the first study to clarify the relationship of working hours of CS with sociodemographic and work-related factors.

The fact that younger surgeons work longer hours is widely known. Hanasaki *et al.*[7] reported average weekly work hours for surgeons aged 70 years and older was 42.2 hours, whereas the average weekly work hours for those aged 39 years and younger was 92.2 hours, which confirms that younger surgeons worked longer hours. This previous study supported our findings. Long working hours of young physicians are not only associated with a high near-miss incidents and accidents[8], but they also are prone to more mental disorders such as depression and self-reported burnout[9–11]. Other studies reported that the burnout is independently associated with the length of working hours[12–14]. Meanwhile, was reported the shorter the working hours, the less occurrence of burnout in a longitudinal study for restriction[15, 16].

For reducing the work hours, residency programs have been required to limit the working hours such as no more than 24 consecutive hours of work, no more than 80 hours of work per week, a minimum of 10 hours of rest between shifts, and one day off per week in the USA[17]. A survey demonstrating the residents reduced working hours, and showed positive results, with a decrease in the average length of stay, the rate of readmission within 30 days, and the rate of transfer to the ICU[21]. However, a "reduced quality of care" could occur owing to the increased handoffs, decreased availability for teaching conferences, and reduced intern presence during daytime work hours[18]. Moreover, the number of consecutive hours (16 hours) worked by surgical residents resulted in a shift of their primary work to senior physicians[19, 20]. These reports showed that balance between surgeons' careers and working hours is a complicated problem in the younger surgeons. Although MHLW recommends overtime work will be limited to 1,860 hours or less per year in the reform of the Japanese work style[22], it might be necessary to set detailed CS working hours according to age through further research.

Regarding the number of shifts, the MHLW recommends one day off and one night-call duty each week[1]. Previous studies reported that the average number of night duties per month for surgeons was 2–4 days[5, 7]. In our results, an average of five or more-night duties per month was an associated factor in the group of 80 hours or more per week, which is more than the number of night duties recommended by the MHLW. Shortage of surgeons is considered to be one cause. According to the MHLW's Summary of Statistics on Doctors, Dentists, and Pharmacists for 2008[23], the aging of surgeons is acknowledged along with the decrease in the number of surgeons trained per year, 51.2% of the facilities had five or fewer full-time physicians, and the av-

Table 2-1. Relationship between average working hours and each characteristic or work-related factor of cardiovascular surgeons (N=607)

Variables	Categories[b]	Average working hours (per week)							
		≥60 to 79 vs <60				≥80 vs <60			
		OR	95%CI		*p*-value[a]	OR	95%CI		*p*-value[a]
Age, years	<30	12.08	2.39	61.05	0.003	95.63	15.93	574.09	<0.001
	30–39	12.71	5.90	27.35	<0.001	47.60	14.83	152.81	<0.001
	40–49	7.81	4.04	15.09	<0.001	22.80	7.56	68.71	<0.001
	50–59	5.20	2.77	9.78	<0.001	9.56	3.17	28.89	<0.001
	≥60	Ref.				Ref.			
Marital status	No vs yes	3.60	1.37	9.45	0.009	5.24	1.96	14.01	0.001
Having children	No	2.50	1.33	4.71	0.005	2.79	1.41	5.54	0.003
	One or two	1.53	0.98	2.39	0.062	1.42	0.86	2.36	0.173
	≥ three	Ref.				Ref.			
Position	Manager	Ref.				Ref.			
	Middle manager	2.77	1.58	4.84	<0.001	3.87	2.06	7.26	<0.001
	General staff	2.22	1.32	3.56	0.002	4.95	2.88	8.05	<0.001
Annual income, Japanese Yen	≤10 million	1.88	0.83	4.25	0.131	5.79	2.46	13.64	<0.001
per year	>10, ≤20 million	1.69	1.01	2.84	0.044	1.87	1.00	3.50	0.049
	>20 million	Ref.				Ref.			
Percentage of main place of	<50	Ref.				Ref.			
work attributed to the total	51–70	0.66	0.34	1.76	0.901	0.74	0.36	1.53	0.419
wage, %	71–99	0.91	0.50	1.67	0.765	0.50	0.25	1.01	0.054
	100	0.96	0.53	1.27	0.212	1.22	0.63	2.35	0.551
Specialized Category	Adult	1.73	0.97	3.07	0.063	2.24	1.11	1.52	0.024
	Pediatric	1.34	0.61	2.95	0.461	2.28	0.93	5.61	0.072
	Vascular surgery	Ref.				Ref.			
Cardiovascular specialist	No vs yes	1.41	0.77	2.56	0.265	3.52	1.93	6.41	<0.001
Chief of training	No vs yes	2.22	1.45	3.39	<0.001	4.29	2.68	6.89	<0.001
Education time, %	≤10 vs >10	1.23	0.76	1.99	0.399	1.80	1.01	3.21	0.046
On duty, times per month	>5 vs ≤5	2.94	1.27	6.77	0.012	8.88	3.89	20.28	<0.001
On-call in workday, times per month	≤10	Ref.				Ref.			
	11–20	1.57	0.84	3.68	0.161	2.54	1.28	5.05	0.008

Table 2-1. Continued

Variables	Categories[b]	Average working hours (per week)							
		≥60 to 79 vs <60				≥80 vs <60			
		OR	95%CI		*p*-value[a]	OR	95%CI		*p*-value[a]
	>20	2.18	1.29	2.94	0.003	4.52	2.59	7.89	<0.001
On-call at night or on holiday, times per month	≤10	Ref.				Ref.			
	11–20	1.42	0.69	2.93	0.339	1.77	0.74	3.07	0.201
	>20	3.08	1.99	4.75	<0.001	5.95	3.59	9.87	<0.001
On duty in other hospital, times per month	≥6	2.61	0.56	12.07	0.220	5.11	1.11	23.45	0.036

OR: odds ratio; 95%CI: 95% confidence interval

a: Using a multinomial logistic regression, entered each variable with *p*-value <0.2 from Table 1-1

b: Missing values were excluded (partner=5, children=3, annual income=3, percentage of main place of work attributed to the total wage=3, cardiovascular specialist=1, chief of training=1, education time=3, on duty=6, on-call in workday=1, on-call at night or on holiday=1, on duty in other hospital=9).

erage number of full-time physicians in this group was 3.3. In other words, fewer full-time physicians meant more on-call and night duties due to emergency surgeries and sudden changes.

As a CS, surgery and acute postoperative management are tasks that cannot be overlooked. The time required for cardiovascular surgery depends on surgical factors such as cardiopulmonary bypass (CPB), hypothermia, and cardiac arrest. The 2017 data provided by JACVSD investigated at operative times and found that the overall average operative time for coronary artery bypass grafting (CABG), valve surgery, and major vascular surgery was 300 minutes, with operative times of 344, 292, and 380 minutes, respectively. According to our survey results, CS spent an average of 34.4% (median 30%) of their entire working time for surgery[6]. Moreover, a characteristic of acute postoperative management in the field of cardiovascular surgery is that most patients are intubated and managed in the ICU. As soon as we enter the ICU, we perform monitoring and initial investigations, Circulation management (cardiovascular drugs and arrhythmia management), sedation and analgesia management, respiratory management, hypothermia to hyperthermia, electrolyte management, glycemic control, hemostasis and blood transfusion. Based on the JACVSD data, the overall median intubation time was 12 hours. Regarding the type of surgery, the median operative time for CABG, valvular surgery, and major vascular surgery (open surgery) was 14, 12 and 18 hours, respectively, suggesting extremely long working hours for postoperative management. Longer operation time means more cardiac decompensation, hypoxemia, hypothermia, and bleeding, and volume over causes prolonged respiratory and cardiovascular drugs and postoperative wound management. The results of this study also showed that the factors that contributed to long working hours were the tasks of postoperative management: management of cardiovascular drugs, and postoperative management by CS. If we focus on the working hours of surgeons aged 30–49 years, the percentage of those working 60 hours or more per week is high at 85.5% and is considered specific to the field of cardiovascular surgery, which requires skilled postoperative management. In contrast, some reports have described improved treatment results when ICU management is conducted by an ICU specialist[24, 25]. If the acute postoperative management could be task shifting to ICU physicians, it will have the advantage of reducing working hours and allowing us to concentrate on surgery.

Regarding task shifting, it is important to train and utilize specific certified nurses who have completed specific action training as well as medical office workers. The MHLW recommends that task shifting of physicians' outpatient and ward duties could reduce working hours by 25% and utilizing 10,000 certified nurses could reduce physicians' working hours by 7 hours per week. However, based on the results of the previous survey[6], 25% of the respondents answered that specific certified nurses had

Table 2-2. Relationship between average working hours and each characteristic or work-related factor of cardiovascular surgeons (N=607)

Variables	Average working hours (per week)							
	≥60 to 79 vs <60				≥80 vs <60			
	OR	95%CI		*p*-value[a]	OR	95%CI		*p*-value[a]
Clinical work in outpatient clinic, yes vs no								
Venous line insertion	1.93	0.53	- 7.040	0.318	3.37	0.92	- 12.31	0.066
Clinical work in the ward, yes vs no								
Medical examination and records	2.35	1.35	- 4.07	0.002	5.32	2.36	- 11.99	<0.001
Examination order	2.37	1.55	- 3.62	<0.001	3.72	2.21	- 6.25	<0.001
Blood sampling	1.46	0.63	- 3.36	0.375	2.35	1.00	- 5.51	0.049
Venous line insertion	2.57	1.29	- 5.11	0.007	2.80	1.35	- 5.79	0.006
Urethral catheter insertion	1.74	0.94	- 3.23	0.079	2.23	1.16	- 4.29	0.016
Insertion and removal of nasogastric tube	1.65	1.04	- 2.61	0.033	2.71	1.66	- 4.43	<0.001
Postoperative wound management	2.18	1.43	- 3.32	<0.001	2.65	1.62	- 4.34	<0.001
Removal of thoracic tube	2.46	1.63	- 3.70	<0.001	3.58	2.19	- 5.83	<0.001
Management of cardiovascular drugs	2.74	1.82	- 4.12	<0.001	6.21	3.70	- 10.42	<0.001
Management of hospital discharge	2.37	1.57	- 3.56	<0.001	3.17	1.98	- 5.10	<0.001
Postoperative management, yes vs no								
Cardiovascular Surgeon at ICU	1.91	1.210	- 3.00	0.01	4.76	2.53	- 8.96	<0.001
ICU doctor at ICU	0.89	0.580	- 1.37	0.595	0.42	0.24	- 0.72	0.002
Cardiovascular Surgeon at High Care Unit	1.31	0.760	- 2.28	0.335	0.55	0.27	- 1.12	0.098
Desk work in the ward, yes vs no								
Informed consent for surgery	4.59	2.56	- 8.23	<0.001	2.72	1.49	- 4.97	0.001
Medical certificate	1.58	1.04	- 2.41	0.031	1.41	0.88	- 2.24	0.150
Registration for NCD	1.40	0.94	- 2.09	0.095	1.43	0.92	- 2.22	0.116
Registration for JCVSD	1.87	1.24	- 2.81	0.003	1.62	1.03	- 2.55	0.037
Registration for DPC	1.31	0.86	- 2.00	0.217	1.87	1.18	- 2.97	0.008
Correspondence for medical receipt	1.49	0.99	- 2.25	0.054	2.04	1.27	- 3.28	0.003

OR: odds ratio; 95%CI: 95% confidence interval; ICU: Intensive Care Unit; NCD: National Clinical Database; JCVSD: Japan Adult Cardiovascular Surgery Database; DPC: Diagnosis Procedure Combination

a: Using a multinomial logistic regression, entered each variable with *p*-value <0.2 from Table 1-2.

Table 3. Relationship between average working hours and related factors of cardiovascular surgeons in the multivariable analysis with stepwise reduction method and adjustment after confounding factors (N=579)

Variables	Average working hours (per week)									
	≥60 to 79 vs <60					≥80 vs <60				
	aOR	95%CI			*p*-value[a]	aOR	95%CI			*p*-value[a]
Age, years										
<30	6.20	1.06	-	36.41	0.044	23.64	3.34	-	167.16	0.002
30–39	7.48	3.01	-	18.64	<0.001	19.10	5.05	-	72.22	<0.001
40–49	5.51	2.52	-	12.04	<0.001	12.17	3.54	-	41.84	<0.001
50–59	3.22	1.58	-	6.56	0.001	4.87	1.49	-	15.97	0.009
≥60	Ref.					Ref.				
On duty, >5 vs ≤5, times per month	1.54	0.63	-	3.76	0.34	3.89	1.58	-	9.55	0.003
On-call at night or on holiday, times per month										
≤10	Ref.					Ref.				
11–20	0.93	0.41	-	2.59	0.87	1.10	0.40	-	3.01	0.855
>20	1.58	0.97	-	2.59	0.07	2.26	1.26	-	4.08	0.007
Clinical work in the ward, yes vs no										
Postoperative wound management	0.47	0.23	-	0.95	0.035	0.16	0.07	-	0.41	<0.001
Management of cardiovascular drugs	1.87	1.00	-	3.47	0.049	5.80	2.45	-	13.67	<0.001
Postoperative management, yes vs no										
Cardiovascular Surgeon at ICU	1.52	0.90	-	2.57	0.118	3.12	1.49	-	6.51	0.003
Desk work in the ward, yes vs no										
Informed consent for surgery	3.29	1.67	-	7.05	<0.001	1.85	0.80	-	4.29	0.149

aOR: adjusted odds ratio; 95%CI: 95% confidence interval; ICU: Intensive Care Unit

a: Using a multinomial logistic regression with manual backward stepwise method, entered variables with *p*-values <0.2 from Table 2 and adjusted after sex, partner, children, affiliation, number of full-time doctors, annual income, percentage of main place of work attributed to the total wage.

been introduced, and only 43% answered that the introduction of task shifting had been effective. Factors affecting long working hours in this study include the preparation of informed consent for surgery, and it must be pointed out that task shifting in the field are insufficient at this stage.

First, duties related to ward operations and medical affairs should be clearly defined, and each hospital's cardiovascular surgery team should be staffed with two or more specific certified nurses according to the number of surgical procedures performed. However, in other countries, nurse practitioners, who are equivalent to specialized nurses, focuses more on "care" in addition to conducting medical tasks ("cure") to meet a patient's needs[26]. The physician assistant system has been introduced overseas and has been extremely effective in reducing the number of working hours of physicians as physician assistants[27, 28]. By introducing this system in Japan as well, it would be effective in reducing overtime work such as duty and ward work. Second, working hours can be reduced by consolidating facilities, increasing the number of full-time physicians to 15 or more, and shifting the work system.

This study has certain limitations since the survey only achieved a 17% response rate from among the large proportion of CS in their 40s and 50s; therefore, the population analyzed may not be representative of the entire population of CS. Nevertheless, this is the first report of basic data for

physician working style reform recommended by the MHLW that included responses from over 600 JSCVS CS. Secondly, the survey could not have avoided information bias since it was a self-reported questionnaire. Thirdly, we could not obtain the average numbers of working hours and night duties for doctors at university hospitals due to the focus on working hours at the main workplace. Lastly, CS do not have a fixed work allocation because their daily work is determined by patient priority, and for this study, we used overall working hours for the analysis. As for the current working conditions for surgeons in the field of cardiovascular surgery, careful interpretation of the survey results is warranted.

Conclusions

The survey results revealed the working hours of CS. We identified factors related to high-adjusted odds ratios by clarifying factors associated with average weekly work of over 60 h to 80 h. We propose recommendations for future policies so that the findings of the present study can support and promote the improvement of the working environment for CS.

Conflict of interest

None declared.

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