

Abstract

Background: Burnout is common among physicians and affects the quality of care. We aimed to determine the prevalence of burnout among Japanese physicians working in stroke care and evaluate personal and professional characteristics associated with burnout.

Methods and Results: A cross-sectional design was used to develop and distribute a survey to 11,211 physicians. Physician burnout was assessed using the Maslach Burnout Inventory General Survey and psychological well-being using the Short-Form 36-Item Health Survey. The predictors of burnout and the relationships among them were identified by creating a generalized linear model and multivariate regression analysis. A total of 2,724 (25.3%) physicians returned the surveys. After excluding those who were not working in stroke care or did not complete the survey appropriately, 2,564 surveys were analysed. Analysis of the participants' scores revealed that 41.1% were burned out, 58% had mild symptoms of depression, and 27.1% had severe symptoms of depression. Multivariate analysis indicated that number of hours worked per week, hours slept per night, holidays per week, after-hours calls per week, and years of experience, as well as income are significant predictors of burnout. Number of hours worked per week and sleep time were found to be the strongest predictor.

Conclusion: The primary risk factors for burnout are heavy workload, short sleep duration, and relatively little experience, among which workload is the strongest predictor. Prospective

research is required to confirm these findings and develop programs for preventing burnout.

Key words: burnout, Japanese Neurosurgical Society, Japanese Society of Neurology, J-ASPECT study, Maslach Burnout Inventory, neurosurgery, stroke, tissue plasminogen activator

Introduction

Burnout is a syndrome characterized by emotional exhaustion and depersonalization leading to decreased effectiveness at work.¹ In a recent large survey of U.S. physicians working in all medical fields, approximately 40% of neurosurgeons were found to have experienced symptoms of burnout.² Another U.S. study found that approximately 40% of surgeons were burned out and 30% were depressed (as assessed by depression symptom screening),³ conditions that are both associated with medical errors.^{4,5} Recent studies suggest that burnout may influence quality of care and lead to early retirement.⁶ However, limited research has been conducted into the relationship between specific demographic and practice characteristics and burnout among physicians working in stroke care, and no survey research has been conducted among Japanese physicians. Such lack of research is troubling, as stroke is the fourth-leading cause of death in Japan, as well as a leading cause of long-term disability.⁷

Recognizing the importance of understanding the relationship between physician well-being and stroke care, the Ministry of Health, Labor and Welfare of Japan has been subsidizing the J-ASPECT study, a nationwide analysis of emergency medical services and comprehensive stroke care centres in Japan. The J-ASPECT study group, a national task force, is responsible for investigating stroke care program in Japan, including that provided in comprehensive stroke care centres. In tandem with increased recognition of burnout among Japanese

physicians working in stroke care, the J-ASPECT study group has been examining the impact of burnout on physician sustainability and patient outcomes. In accordance with this focus, the objective of this study was to determine the prevalence of burnout among Japanese neurosurgeons and neurologists working in stroke care and evaluate the personal and professional characteristics associated with burnout among this physician population. By doing so, this study was able to examine the hypothesis that the most important risk factor for burnout among physicians working in stroke care is an excessive workload, as assessed by the number of hours worked per week.

Methods

Study design

In March 2011, a cross-sectional survey was sent to 11,211 physicians, among whom were all board-certified members of the Japanese Neurosurgical Society and the Societas Neurologica Japonica working in stroke care throughout Japan. The survey was developed by J-ASPECT researchers, based on the previous studies on physician burnout. We sent the survey to a total of 10,791 physicians via postal mail; however, we could not mail the questionnaire to 420 physicians in the 3 Tohoku prefectures that were affected by Great Tohoku Earthquake. The cover letter accompanying the survey informed the physicians that only physicians who are currently working for stroke care are eligible for the survey, that

their participation was voluntary, and that their responses would remain anonymous. They were requested to return the completed survey within 8 weeks. The survey contained items that collected data regarding relevant demographic variables, including age, sex, occupation, relationship status, current employment status, and income; items that collected data regarding variables related to practice patterns, including years of experience providing stroke care, certification status on the relevant medical boards, mean number of hours worked per week, mean number of nightshifts worked per month, mean number of after-hours calls taken per week, mean number of hours slept per night, and mean number of cases treated by tissue plasminogen activator (t-PA) per year; items that allowed for self-assessment of burnout; and, for neurosurgeons, items that collected data regarding mean number of all operations, stroke-related operations, and emergency operations performed per year. This study was approved by the Institutional Review Board of the National Cerebral and Cardiovascular Center, Japan.

Measurement of burnout, depression, and quality of life

Burnout among physicians was measured using the Japanese version of the Maslach Burnout Inventory-General Survey (MBI-GS), a validated version of the Maslach Burnout Inventory (MBI), which is currently considered the gold standard for measuring burnout.⁸⁻¹⁰ This 16-item questionnaire^{11 12} contains 3 subscales that evaluate what are considered the 3

major domains of burnout: exhaustion, cynicism (depersonalization), and professional efficacy. Based on the results of previous studies using the MBI-GS, which reported that a high score on the emotional exhaustion and/or depersonalization subscale is an indication of physician burnout,^{2 10 13 14} and the findings from a survey of Japanese population,¹⁵ an exhaustion score greater than 4.0 and/or a cynicism (depersonalization) score greater than 2.6 were selected as primary criteria for burnout. The criteria for severe burnout status were an exhaustion score greater than 4.0 and either a cynicism score greater than 2.6 or a professional efficacy score lower than 4.17. The use of at least one additional criterion for severe burnout (i.e. the use of ‘exhaustion+1’ criteria) was adopted because exhibiting at least one other symptom of burnout besides exhaustion has been reported to be a more appropriate and reliable indicator of severe burnout among the general population¹⁶ compared to the approaches used in former studies of physician burnout.

Psychological well-being was assessed using the Mental Health (MH) subscales of the Medical Outcome Study Short-Form 36-Item Health Survey (SF-36), a valid and reliable instrument for measuring health-related quality of life.^{17 18} The scores of the individual items were summed to produce a score scale ranging from 0 to 100, with higher scores indicating better mental health, and then examined to determine whether the participants exhibited symptoms of depression according to the criteria of Yamazaki et al.¹⁹ For comparison of the study population with the general population of Japanese workers, the MBI-GS scores of the

participants were compared with the MBI-GS scores of 2,843 Japanese office workers and 751 civil servants that one of our investigators had previously published.¹⁵

Statistical analysis

Standard descriptive summary statistics were used to determine whether the participants had not been burned out, had been burned out, or had been severely burned out at the time of the survey. Continuous variables were analysed using the t-test for independent and paired samples or the Mann-Whitney U test for independent samples and Wilcoxon's rank test for paired samples. The Cochran–Armitage test was used to identify any trends in the data. All statistical analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA) and STATA 11 (STATA Corp., College Station, TX, USA) software, all tests were 2-sided, and all values that had a p-value less than 0.05 were considered significant.

As the study design was cross-sectional in nature and use of the odds ratio (OR) often leads to overestimation if the baseline prevalence of an outcome is common,^{20 21} a multivariate generalized linear model with the link of complementary log–log with binomial family (complementary log–log regression)^{22 23} was used to identify demographic and professional characteristics associated with burnout. In this model, burnout was considered the primary outcome and a dichotomized variable and other demographic and practice pattern variables were considered potential predictors of burnout. Age and sex were considered potential

confounders, and adjustment was accordingly conducted for all analyses. Determinants of hours worked and slept were analysed by multivariate linear regression. Forward selection using the Bayesian information criterion (BIC) was used to select the best predictors. Observations from the missing data in the survey questionnaire were not incorporated in this study. The interaction (effect modification) between predictors was determined by evaluating whether the interaction terms were significant.

Results

Burnout among Japanese physicians working in stroke care

Figure 1 shows the process used to select the study participants. Of a total of 11,211 board-certified neurosurgeons and neurologists practicing in any prefecture excluding the three prefectures affected by the Tohoku earthquake ($n = 469$), 2,724 (25.3%) returned the survey. Among these, 2,635 (97.0%) completed the questionnaire appropriately for analysis of their responses. After excluding 71 (2.7%) physicians who reported that they were not working actively in the field of stroke care, a total of 2,564 physicians remained for analysis. At the time that they completed this survey, the study population had been in practice for a mean of 21.7 years, worked a mean of 66.3 hours per week, were on duty a mean of 2.91 nights per month, and received a mean of 2.00 after-hours calls per week. Among these 2,564 physicians 1,525 (59.4%) were employed at 578 teaching hospitals or comprehensive stroke

centres that were participating in a survey of comprehensive stroke centres as part of the J-ASPECT study group. As 3,757 physicians were working at institutes participating in the J-ASPECT study in March 2011, the average response rate among active stroke-care centre physicians was estimated at 40.6%. Other relevant personal characteristics regarding the study population are summarized in Table 1.

Review of the participants' MBI-GI scores indicates that 41.1% (N = 1,055) of the study population was burned out and 21.8% (N = 560) was severely burned out at the time of the survey (Figure 2). Consideration of the scores of the study population as representative of the population of Japanese physicians working in stroke care and comparison of their scores with the MBI-GS scores of 2,843 office workers (2339 male and 501 female) and 751 civil servants (375 male and 374 female) indicates that the prevalence of burnout and severe burnout among stroke care physicians (41.1% and 21.8%, respectively) is significantly higher than that among civil servants (28.8%, $p < 0.001$ and 17.8%, $p = 0.0268$, respectively) and office workers (27.1%, $p < 0.001$ and 12.2%, $p = 0.004$, respectively). Further analysis of the study population's mental health scores indicated that 58% had mild symptoms of depression and 26.6% had symptoms of severe depression according to MH-5 criteria. Analysis of these mental health scores indicated that 27.8% had a mental quality of life (QOL) score more than 1 standard deviation below the population norm

Relationship between burnout and workload, sleep duration, and work experience

Analysis of the scores indicated that the number of hours worked per week is positively associated with burnout severity, with the mean number of hours worked per week by physicians who were not burned out, burned out, and severely burned out found to be 64.3, 69.9, and 72.4 hours, respectively. Analysis of these data indicates that physicians who are burned out work a significantly greater number of hours per week compared to those who are not burned out ($p < 0.001$). In contrast, analysis of the data also indicates that sleep duration is inversely associated with burnout. Specifically, physicians who were not burned out, burned out, and severely burned out were found to sleep a mean of 6.07, 5.74, and 5.62 hours per night, respectively, indicating that the severity of burnout increases significantly as the number of hours slept per night decreases (p for trend < 0.001). Likewise, number of years of experience was found to be inversely associated with severity of burnout. Specifically, physicians who were not burned out, burned out, and severely burned out were found to have worked a mean of 22.6, 20.1, and 19.6 years, respectively, indicating that the severity of burnout significantly increases as the number of years of experience decreases (p for trend < 0.001 ; Table 1).

Thus, the study results indicate that a relatively greater workload per week, shorter sleep duration per night, and briefer work experience are all associated with increased prevalence of burnout and burnout severity. As shown in Figure 3a, which stratifies the data according to quartiles, the prevalence of burnout among the physicians in the 1st to 4th quartile of number

of hours worked per week was found to be 32.3%, 37.1%, 48.8%, and 53.6%, respectively. Analysis of these data indicates that the trend of increasing prevalence of burnout with an increasing number of hours worked per week is statistically significant ($p < 0.001$). Confirming this trend, the age-and-sex-adjusted prevalence ratio (PR) for burnout was found to increase as the number of hours worked per week increases, with the risk for physicians in the 4th quartile for number of hours worked (over 90 hours/week) approximately 2.1 times greater than that for those in the 1st quartile (40–55 hours/week; PR = 2.14; 95% confidence interval [CI], 1.69 to 2.71, $p < 0.001$). In contrast, the age-and-sex-adjusted PR for burnout was found to increase as the number of hours slept per night decreased, with the percentage of burnout among physicians in 1st to 4th quartiles of sleep duration found to be 55.6%, 38.1%, 31.7%, and 32.4%, respectively (p for trend < 0.001). As shown in Figure 3b, the prevalence of burnout among physicians in the 4th quartile of number of hours slept per night (6.7–9 hours/night) was approximately 48% lower than that of physicians in the 1st quartile (3–5 hours/night; PR = 0.52; 95% CI, 0.43 to 0.63, $p < 0.001$). Likewise, the prevalence of burnout was found to be inversely associated with number of years of experience. As shown in Figure 3c, the prevalence of burnout among physicians in 4th quartile (more than 40 years of experience), which was found to be 18.7%, was approximately 78% lower than that of physicians in the 1st quartile (less than 10 years of experience), which was found to be 52.3% (PR = 0.22; 95% CI, 0.13 to 0.38, $p < 0.001$). In accordance, the prevalence of burnout

among physicians in the 2nd quartile (30–39 years of experience) was found to be 31.6%, a prevalence between that of the 1st and 4th quartiles (PR = 0.49; 95% CI, 0.37 to 0.65, $p < 0.001$). Further analysis indicates that number of hours worked per week and the number of hours slept per night are both inversely associated with the number of years of experience (Appendix Table 1) and that these associations hold for both burned-out and severely burned-out physicians (Appendix Figure 1).

Other significant predictors of burnout

Other personal and professional variables found to be significantly related to the prevalence of burnout are number of holidays per week, number of on-duty nights per month, number of after-hours calls per week, number of t-PA cases treated per year, percentage of time spent providing stroke care, and number of patients under charge (Table 1). The results of complementary log–log regression analysis adjusted for age and sex also revealed that the factors associated with workload include number of holidays per week, number of on-duty nights per month, number of after-hours calls per week, number of t-PA cases treated per year, and number of patients under charge (Figure 4a).

Figure 4b shows the predictors that remained in the final prediction model for burnout after performing forward selection using the BIC. These predictors are number of hours worked per week (PR = 1.08/10 incremental hours; 95% CI, 1.03 to 1.13), number of hours slept per

night (PR = 0.86; 95% CI, 0.80 to 0.93), number of holidays per week (PR = 0.86; 95% CI, 0.80 to 0.93), number of after-hours calls per week (PR = 1.20/10 incremental calls; 95% CI, 1.02 to 1.40), number of years of experience (PR = 0.90/10 incremental years; 95% CI, 0.83 to 0.98), number of patients under charge (PR = 1.13/10 incremental patients; 95% CI 1.02 to 1.35), and income (PR = 0.97/1 million incremental Yen, approximately 9,350 Euro; 95% CI, 0.96 to 0.99). For neurosurgeons, the number of t-PA cases treated per year was also found to increase the risk of burnout by 15% (PR = 1.15/5 incremental treatments; 95% CI, 1.03 to 1.29). The significant predictors shown in Figure 4b, number of hours slept, number of holidays, income and hours worked were also found to be significant (Figure 4c). Furthermore, these associations were found to be robust such that they held when stricter criteria for burnout were applied to the model (Appendix Tables 2 and 3).

Determinants of workload and sleep duration

Table 2 shows the results of multivariate linear regression analysis to identify the predictors of number of hours worked per week and slept per night. As can be observed, the number of hours worked per week was found to be proportional to the number of night shifts worked per week ($\beta = 1.12$, $p < 0.001$), number of extra after-hours calls per week ($\beta = 0.97$, $p < 0.001$), number of t-PA cases per year ($\beta = 0.60$, $p < 0.001$) but inversely proportional to female sex ($\beta = -7.05$, $p < 0.001$) and number of years of experience ($\beta = -0.31$, $p < 0.001$). Moreover, number of hours slept per night was found to be inversely proportional to number of hours

worked per week ($\beta = -0.018$, $p < 0.001$) and numbers of after-hours calls per week ($\beta = -0.027$, $p < 0.001$).

For neurosurgeons, the number of hours worked per week was also found to be proportional to both the number of emergency operations performed per year ($\beta = 2.02$, $p = 0.002$) and the number of stroke-related operations performed per year ($\beta = 1.41$, $p = 0.002$). The number of hours slept per night was again found to be proportional to the number of hours worked per week and the numbers of after-hour calls per week. No interaction term between predictors in GLM model showed statistical significance.

Discussion

This nation-wide survey of Japanese physicians working in stroke care produced several significant findings regarding this population that have important implications for health care. Specifically, the findings indicate that this population (1) experiences burnout at a rate considerably higher than that of the general population of Japanese workers and (2) tends to experience a low QOL and symptoms of depression. The findings also indicate that among the physicians in this population, those who work relatively more hours per week, sleep fewer hours per night, have fewer holidays per week, and have fewer years of experience are at greater risk of burnout. In addition, factors associated with off-schedule work, such as number of night shifts per week, number of after-hours calls per week, and number of

emergency cases treated (number of t-PA cases treated and emergency and stroke-related operations performed) per year were found to be directly related to the number of hours worked per week and indirectly related to prevalence of burnout.

The primary hypothesis examined in this study is that the most important risk factor for burnout among physicians working in stroke care is heavy workload, more specifically working an excessive number of hours per week. Whereas the mean number of hours worked per week by the study population was 66.3 hours, the mean number of hours worked by the general Japanese population was 45.8 hours in 2010,²⁴ with only 12% of non-agricultural employees working a mean of 60 or more hours per week.²⁵ These findings accord with previous research demonstrating that working an excessive number of hours is a risk factor for burnout¹ and fatigue.²⁶ As the study participants work considerably more hours per week than the general population, they are at greater risk of burnout, as shown in Figure 2, which clearly illustrates the trend of increased rates of burnout among the study population with increases in the number of working hours. Thus, working a decreased number of hours worked per week, which has been associated with higher job satisfaction among physicians,²⁷ may prevent burnout.

As the results of all analyses indicated that number of hours worked per week is a strong and robust predictor, it can be concluded that the difference in the number of working hours per week between the study population and the general population of workers largely

explains the difference in their rates of burnout. While this association between high rates of burnout and long working hours accords with a study of U.S physicians² and U.S surgeons,^{2,3} neither of these studies investigated the factors quantitatively by performing stratification by quartile. Other previous studies focused on the prevalence of burnout itself or the psychosocial background of the participants²⁸⁻³⁰ rather than the relationship between burnout and number of working hours, sleep duration, and risk factors related to specific practice patterns.

The results of the present study also indicate that sleep duration is strongly associated with burnout, with number of hours slept per night found to be a robust estimator of burnout in all analyses performed. Burnout has been associated with generally poor sleep as well as increased daytime sleepiness and fatigue,³¹ with the polysomnography results of burned-out patients observed to indicate pronounced sleepiness and mental fatigue.³² One prospective study reported that insomnia increased emotional exhaustion 3-fold,³³ while another study identified a higher prevalence of depressive disorder among patients who slept relatively few hours.³⁴ As the physicians in this study slept a mean of 5.94 hours per night, it is unsurprising that approximately 2/3 were found to have symptoms of mild depression. As shown in Table 2, relatively short sleep duration was also found to be related to relatively long working hours. Among physicians, working long hours in addition to taking frequent after-hours calls may decrease sleep duration and cause sleep fragmentation, increasing the risk of burnout. Thus,

sleep duration is another important and potential modifiable factor to consider in the prevention of burnout.

Interventions aimed at reducing working hours and increasing sleep duration have been found to reduce the prevalence of burnout among physicians. One intervention that limited the number of hours scheduled for interns working in the ICU was found to significantly reduce working hours, increase sleep duration and reduce medical errors by more than 50%.³⁵

Although one trial study that limited the number of hours for residents to 80 per week³⁶ found no reduction in the prevalence of burnout, 80 hours is an excessive number of hours, and trial studies further limiting the number of working hours should therefore be conducted.

Interestingly, providing sabbaticals to nurses has been found to be cost effective to reduce burnout among nurses, and should be considered for physicians.³⁷ All the findings indicate that the Japanese Government should set national policies aiming to reduce fatigue and sleepiness to treat burnout among physicians working in stroke care. We need prospective study of stroke-care physicians with less than 10 years of experience, who are at higher risk of burnout; examining the means of reducing physician workload to reduce burnout, such as by developing and examining programs whereby physicians work together in the comprehensive stroke centers. Effect on quality of care for stroke patients also should be examined.

This study had several strengths that contributed to the reliability and validity of the findings

and allows it to contribute to the medical literature. First, it was the first large study to show an association between physician burnout and workload in Asian countries. As the rate of burnout among the physicians in this study was found to be similar to that among physicians in western countries,^{2 3 38 39} burnout appears to be a common phenomenon among physicians in both the East and the West. Second, this study confirmed the results of the study by Shanafelt et al., the first study to identify a higher prevalence of burnout among physicians compared to the general population of Japanese workers,² by validating their results in a different population. Specifically, whereas the response rate (26.7%) and sample size (N = 3,442) of their study were similar to those of this study, Shanafelt et al. focused on the entire population of physicians while this study focused on physicians within one specialty. As such, this study was unique in allowing for analysis of specific practice patterns among a specific population.

Third, this study examined a sufficiently large sample of physicians with a homogenous training and practice background and varying workloads. In contrast, most previous studies were conducted in a single centre using a sample size insufficiently large to identify an association between burnout and workload,^{40 41} with even studies using a relatively large sample identifying no association.³⁸ However, these findings may be attributed to the fact that all of the participants in these studies worked relatively long hours, preventing comparison of the impact of workload among them. By examining a sufficiently large sample of physicians

with a homogenous training and practice background but with varying workloads, this study was able to identify clear associations among workload, sleep duration and burnout. This certified the generalizability of our work for Japanese stroke care physicians.

Fourth, to the best of our knowledge, this was the first study to examine and identify a relationship between physician burnout and factors related to off-hour workload and emergency treatment of stroke cases. As shown in Table 2, the number of hours worked per week was found to be proportional to the off-hour-related factors of number of nightshifts worked per week and number of after-hours calls per week, as well as the emergency-treatment-related factors of number of t-PA cases treated and number of emergency and stroke operations performed per year. These findings suggest that providing emergency and off-hour care to stroke patients is directly related to workload and sleep duration, and thus indirectly related to burnout. In accordance with these findings, the burden of being responsible for emergency admission has been associated with feelings of being ‘overwhelmed’,⁴² and physicians working in emergency medicine have been found to experience the highest rate of burnout among all U.S physicians.²

Fifth, this study used a stricter set of criteria termed ‘exhaustion+1’, which is considered more appropriate for assessment of burnout than those used in past studies. The predictors of burnout in conventional criteria for burnout is robustly predicted the more severe burnout status. This certified that the predictors of burnout in our study have strong and robust

association with burnout, even when different burnout criteria were applied for the diagnosis.

Sixth, compared to the use of the OR in previous studies, the use of the PR by GLM analysis in this study provided for a more conservative estimation of values and greater support that the results are robust.

Finally, this study demonstrated that the prevalence of burnout is inversely associated with the number of years of experience, as had several previous studies,²³ as well as the number of hours slept per night. This phenomenon is likely due to the fact that promotion to an administrative position after acquiring a certain number of years of experience leads to a decreased clinical workload (Appendix Table 1). Appendix Figure 2 summarizes all of the associations identified among workload, sleep duration, practice patterns, and burnout in this study.

Despite these strengths, this study also faced several limitations. First, this study used a cross-sectional design, and was thus unable to determine the existence of any direct causal relationships. Thus, future studies should employ a prospective longitudinal design to confirm the relationships identified between off-work-related factors and sleep duration among physicians providing stroke care. Second, the percentage of female physicians examined in this study was smaller than that of the general population of female physicians in Japan, which was 18.9% of all physicians in 2010.³³ Therefore, the findings may not be generalizable to female physicians. Nevertheless, no differences were observed between the