Risks and Causes of Hospitalizations among Physicians in Taiwan

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Objectives. To assess the causes and cause-specific risks of hospitalization among physicians in Taiwan.

Data Source. The data used in this study were retrieved from filed claims and registries of the National Health Insurance Research Database. A cohort of 33,380 physicians contracted with the national insurance program between 1997 and 2002 were linked to the information on the inpatient claim data for hospitalization.

Study Design. The physicians' incidence density of hospitalization was compared with that of the general population, other health personnel, and nurses to compute the calendar year-, age-, and gender-standardized hospitalization ratios (SHRs). A multivariate log-linear model was also used to assess the effects of gender, age, type of contract, and specialty on the risks of hospitalization.

Principal Findings. Compared with the general population, physicians experienced significantly reduced risks of all causes (SHR = 54.5, 95 percent confidence interval [CI] 53.4–55.5) and all major cause-specific hospitalizations, especially mental disorders (SHR = 6.9, 95 percent CI 5.8–8.4). On the other hand, compared with other health personnel, physicians had a small but significantly higher risk of all causes of hospitalization (SHR = 107.8, 95 percent CI 105.1–110.6). Higher risks of hospitalization were also noted for neoplasms (SHR = 108.9, 95 percent CI 102.0–116.3) and diseases of the respiratory system (SHR = 114.2, 95 percent CI 107.3–121.5). In addition to the above diagnoses, physicians also had significantly higher risks for genitourinary and musculoskeletal system and connective tissue problems than nurses. Compared with their physician colleagues, female physicians, young (<30 years) and older (≥ 60 years) physicians, and those working with the health institutions and programs were at elevated risks of hospitalization for all causes as well as for certain specific diseases.

Conclusions. Physicians in Taiwan are at higher risks of developing specific diseases compared with their allied health colleagues. As the health of physicians is vital to the quality of care, Taiwanese health policy analysts should recognize that increased patient volume and satisfaction with public health care should not be achieved at the expense of physicians' health.

Key Words. Cohort studies, physician, hospitalization, respiratory disease, neoplasms

The health of physicians is vital to the quality of care. Since Duffy and Litin (1964) found in 1964 an elevated risk of psychiatric disorders for physicians, the health among physicians has frequently raised attention, including not only psychological (Stavem, Hofoss, and Aasland 2003) but also physical (Sundquist and Johansson 1999; Stavem et al. 2001) health problems. For a long time, there has been mounting recognition of the fact that practicing medicine can seriously impact a physician's health (Sutherland and Cooper 1993; Caplan 1994; Silvester, Allen, and Withey 1994; Fish and Steinert 1995; Spurgeon, Barwell, and Maxwell 1995). In addition, physicians' heavy workloads might jeopardize the quality of care. It has been reported that higher risks of medical errors (Landrigan et al. 2004), adverse events, and attentional failures (Barger et al. 2006) were observed among interns with frequent extended-duration shifts. Moreover, it is not uncommon for physicians to be reluctant to seek health care from their colleagues through the usual mechanisms. Consequently, physicians may tend to work through illnesses and inappropriately care for themselves, resulting in late presentation with serious illnesses (McKevitt et al. 1997; Clarke, O'Sullivan, and Maguire 1998; Thompson et al. 2001).

Since the launch of the National Health Insurance (NHI) program in 1994, the health services industry in Taiwan has changed dramatically. Universal health insurance removed barriers to health care for those newly insured, enabling them more equal access to health care (Cheng and Chiang 1997; Lu and Hsiao 2003). By the end of 2004, more than 98 percent of the Taiwanese people were covered by the insurance program (Division of Health Statistics 2003). Because of the increased demand for health care, the health professionals have encountered heavy workload strains and greater psychosocial demands (Lin, Chang, and Tsai 2004). Taiwanese physicians may experience higher workloads than physicians of Western nations. The number of physicians per 1,000 people in Taiwan was 2.0 in 2003 (Division of Health Statistics 2004), much less than the figures of most nations of the Organization for Economic Cooperation and Development (OECD). Except for Korea, Mexico, and Turkey, which have had fewer than 2 physicians per 1,000 people, the other 27 OECD nations have 2.1 (Japan and Canada) to 4.4 (Greece)

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physicians (OECD Health Data 2005). Moreover, the provision of universal health care coverage has increased the health care demand (Lu and Hsiao 2003). For example, the number of outpatient visit per person increased from 7.89 in 1992 to 11.46 in 2003 (Department of Health 2003). The annual number of outpatient visits per physician in Taiwan increased to 8,807 in 2003, from only 6,621 in 1992 (Division of Health Statistics 2004), suggesting an increasing heavy workload for physicians in Taiwan.

Despite acknowledging the heavy workload among physicians in Taiwan, there are limited studies concerning their health status. Two recent surveys investigated the quality of life of physicians in Taiwan (Lin, Chang, and Tsai 2004; Lee et al. 2005). Based on Karasek's job demand-control model (Karasek et al. 1998), Lin, Chang, and Tsai (2004) reported that approximately 10 percent of the physicians practicing at a medical center in central Taiwan have high-strain jobs. This high-strain group reported a significantly lower quality of life, especially on the psychological scale, compared with the low-strain group. In another study, Lee et al. (2005) reported an inverse relationship between the level of job stress and quality of life among physicians at primary health care centers across the nation. In the present study, we further used the national insurance claim data to examine the risks and causes of hospitalization among physicians in Taiwan.

METHODS

Data analyzed in this study were retrieved from several claim files of the National Health Insurance Research Database (NHIRD) provided by the Bureau of National Health Insurance (BNHI), Department of Health, and managed by the National Health Research Institutes (NHRI). The universal NHI program was implemented in Taiwan in March 1995. By the end of 1996, 96 percent of the total population in Taiwan had enrolled in the program (Lu and Hsiao 2003) and the Bureau of NHI contracts with 97 percent of hospitals and 90 percent of clinics across the nation (Chiang 1997). The NHIRD has accumulated eight different registries and eight claims files reported from all contracted hospitals and clinics. Details of both the registry and claims files are described elsewhere (NHRI 2006). To ensure the accuracy of the claims files, the BNHI performs an expert review on random samples of every 50–100 ambulatory and inpatient claims quarterly in all hospitals and clinics (BNHI 2006), and false reports of diagnoses are punished by severe penalties from the BNHI (Tseng 2004; BNHI 2006). With the approval of the NHRI, we used the

registry for health personnel (1997–2002), all inpatient claims (1997–2002), and an updated registry of beneficiaries (1997–2002) in this study. The datasets used in this study can be interlinked by the unique scrambled individual's personal identification number (PIN). Access to the NHIRD was approved by both the NHRI and the Fu-Jen Catholic University Ethics Review Board.

The registry of health personnel covers information on demographic and work characteristics as well as on the contract status with the NHI of various health professionals including physicians, physicians of Chinese medicine, dentists, pharmacists, nurses, medical laboratory technicians, and physical and occupational therapists. In total, 133,977 health personnel had contracts with the NHI between 1997 and 2002, among whom 33,380 were practicing physicians. For each physician, we linked his/her PIN to the inpatient claim data to retrieve information on episodes of hospitalization. A linkage was considered to be successful only if the date of hospitalization was within the contract period. We excluded hospitalizations due to normal delivery and other indications of pregnancy, labor, and delivery (International Classification of Diseases 9th Revision, Clinical Modification [ICD-9-CM]: 650–659). This study cohort of physicians developed a total of 9,896 hospitalization episodes with various diagnoses in the period of 1997–2002.

We performed both external and internal comparisons to assess physicians' risks of hospitalization for all causes as well as seven major disease categories including neoplasms (ICD-9-CM: 140–239); endocrine, nutritional, and metabolic disease and immunity disorders (ICD-9-CM: 240–279); mental disorders (ICD-9-CM: 290–319); diseases of the circulatory system (ICD-9-CM: 390–459); diseases of the respiratory system (ICD-9-CM: 460–519); diseases of the genitourinary system (ICD-9-CM: 580–629); and diseases of the musculoskeletal system and connective tissue (ICD-9-CM: 710–739). For external comparisons, the expected number of hospitalization for physicians was calculated from the person-year approach, using the age (5-year intervals) and sex-specific annual rates of hospitalization with reference to the general population. Information regarding the hospitalization, and the registry for beneficiaries and inpatient claim data, were retrieved for both the physicians and the general population from the NHI program between 1997 and 2002. Standardized hospitalization ratios (SHRs) were calculated by dividing the observed number of hospitalizations by the expected number. The annual average size of the general population over the study period was 15,586,025.

There were two analytical strategies for internal comparisons. First, we replaced the general population with all health personnel excluding physicians ($N = 100,597$) or with nurses only ($N = 61,466$), and then adopted the same statistical approach that was used for the external comparisons. Second, we limited the analyses to only physicians and examined the independent effects of gender, age, type of contract, and specialty on the risk of hospitalization among physicians. In the second part, a log-linear model with the natural logarithm of the incidence density as the dependent variable was used to fit grouped data from the two genders, five age groups (< 30 , $30-39$, $40-49$, $50-59$, and ≥ 60 years), two types of contracts, and seven different specialties. The log-linear model was fitted with a standard Poisson distribution assumption (Holford 1983). The analyses were performed using EGRET[®] (Cytel Software Corporation, Cambridge, MA), and significance was accepted at an α -value of 0.05.

RESULTS

There were 29,702 male and 3,678 female physicians included in this study, representing 89.0 and 11.0 percent, respectively, of the study cohort (Table 1). The mean age of the study cohort was 41.0 years with a standard deviation of 13.7 years. More than half (56.6 percent) of the physicians were aged 30–49 years, while those of younger (< 30 years) and older ages (≥ 60 years) accounted for 23.4 and 12.0 percent of the cohort, respectively. Approximately 1/4 of the physicians were community practitioners, and the rest were hospital physicians (including hospital specialists, residents, and practicing physicians with contracts with certain health programs such as primary health care programs and occupational medicine programs). Nearly the same numbers of physicians worked at medical centers (32.1 percent) and clinics (31.0 percent), and 21.1 and 15.7 percent of the physicians worked at regional and local community hospitals, respectively. Additionally, nearly 20 percent of the physicians in Taiwan practiced internal medicine. Other major specialties, including family medicine, surgery, obstetrics and gynecology, pediatrics, and ear/nose/throat, accounted for another 51.7 percent of physicians.

Table 2 shows all causes and disease-specific SHRs. As compared with the general population, physicians experienced significantly reduced SHRs for all causes of hospitalization (SHR 54.5, 95 percent CI 53.4–55.5) as well as for all diseases of interest, with the lowest SHR of 6.9, (95 percent CI 5.8–8.4)

Table 1: Demographic Characteristics of the Studied Physician Cohort in Taiwan

<i>Characteristic</i>	<i>n</i>	<i>%</i>
Gender		
Male	29,702	89.0
Female	3,678	11.0
Age (years)		
<30	7,815	23.4
30–39	11,804	35.4
40–49	7,072	21.2
50–59	2,682	8.0
≥ 60	4,007	12.0
Mean (SD)	41.0	(13.7)
Type of employment		
Community practitioner	8,813	26.4
Hospital physician	24,567	73.6
Workplace		
Medical center	10,710	32.1
Regional hospital	7,056	21.1
Local community hospital	5,254	15.7
Community clinic	10,360	31.0
Specialty		
Internal medicine	6,576	19.7
Family medicine	4,740	14.2
Surgery	4,406	13.2
Obstetrics and gynecology	3,204	9.6
Pediatrics	3,038	9.1
Ear, nose, and throat	1,869	5.6
Other	9,547	28.6
Total	33,380	100.0

for mental disorders and the highest SHR of 92.6 (95 percent CI 87.4–98.2) for neoplasms. When endocrine, nutritional, and metabolic diseases and immunity disorders were excluded, physicians no longer had reduced risks of hospitalization for all causes and specific causes as compared with the other health personnel as a whole (Table 3).

When compared with other health personnel as a whole, physicians had a small but significant excess risk of all causes of hospitalization (SHR 107.8, 95 percent CI 105.1–110.6) (Table 3). Higher risks of hospitalization were also observed for neoplasms (SHR 108.9, 95 percent CI 102.0–116.3) and diseases of the respiratory system (SHR 114.2, 95 percent CI 107.3–121.5). Table 3 also shows physicians' cause-specific SHRs relative to those of nurses, a cohort representing a large part of the workforce in hospitals and having a number of

Table 2: All Causes and Disease-Specific Standardized Hospitalization Ratios (SHRs) among Physicians in Taiwan as Referenced to the General Population

<i>Diagnosis of Disorder*</i>	<i>Number of Hospitalizations</i>		<i>SHR (%)[†]</i>	
	<i>Observed</i>	<i>Expected</i>	<i>Estimated</i>	<i>95% CI</i>
All causes	9,896	18,171	54.5	53.4–55.5
Neoplasms (140–239)	1,142	1,233	92.6	87.4–98.2
Endocrine, nutritional, and metabolic disease and immunity disorders (240–279)	181	505	35.8	31.0–41.5
Mental disorders (290–319)	110	1,585	6.9	5.8–8.4
Circulatory system (390–459)	1,413	1,995	70.8	67.2–74.6
Respiratory system (460–519)	1,022	1,832	55.8	52.5–59.3
Genitourinary system (580–629)	866	1,421	60.9	57.0–65.1
Musculoskeletal system and connective tissue (710–739)	406	824	49.3	44.7–54.3

Note:

*Numbers in parenthesis are the International Classification of Diseases 9th Revision, Clinical Modification (ICD-9-CM) codes.

[†]Age, gender, and calendar year-standardized hospitalization ratio in percent.

CI, confidence interval.

similar stresses. A significantly increased SHR was observed not only for all causes of hospitalizations (SHR 110.2, 95 percent CI 108.7–111.6) but also for neoplasms (SHR 106.5), and diseases of the respiratory system (SHR 119.8), genitourinary system (SHR 105.5), and musculoskeletal system and connective tissue (SHR 114.4).

Risks of hospitalization were quite homogeneous among physicians irrespective of their specialties. However, hospital physicians had a slightly higher risk of overall hospitalization compared with community practitioners (with an incidence density ratio [IDR] of 1.2, 95 percent CI 1.1–1.3), which was largely due to higher risks of respiratory (IDR 1.5, 95 percent CI 1.2–1.8) and genitourinary diseases (IDR 1.4, 95 percent CI 1.4–1.7) (Table 4). Additionally, the age-specific risk of hospitalization tended to be U-shaped in that physicians aged between 30 and 59 were at reduced risks of overall and most cause-specific hospitalizations as compared with younger (<30 years old) and older (≥ 60 years old) physicians. We also noted that female physicians were 2.2 times (95 percent CI 2.2–2.5) more likely to be hospitalized due to all causes than their male counterparts. Particularly higher risks

Table 3: All Causes and Disease-Specific Standardized Hospitalization Ratios (SHRs) among Physicians in Taiwan as Referenced to Other Medical Personnel and Nurses

<i>Diagnosis of Disorder*</i>	<i>Referenced to Other Medical Personnel</i>			<i>Referenced to Nurses</i>		
	<i>Expected No. of Hospital- izations</i>	<i>SHR[†] Estimate</i>	<i>95% Confidence Interval</i>	<i>Expected No. of Hospital- izations</i>	<i>SHR[†] Estimate</i>	<i>95% Confidence Interval</i>
All causes	9,179	107.8	105.1–110.6	19,647	110.2	108.7–111.6
Neoplasms (140–239)	1,049	108.9	102.0–116.3	1,584	106.5	101.5–111.7
Endocrine, nutritional, and metabolic disease and immunity disorders (240–279)	225	80.5	69.5–93.1	410	70.5	62.9–79.2
Mental disorders (290–319)	125	88.3	73.2–106.5	218	94.4	82.4–108.3
Circulatory system (390–459)	1,358	104.1	98.8–109.7	1,603	102.2	97.4–107.3
Respiratory system (460–519)	895	114.2	107.3–121.5	1,632	119.8	114.6–125.2
Genitourinary system (580–629)	869	99.7	93.3–106.5	1,665	105.5	100.7–110.5
Musculoskeletal system and connective tissue (710–739)	380	106.8	97.0–117.6	650	114.4	106.5–122.9

Notes: *Numbers in parenthesis are the International Classification of Diseases 9th Revision, Clinical Modification (ICD-9-CM) codes.

[†]Age, gender, and calendar year-SHRs in percent.

for female physicians included cancer (IDR 2.0, 95 percent CI 1.6–2.5); endocrine, nutritional, and metabolic diseases and immunity disorders (IDR 2.5, 95 percent CI 1.3–4.7); and genitourinary diseases (IDR 2.1, 95 percent CI 1.6–2.7). Compared with male physicians, however, female physicians had only 1/2 the risk of circulatory diseases (IDR 0.5, 95 percent CI 0.3–0.8) (Table 4).

To further assess the relative risks of female physicians, we performed comparisons between female physicians and other female medical personnel. The age and calendar year SHR showed that female physicians also had a significantly higher overall risk of hospitalization (108.5, 95 percent CI 106.7–110.3) than other female medical personnel. The cause-specific SHRs were also significantly higher for respiratory (108.5, 95 percent CI 106.7–110.3), genitourinary (117.8, 95 percent CI 110.7–125.3), and musculoskeletal system diseases (106.7, 95 percent CI 100.3–113.6), but significantly lower risks existed for endocrine, nutritional, and metabolic diseases and immunity disorders (117.7, 95 percent CI 106.3–130.4) (data not shown in table).

Table 4: Disease-Specific Incidence Density Ratio of Hospitalizations in Relation to Gender, Age, Type of Contract, and Specialty among Physicians in Taiwan

	Diagnosis and ICD-9 CM Codes							
	All Causes	Neoplasms (140-239)	Metabolic (240-279)	Mental (290-319)	Circulatory (390-459)	Respiratory (460-519)	Genitourinary (580-629)	Musculoskeletal (710-739)
Gender								
Male	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Female	2.2 (2.2-2.6)*	2.0 (1.6-2.5)	2.5 (1.3-4.7)	1.2 (0.5-2.7)	0.5 (0.3-0.8)	0.9 (0.6-1.2)	2.1 (1.6-2.7)	1.1 (0.7-1.7)
Age (years)								
< 30	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30-39	0.3 (0.1-0.2)	0.4 (0.2-0.7)	0.2 (0.1-0.4)	0.2 (0.1-0.4)	0.5 (0.2-1.2)	0.2 (0.1-0.4)	0.3 (0.2-0.6)	0.2 (0.1-0.4)
40-49	0.2 (0.1-0.2)	0.5 (0.3-1.1)	0.3 (0.1-0.9)	0.1 (0.1-0.3)	0.6 (0.2-1.4)	0.1 (0.1-0.2)	0.4 (0.2-0.7)	0.2 (0.1-0.4)
50-59	0.4 (0.3-0.4)	1.5 (0.8-3.0)	0.6 (0.2-2.1)	0.1 (0.1-0.3)	1.9 (0.8-4.7)	0.2 (0.1-0.3)	0.5 (0.3-1.0)	0.3 (0.1-0.6)
≥ 60	1.0 (0.9-1.2)	4.1 (2.1-8.1)	1.8 (0.5-6.1)	0.4 (0.2-1.0)	7.1 (2.9-17.3)	0.8 (0.5-1.2)	2.3 (1.3-4.3)	0.8 (0.4-1.6)
Type of contract								
Community practitioner	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hospital physician	1.2 (1.1-1.3)	1.2 (1.0-1.4)	1.0 (0.7-1.6)	1.6 (0.9-2.9)	1.2 (1.0-1.4)	1.5 (1.2-1.8)	1.4 (1.1-1.7)	0.8 (0.6-1.1)
Specialty								
Internal medicine	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Family medicine	1.0 (0.9-1.1)	1.1 (0.9-1.4)	0.7 (0.4-1.5)	0.5 (0.2-1.2)	1.2 (1.0-1.6)	0.8 (0.5-1.0)	0.8 (0.6-1.1)	0.7 (0.4-1.1)
Surgery	1.1 (1.0-1.2)	0.9 (0.7-1.1)	1.0 (0.5-2.0)	0.6 (0.3-1.3)	1.2 (0.9-1.5)	1.2 (0.9-1.5)	1.0 (0.7-1.3)	1.3 (0.9-1.9)
Obstetrics and gynecology	1.0 (0.9-1.1)	1.0 (0.8-1.3)	0.7 (0.3-1.7)	0.5 (0.2-1.4)	0.8 (0.6-1.0)	1.0 (0.8-1.4)	1.1 (0.8-1.6)	1.1 (0.7-1.8)
Pediatrics	1.0 (0.9-1.1)	1.2 (0.9-1.6)	0.9 (0.4-1.9)	0.2 (0.1-1.0)	0.9 (0.7-1.2)	0.7 (0.5-1.0)	0.9 (0.6-1.3)	0.7 (0.4-1.2)
Ear, nose, and throat	0.9 (0.8-1.0)	0.9 (0.6-1.3)	1.1 (0.5-2.9)	0.2 (0.0-1.6)	0.9 (0.6-1.3)	1.1 (0.8-1.6)	1.0 (0.6-1.6)	0.5 (0.2-1.1)
Other specialty	1.0 (0.9-1.1)	0.8 (0.6-1.0)	0.7 (0.4-1.4)	0.9 (0.5-1.6)	1.0 (0.8-1.3)	0.9 (0.8-1.2)	0.8 (0.6-1.1)	1.0 (0.7-1.5)

Notes: *Numbers in parenthesis are the 95% confidence intervals.
ICD-9-CM, International Classification of Diseases 9th Revision, Clinical Modification.

DISCUSSION

Compared with the general population, the physician population in Taiwan experienced substantially reduced risks of hospitalization due to all causes and seven major individual causes. However, compared with other health personnel, physicians were at elevated risks of hospitalization due to all causes, neoplasms, and respiratory diseases, but were still less vulnerable to being hospitalized due to metabolic and immunity disorders. We noted little effects of specialty on the risks of hospitalization among Taiwanese physicians. Nonetheless, we noted that female physicians, younger (< 30 years old) and older (≥ 60 years old) physicians, and those who were employees of health institutions and programs were all at elevated risks of hospitalization for all causes and certain specific diseases.

The accuracy of the diagnostic codes of NHID is critical to the results of this analysis. While the accuracy of diagnostic codes of NHID has not been systematically assessed, a recent validation study that compared patients' self-reports and that of the NHID found an overall rate of concordance of 74.6 percent for diabetes (Lin et al. 2005). Another validity study of claims data performed in a medical center showed that there were high sensitivity and specificity of diabetes and acute myocardial infarction diagnoses (Chou 2003). Moreover, the discharge diagnoses retrieved from inpatient claim files are generally believed to be more valid than diagnostic information of ambulatory care claims data (Lai, Yaung, and Fan 1998). Given the above information, our study did not likely contain serious information bias.

The observed lower risks of hospitalization in physicians than in the general population are consistent with the results from a Norwegian study reporting that the self-perceived health status of Norwegian physicians was as good as or better than that of the general population (Stavem et al. 2001). Additionally, Carpenter, Swerdlow and Fear (1997) examined patterns of cause-specific mortality for hospital consultants and concluded that the consultants had low overall death rates, which were substantially contributed to by the low prevalence rate of smoking, and to a lesser extent by other beneficial health-related behaviors; better access to health care also played a role. The findings from the above studies suggest that physicians have better health consciousness and frequently are early adopters of healthy behaviors based on their knowledge and economic resources. In addition, two other reasons are also likely responsible for such a substantial reduction in risks of physicians.

First, the considerable reduction in the risk of hospitalization for physicians was a likely consequence, at least to some extent, of a healthy worker

effect (Li and Sung 1999), as the present study included only physicians in active practice. Good health is usually required for people to continue employment. Additionally, there is also a tendency for those who develop diseases to leave their jobs (Monson 1987; Ostlin 1989). Thus, physicians who discontinued practicing may have done so because of certain health problems, while physicians actively practicing are generally considered to be healthier than the general population as a whole. Second, in addition to the healthy worker effect, physicians' attitudes toward illness could also be another reason why physicians' risks of hospitalization seemed to have been less emphasized in the present analysis. In a qualitative interview, Thompson et al. (2001) reported that physicians need to portray a healthy image to both patients and colleagues. Moreover, physicians' embarrassment in adopting the role of patient and concerns about confidentiality might impede their access to appropriate health care (Thompson et al. 2001), and thus the true rate of hospitalization among physicians may be underestimated. This is especially true for mental disorders, with the lowest SHR in this study, because physicians are likely to self-regard the psychiatric illness as a personal weakness. Acknowledging psychological illness is extremely difficult among physicians (Thompson et al. 2001).

The results from internal comparisons may have considerably, even though not entirely, removed the healthy worker effect as well as the self-caring effects by physicians described above. As compared with the other health personnel, physicians in Taiwan were at slightly elevated risks of hospitalization due to all causes, neoplasms, and respiratory diseases. Similar findings were observed previously. A study by Carpenter, Swerdlow, and Fear (1997) found few significant excesses of specific cancers for certain specialties. Additionally, Innos et al. (2002) reported that an elevated standardized incidence ratio (SIR) for all cancers was only noted for female physicians (SIR 1.32), and not for males (SIR 0.92). Higher SIRs for female physicians are especially associated with the risks of breast cancer (SIR 2.03) and myeloid leukemia (SIR 3.69). But, both the studies were unable to identify any occupational exposure of physicians linked to cancer risks. Other studies reported that ionizing radiation might cause brain cancer (Wenzl and McDonald 2002) and lymphatic and hematological cancer (Maitre et al. 2003) in physicians. Owing to limited information regarding potential work hazards and adverse health behaviors such as a lack of screening for neoplasia of Taiwanese physicians, we were unable to make explicit interpretations of the study findings.

As for the higher risk of respiratory diseases noted among physicians, we examined the data and found that the leading respiratory cause of

hospitalization was pneumonia, accounting for 22.4 percent (229/1,022) of the total respiratory causes. Acute pharyngitis and tonsillitis accounted for another 16.6 percent of the total causes. Previous studies also reported that most of the respiratory diseases causing hospitalizations among physicians were not smoking-related because of the low prevalence of smoking among physicians (Carpenter, Swerdlow, and Fear 1997; Torre et al. 2005). A recent national survey of over 20,000 participants showed that the ratio of male to female smoking rates was 10.9 to 1 among adults (46.8 /4.3 percent), but 3.6 to 1 among underage teenagers (14.3/4.0 percent). The above data indicate that people in Taiwan have a particularly higher smoking prevalence in males but a much lower prevalence in females as compared with many industrialized nations (Wen et al. 2005). However, to our knowledge, there has been no study that specifically investigated the smoking behavior of physicians in Taiwan. According to health statistics, respiratory diseases have been the leading cause of visits to outpatient clinics in Taiwan in recent years (Division of Health Statistics 2004). In 2003, for example, acute infection of the upper respiratory tract (ICD-9-CM: 460–462, 465) was the leading cause of ambulatory care, accounting for 24.6 percent of all care cases (Division of Health Statistics 2004). Together with all other respiratory diseases, including pneumonia and influenza, diseases of the respiratory system accounted for 33.1 percent of all ambulatory care cases. Physicians are more likely than other health professionals to have a close contact with patients, and are more vulnerable to respiratory disease infection. To assess the above speculation, we performed further comparisons between physicians and nurses as well as between physicians and laboratory technologists for the risks of respiratory disease. The results showed that physicians still had a significantly elevated SHR (119.8, 95 percent CI 114.6–125.2) of respiratory disease compared with nurses, but had a significantly reduced SHR (59.7, 95 percent CI 56.4–63.3) compared with laboratory technologists, who supposedly have less patient contact.

Being a physician is frequently considered to be a profession with high levels of stress (Waldron 1996; Gilliland et al. 1998) and psychological distress (Wall et al. 1997; Appleton, House, and Dowell et al. 1998). Stressful jobs are associated not only with elevated risks of mental disorders but also with adverse effects of diseases of the circulatory system through triggering the release of catecholamines and increased blood pressure, both of which are known risk factors for cardiovascular diseases (Karasek and Theorell 1990). A recent Taiwanese study on employees' health at a medical center also reported that both physicians and nurses apparently had a lower health-related quality of life compared with other health personnel (Lin, Chang, and Tsai 2004).

Despite this, the national data presented here do not show higher risks of mental disorders or circulatory diseases among Taiwanese physicians.

Physicians were also noted to experience significantly reduced risks of hospitalization from metabolic diseases and immunity disorders, which are probably the most highly lifestyle-related symptoms investigated in this study. It has been shown that physicians may use their own professional knowledge and skills and may engage healthier lifestyles in ways that reduce their own risks of adverse health outcomes (Innos et al. 2002). There is no information regarding the lifestyles of health personnel in Taiwan, and so we were unable to confirm or refute the above speculation.

Although the study by Lin, Chang and Tsai (2004) found few effects of age, position, and seniority on the health-related quality of life in health personnel working at a medical center in Taiwan, our study found that the age-specific risk of hospitalization tended to be U-shaped, where young and older physicians were at significantly elevated risks of hospitalization due to all causes and many disease-specific causes. This finding suggests that there are certain health-related hazards of either work or lifestyle, associated with an increased risk for hospitalizations among young physicians in Taiwan, which is worthy of further investigations. On the other hand, the healthy worker effect might have overlooked hospitalization risks of older physicians in such a way that early mortality and retirement for unhealthy physicians may have resulted in a group of relatively healthy physicians still practicing at older ages. Compared with internal medicine, some subspecialties had insignificantly higher cause-specific IDRs. However, no significance could be assigned to those relative risk estimates due to limited numbers of hospitalizations for stratification analyses. The limited numbers of hospitalizations also did not allow further analyses of the relationships between risks of hospitalization and subspecialties.

We noted a 120 percent increase in the hospitalization from all causes among female physicians compared with their male colleagues. Particularly higher risks for female physicians were noted for cancer; endocrine, nutritional, and metabolic diseases and immunity disorders; and genitourinary diseases. A Swedish study comparing the self-reported health status of female and male physicians reported that female physicians were at a higher risk than males for an impaired health status (Sundquist and Johansson 1999). Additionally, large-scale health surveys have suggested that women's morbidity and medical care utilization tend to be higher than men's (Gijsbers van Wijk 1992, 1995). The gynecological and obstetrical diagnoses are accountable for over 40 percent of female morbidities, and more than a quarter of these data

can be explained by prevention and diagnostics. The often-alleged female excess of "vague" or psychosomatic symptoms accounted for less than 20 percent of the overall gender difference (Gijsbers van Wijk et al. 1992). As the female physicians in Taiwan experienced elevated risks of hospitalization for not only all causes but also for several major disease-specific causes, which are not gender-specific, the higher risks of hospitalization among female physicians in Taiwan cannot entirely be explained by gender-specific conditions. Further investigations of health-related hazards among female physicians may allow more-specific interpretations of such gender differences in hospitalization risks.

Owing to limited information regarding specific work habits and lifestyles as well as possible occupationally related hazards, we were unable to make specific interpretations regarding these findings. Additionally, we did not have complete information on the study subjects' history of employment, which also limited causal inferences between one's profession and the risk of hospitalization. Nonetheless, with such a large physician cohort and multiple control groups, we can point out that physicians in Taiwan are indeed at greater hospitalization risks from cancer and respiratory diseases. Future studies should explore the specific hazards, either work or lifestyle related, that contribute to such elevated risks in order to take appropriate preventive measures and improve the health of physicians. Additionally, whether the findings noted in this study are region specific or common to other places also deserves further investigation.

The results from this analysis have two health policy implications. First, under the NHI, Taiwanese have more equal access to health care (Lu and Hsiao 2003), resulting in an increase in workload for physicians and health care demands by the Taiwanese people. This analysis suggested that physicians in Taiwan have greater risks of certain diseases than the other health workforces. Given that the NHI consistently receives a 70 percent satisfactory rate by the public (Lu and Hsiao 2003), Taiwanese health policy analysts should clearly recognize that increased patient volume and the public satisfactory rate of health care should not be achieved at the expense of physicians' health, which is very critical to the quality of patient care. Unfortunately, no national measures or preventive guidelines have been implemented by the Taiwanese government to reduce work-related strains on physicians. Second, this analysis noted a very low rate of hospitalization for physicians compared with the general population. It is likely that physicians possibly engage in healthier behaviors, live healthier lifestyles, and take more preventive measures to avoid the occurrence of disease. However, the possibility that many physi-

cians might work through illness, inappropriately self-care for themselves, or even purposely hide their diseases should not be completely excluded. If physicians with certain health problems choose to continue their practice, they could jeopardize patient safety. When engaged in surgery and other treatments, physicians with a major medical condition could cause serious medical errors and harm, or even the death of patients. Consequently, policy makers and hospital administrators must not overlook physicians' potentially unseen health problems. Two measures likely need to be considered: first, the hospital is obligated to provide sick compensations and necessary care to the physician for recuperation from the illness. Second, because a physician's health is highly related to the quality and safety of patient care, a mandatory periodical physical examination for physicians must seriously be considered.

ACKNOWLEDGMENTS

This study was supported by a grant (NSC-93-2320-B030-006) from the National Science Council of Taiwan.

Disclaimer: This study is based in part on data from the NHIRD provided by the BNHI, Department of Health, and managed by NHRI. The interpretations and conclusions contained herein do not represent those of the BMHI, Department of Health, or NHRI.

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