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Prevalence of chronic diseases among physicians in Taiwan: a population-based cross-sectional study

Li-Ting Kao,[1,2,3] Yu-Lung Chiu,[1,2,3] Herng-Ching Lin,[3] Hsin-Chien Lee,[4] Shiu-Dong Chung[3,5,6]

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H-CL and S-DC contributed equally.

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For numbered affiliations see end of article.

Correspondence to
Dr Shiu-Dong Chung;
chungshiudong@gmail.com

ABSTRACT

Objectives: The health of physicians is an important topic which needs to be addressed in order to provide the best quality of patient care. However, there are few studies on the prevalence of chronic diseases among physicians. In this study, we explored the prevalence of chronic diseases among physicians and compared the probability of chronic diseases between physicians and the general population using a population-based data set in Taiwan.

Study design: A cross-sectional study.

Setting: Taiwan.

Participants: Our study consisted of 1426 practising physicians and 5704 general participants.

Primary outcome measures: We chose 22 chronic diseases from the Elixhauser Comorbidity index and nine highly prevalent medical conditions in an Asian population for analysis. We used conditional logistic regression analyses to investigate the OR and its corresponding 95% CI of chronic diseases between these two groups.

Results: The conditional logistic regression analyses showed that physicians had lower odds of peripheral vascular disorders (OR=0.41, 95% CI=0.19 to 0.90), uncomplicated diabetes (OR=0.76, 95% CI=0.60 to 0.97), complicated diabetes (OR=0.53, 95% CI=0.34 to 0.83), renal failure (OR=0.41, 95% CI=0.19 to 0.90), liver diseases (OR=0.78, 95% CI=0.66 to 0.94), and hepatitis B or C (OR=0.62, 95% CI=0.49 to 0.77) and higher odds of hypertension (OR=1.21, 95% CI=1.03 to 1.41), hyperlipidaemia (OR=1.43, 95% CI=1.23 to 1.67) and asthma (OR=1.59, 95% CI=1.16 to 2.18) than the general population.

Conclusions: We concluded that although physicians had decreased prevalence of some chronic diseases, they had a significantly increased prevalence of hypertension, hyperlipidaemia and asthma.

Strengths and limitations of this study

- This study used a population-based data set.
- This study had a sufficient sample size to detect statistical significance in the prevalence of comorbidities between physicians and the general population.
- The data set used in this study did not provide information on education, lifestyle or health behaviour of the participants.
- The sampled participants included many different ethnic groups.

INTRODUCTION

Much of the previous literature reported that physicians, who have healthy behaviours or received some preventive practices, were more likely to counsel their patients to have similar health-promoting behaviours or preventive measures.[1–5] This healthy doctor–healthy patient relationship totally highlights the importance of physicians' health, including physical and mental health issues.

However, to date, most studies on physician health focused on mental health. For instance, many questionnaire surveys observed that physicians have a higher prevalence of psychological distress, mental disorders and substance use disorders than those in the general population.[6–9] Another study using records from the USA National Violent Death Reporting System also found that mental illness was an important comorbidity for physicians who were suicide victims.[10] On the other hand, one recent study found that physicians have lower odds of obsessive-compulsive disorder, major depression and specific phobias compared to their counterparts.[11] Therefore, conclusions as to whether physicians have a higher risk of mental illness than the general population remain unclear. Furthermore, nowadays, very few studies have concentrated on the issue of physical health among physicians. To the best of our knowledge, only one Finnish study has shown that the self-reported health status of female physicians was better than that of the general population.[9] Nonetheless, they reported that several chronic diseases including chronic eczema, digestive diseases

and asthma were more prevalent in physicians than in the general population.[9]

Additionally, population-based data regarding the prevalence of chronic diseases among physicians remain sparse. Conclusions based on data collected in referral centres may be limited, due to the relatively small sample size and selection bias of the studies.[7–14] Therefore, this study aimed to explore the prevalence of chronic diseases among physicians in Taiwan using a population-based data set. We also compared risks of chronic diseases among physicians with those for matched controls from the general population. We hypothesised that physicians would have a lower prevalence of some chronic diseases in the physical aspect because physicians have more medical knowledge and better health behaviours than the general population. However, physicians may have increased prevalence of mental illnesses due to the high levels of work-related stress.

MATERIALS AND METHODS

Database

The data for this study were retrieved from the Longitudinal Health Insurance Database 2000 (LHID2000). The LHID2000, derived from Taiwan's Bureau of National Health Insurance (NHI) records, is provided to scientists in Taiwan for research purposes by the Taiwan National Health Research Institute (NHRI). The LHID2000 consists of the registration files and original medical claims for 1 000 000 beneficiaries under the NHI programme. These selected 1 000 000 beneficiaries were randomly sampled from the year 2000 Registry of Beneficiaries (n=23.72 million). The LHID2000 provides an exclusive opportunity for researchers to follow-up the use of all medical services for these 1 000 000 beneficiaries since initiation of the NHI programme in 1995. Numerous researchers have used the data derived from the Taiwan NHI programme to perform and publish their studies.[15 16]

The LHID2000 consists of de-identified secondary data with scrambled identification codes of patients and medical facilities. It is released to the public for research purposes, and so this study was exempted from a full review following consultation with the National Defense Medical Center Institutional Review Board.

Study sample

Our cross-sectional study included a physician group and a comparison group. The physician group was identified by registry for board-certified specialists in the LHID2000. These files included data of physician characteristics, such as age, sex, specialty (family practice, internal medicine, surgery, etc), practice type (hospital-based or office-based), etc. NHRI protected patient confidentiality in LHID2000 by scrambling the identification codes. This study first selected 1508 physicians who were practising medicine between 1 January 2010 and 31 December 2010. In order to better reflect the actual scenario of physicians practising in Taiwan, physicians aged over 80 years (n=82) were excluded from this study. As a result, 1426 physicians were included in the physician group.

The comparison group was defined as the general population in Taiwan. We likewise selected the comparison group from the remaining beneficiaries of the LHID2000. We excluded all beneficiaries who had ever been a practising physician. In addition, we excluded all beneficiaries aged over 80 years. We then randomly selected 5704 beneficiaries (four for every physician) matched with the physician group in terms of sex, age group (25–39, 40–49, 50–59, 60–69, and >69 years) monthly insured salary, geographic location (northern, central, eastern and southern Taiwan) and urbanisation level (five levels, with 1 being the most urbanised and 5 being the least) using the SAS program proc survey select (SAS System for Windows, V.8.2, Cary, North Carolina, USA). Ultimately, there were 7130 sampled participants including 1426 physicians and 5704 comparison participants in this study.

Outcome measures

This study selected 31 chronic diseases for analysis (see online supplementary appendix). Of these chronic diseases, 22 were selected from the Elixhauser Comorbidity Index, and the other nine were selected due to their high prevalence in Taiwan. The Elixhauser Comorbidity Index includes 30 comorbidity measures. Since there were no clear clinical definitions and a low prevalence in Taiwan, we did not choose the following eight diseases from the index for analysis: valvular disease, other neurological disorders, paralysis, weight loss, obesity, coagulopathy, lymphoma and HIV. The nine highly prevalent medical conditions in Taiwan included stroke, ischaemic heart disease, hyperlipidaemia, hepatitis B or C, migraines, Parkinson's disease (PD), systemic lupus erythematosus (SLE), ankylosing spondylitis (AS) and asthma.

Since administrative data sets have been criticised for low validity of diagnoses, this study only counted these 31 chronic diseases if they occurred in an inpatient setting or appeared in two or more ambulatory care claims coded between 2010 and 2012. The ICD-9 CM (International Classification of Diseases, Ninth Revision, Clinical Modification) codes of all chronic diseases are presented in the online supplementary appendix.

Statistical analysis

The SAS statistical package (SAS System for Windows, V.8.2) was used to perform all analyses on the data set of this study. The prevalence of individual chronic diseases in this study was the percentage of the study populations which was found to have the relevant diagnosis (as stated in table 1) between 2010 and 2012. We used χ^2 tests to explore differences in the prevalence of chronic diseases, participants' monthly insured salary,

Table 1 Crude and adjusted ORs of chronic diseases in male physicians compared to female physicians (n=1426)

Variable	Male physicians vs female physicians	
	Crude OR (95% CI)	Adjusted OR (95% CI)
Cardiovascular diseases		
Hypertension	5.28*** (3.08 to 9.04)	3.37*** (1.93 to 5.91)
Ischaemic heart disease	–	–
Hyperlipidaemia	1.56* (1.08 to 2.26)	1.18 (0.81 to 1.74)
Congestive heart failure	–	–
Cardiac arrhythmias	1.70 (0.66 to 4.35)	1.18 (0.45 to 3.12)
Blood loss anaemia	0.43 (0.04 to 4.74)	0.51 (0.04 to 6.22)
Peripheral vascular disorders	–	–
Stroke	2.83 (0.67 to 12.01)	1.58 (0.36 to 6.98)
Neurological diseases		
Migraines	0.40* (0.17 to 0.94)	0.53 (0.22 to 1.30)
Parkinson's disease	–	–
Rheumatologic diseases		
Rheumatoid arthritis	0.47 (0.21 to 1.04)	0.36* (0.15 to 0.86)
Systemic lupus erythematosus	–	–
Ankylosing spondylitis	1.07 (0.13 to 9.23)	1.57 (0.18 to 13.94)
Pulmonary diseases		
Pulmonary circulation disorders	–	–
Chronic pulmonary disease	1.04 (0.60 to 1.78)	0.87 (0.49 to 1.52)
Asthma	1.13 (0.55 to 2.33)	1.22 (0.58 to 2.57)
Endocrine diseases		
Diabetes, uncomplicated	1.50 (0.81 to 2.80)	0.76 (0.39 to 1.48)
Diabetes, complicated	0.77 (0.28 to 2.09)	0.33* (0.11 to 0.98)
Hypothyroidism	0.23*** (0.14 to 0.39)	0.19*** (0.11 to 0.32)
Renal diseases		
Renal failure	1.29 (0.16 to 10.75)	0.66 (0.07 to 5.99)
Fluid and electrolyte disorders	0.64 (0.13 to 3.20)	0.62 (0.12 to 3.32)
Gastrointestinal diseases		
Liver diseases	2.57*** (1.46 to 4.52)	2.48** (1.39 to 4.41)
Peptic ulcers	0.83 (0.53 to 1.28)	0.74 (0.47 to 1.18)
Viral/infectious diseases		
Hepatitis B or C	1.84 (0.94 to 3.60)	2.00* (1.01 to 3.97)
Haematological diseases		
Deficiency anaemias	0.16 (0.08 to 0.32)	0.13*** (0.06 to 0.27)
Mental illnesses		
Depression	0.91 (0.30 to 2.73)	0.81 (0.26 to 2.54)
Psychoses	0.57 (0.15 to 2.16)	0.49 (0.12 to 1.99)
Oncological diseases		
Metastatic cancer	0.86 (0.10 to 7.71)	0.68 (0.07 to 6.61)
Solid tumour without metastasis	0.67 (0.27 to 1.71)	0.40 (0.15 to 1.08)
Others		
Alcohol abuse	–	–
Drug abuse	–	–

The adjusted ORs of morbidities for male physicians and female physicians were calculated by logistic regression analyses adjusted for participants' age group and urbanisation level.
*p≤0.05, **p≤0.01, ***p≤0.001.

geographic location, and urbanisation level between physicians and the general population. Subjects' monthly insured salary was categorised by the personal monthly health insurance salary, and the geographic location was classified into northern, central, eastern and southern areas. The northern, southern and central areas in Taiwan are much more populated and industrialised than the eastern area.[17] Moreover, all townships in Taiwan were stratified into five classifications with level 1 being the most urbanised and level 5 the least urbanised. Additionally, we used conditional logistic regression analyses conditioned on sex, age group, monthly insured salary, geographic region and urbanisation level to further investigate the OR and its corresponding 95% CI of chronic diseases between these two groups. We also conducted logistic regression analyses to investigate the ORs of chronic diseases in male physicians compared to female physicians. A two-sided p value of <0.05 was considered statistically significant for this study.

RESULTS

Table 2 shows the distribution of sociodemographic characteristics between physicians and the general population. Of the 7130 sampled participants, the mean age was 44.4 (SD=11.7) years. Sex, age group, monthly insured salary, geographic region and levels of urbanisation were the matching variables in this study.

Table 3 presents the prevalence of chronic diseases according to group. It shows that physicians had a significantly lower prevalence of peripheral vascular disorders (0.5% vs 1.2%; p=0.023), uncomplicated diabetes (6.6% vs 8.3%; p=0.032), complicated diabetes (1.6% vs2.9%; p=0.006), renal failure (0.5% vs 1.2%; p=0.023), liver diseases (11.8% vs 14.6%; p=0.007) and hepatitis B or C (6.5% vs 10.2%; p<0.001) compared to the general population. However, compared to the general population, physicians had a significantly higher prevalence of hypertension (21.7% vs 19.1%; p=0.028), hyperlipidaemia (21.0% vs 16.0%; p<0.001), and asthma (3.9% vs 2.5%; p=0.004). There were no significant differences between physicians and the general population in the prevalence of migraines, PD, rheumatoid arthritis, SLE, AS, pulmonary circulation disorders, chronic pulmonary disease, depression or psychoses.

Table 4 presents the ORs of various chronic diseases for physicians and the general population. Conditional regression analyses conditioned on sex, age group, monthly insured salary, geographic region and urbanisation level revealed that compared to the general population, physicians had lower odds of peripheral vascular disorders (OR=0.41, 95% CI=0.19 to 0.90), uncomplicated diabetes (OR=0.76, 95% CI=0.60 to 0.97), complicated diabetes (OR=0.53, 95% CI=0.34 to 0.83), renal failure (OR=0.41, 95% CI=0.19 to 0.90), liver diseases (OR=0.78, 95% CI=0.66 to 0.94) and hepatitis B or C (OR=0.62, 95% CI=0.49 to 0.77). Additionally, physicians had higher odds of hypertension (OR=1.21, 95% CI=1.03 to 1.41), hyperlipidaemia (OR=1.43, 95% CI=1.23 to 1.67) and asthma (OR=1.59, 95% CI=1.16 to 2.18) than the general population.

Table 1 shows crude and adjusted OR of chronic diseases in male compared to female physicians. It displays that male physicians had lower adjusted odds of rheumatoid arthritis (OR=0.36, 95% CI=0.15 to 0.86), complicated diabetes (OR=0.33, 95% CI=0.11 to 0.98), hypothyroidism (OR=0.19, 95% CI=0.11 to 0.32), and deficiency anaemias (OR=0.13, 95% CI=0.06 to 0.27) compared to female physicians after adjusting for age group and urbanisation level. Additionally, male physicians had higher adjusted odds of hypertension (OR=3.37, 95% CI=1.93 to 5.91), liver diseases (OR=2.48, 95% CI=1.39 to 4.41) and hepatitis B or C (OR=2.00, 95% CI=1.01 to 3.97) than female physicians.

DISCUSSION

This is the first study to systematically investigate the prevalence of chronic diseases among practising

Table 2 Demographic characteristics of physicians and the general population in Taiwan (n=7130)

	Physicians (n=1426)		General population (n=5704)		
Variable	**Total no.**	**Column %**	**Total no.**	**Column %**	**p Value**
Sex					Matching variables
Male	1174	82.3	4696	82.3	
Female	252	17.7	1008	17.7	
Age (years)					Matching variables
25–39	547	38.4	2188	38.4	
40–49	411	28.8	1644	28.8	
≥50	468	32.8	1872	32.8	
Monthly insured salary					Matching variables
≤NT$15 840	21	1.5	84	1.5	
NT$15 841–25 000	27	1.9	108	1.9	
≥NT$25 001	1378	96.6	5512	96.6	
Urbanisation level					Matching variables
1 (most urbanised)	529	37.1	2116	37.1	
2	484	33.9	1936	33.9	
3	143	10.0	572	10.0	
4	164	11.5	656	11.5	
5 (least urbanised)	106	7.4	424	7.4	
Geographical Region					Matching variables
Northern	667	46.8	2668	46.8	
Central	323	22.7	1292	22.7	
Southern	406	28.5	1624	28.5	
Eastern	30	2.1	120	2.1	

US$1=NT$29.8 in 2010.

Table 3 Prevalence of chronic diseases in physicians compared to the general population (n=7130)

Variable	n (%) Physicians (n=1426)	General population (n=5704)	p Value
Cardiovascular diseases			
Hypertension	309 (21.7)	1089 (19.1)	0.028
Ischaemic heart disease	9 (0.6)	42 (0.7)	0.673
Hyperlipidaemia	300 (21.0)	911 (16.0)	<0.001
Congestive heart failure	10 (0.7)	76 (1.3)	0.051
Cardiac arrhythmias	44 (3.1)	161 (2.8)	0.595
Blood loss anaemia	3 (0.2)	8 (0.1)	0.546
Peripheral vascular disorders	7 (0.5)	67 (1.2)	0.023
Stroke	28 (2.0)	135 (2.4)	0.362
Neurological diseases			
Migraines	23 (1.6)	106 (1.9)	0.534
Parkinson's disease	2 (0.1)	11 (0.2)	0.677
Rheumatological diseases			
Rheumatoid arthritis	29 (2.0)	145 (2.5)	0.266
Systemic lupus erythematosus	1 (0.1)	5 (0.1)	0.838
Ankylosing spondylitis	6 (0.4)	32 (0.6)	0.515
Pulmonary diseases			
Pulmonary circulation disorders	1 (0.1)	3 (0.1)	0.803
Chronic pulmonary disease	99 (6.9)	326 (5.7)	0.080
Asthma	56 (3.9)	143 (2.5)	0.004
Endocrine diseases			
Diabetes, uncomplicated	94 (6.6)	474 (8.3)	0.032
Diabetes, complicated	23 (1.6)	167 (2.9)	0.006
Hypothyroidism	66 (4.6)	217 (3.8)	0.154
Renal diseases			
Renal failure	7 (0.5)	67 (1.2)	0.023
Fluid and electrolyte disorders	8 (0.6)	32 (0.6)	1.000
Gastrointestinal diseases			
Liver diseases	168 (11.8)	830 (14.6)	0.007
Peptic ulcers	138 (9.7)	520 (9.1)	0.513
Viral/infectious diseases			
Hepatitis B or C	93 (6.5)	579 (10.2)	<0.001
Haematological diseases			
Deficiency anaemias	34 (2.4)	98 (1.7)	0.095
Mental illnesses			
Depression	21 (1.5)	119 (2.1)	0.135
Psychoses	11 (0.8)	66 (1.2)	0.208
Oncological diseases			
Metastatic cancer	5 (0.4)	7 (0.1)	0.060
Solid tumour without metastasis	25 (1.8)	133 (2.3)	0.184
Others			
Alcohol abuse	1 (0.1)	15 (0.3)	0.169
Drug abuse	–	3 (0.1)	–

physicians using a population-based database produced by the NHI program in Taiwan and which can provide a large number of physicians for analyses. We found that physicians had significantly lower odds of peripheral vascular disorders, diabetes, renal failure, liver diseases and hepatitis B or C and greater odds of hypertension, hyperlipidaemia and asthma than the general population. In addition, there was no significant difference in the prevalence of other chronic diseases between practising physicians and the general population.

The findings regarding the low risks for some chronic diseases in this study were consistent with several studies which investigated differences in health statuses between physicians and the general population. A Norwegian study reported that the self-perceived health status of physicians was frequently better than that of the general population.[7] A study which included a large physician cohort also found that physicians experienced significantly reduced risks of all causes and many major cause-specific hospitalisations, including metabolic diseases, circulatory system diseases, genitourinary system diseases, etc compared to the general population.[18] Additionally, the prior literature showed the prevalence of mental disorders among physicians. According to the results of our

Table 4 ORs of chronic diseases in physicians compared to the general population (n=7130)

Variable	Physicians vs general population OR (95% CI)
Cardiovascular diseases	
Hypertension	1.21* (1.03 to 1.41)
Ischaemic heart disease	0.85 (0.41 to 1.77)
Hyperlipidaemia	1.43*** (1.23 to 1.67)
Congestive heart failure	0.52 (0.27 to 1.01)
Cardiac arrhythmias	1.10 (0.78 to 1.55)
Blood loss anaemia	1.50 (0.40 to 5.66)
Peripheral vascular disorders	0.41* (0.19 to 0.90)
Stroke	0.82 (0.54 to 1.25)
Neurological diseases	
Migraines	0.87 (0.55 to 1.37)
Parkinson's disease	0.73 (0.16 to 3.28)
Rheumatological diseases	
Rheumatoid arthritis	0.79 (0.53 to 1.19)
Systemic lupus erythematosus	0.80 (0.09 to 6.85)
Ankylosing spondylitis	0.75 (0.31 to 1.80)
Pulmonary diseases	
Pulmonary circulation disorders	1.33 (0.14 to 12.82)
Chronic pulmonary disease	1.24 (0.98 to 1.57)
Asthma	1.59** (1.16 to 2.18)
Endocrine diseases	
Diabetes, uncomplicated	0.76* (0.60 to 0.97)
Diabetes, complicated	0.53** (0.34 to 0.83)
Hypothyroidism	1.23 (0.93 to 1.63)
Renal diseases	
Renal failure	0.41* (0.19 to 0.90)
Fluid and electrolyte disorders	1.00 (0.46 to 2.18)
Gastrointestinal diseases	
Liver diseases	0.78** (0.66 to 0.94)
Peptic ulcers	1.07 (0.88 to 1.30)
Viral/infectious diseases	
Hepatitis B or C	0.62*** (0.49 to 0.77)
Haematological diseases	
Deficiency anaemias	1.41 (0.94 to 2.09)
Mental illnesses	
Depression	0.70 (0.44 to 1.12)
Psychoses	0.66 (0.35 to 1.26)
Oncological diseases	
Metastatic cancer	2.86 (0.91 to 9.00)
Solid tumour without metastasis	0.75 (0.48 to 1.15)
Others	
Alcohol abuse	0.27 (0.04 to 2.02)
Drug abuse	–

The ORs of morbidities for physicians and the general population were calculated by conditional logistic regression analyses conditioned on sex, age group, monthly insured salary, urbanisation level and geographical region of the participants.
*p≤0.05, **p≤0.01, ***p≤0.001.

study, the prevalence of psychiatric disorders, including depression and psychoses, of physicians was similar to that of those in the general population. Our finding is consistent with a report by Gagné *et al*,[12] which found that there was no significant difference in the prevalence of psychiatric diseases between physicians and non-physicians. A review reported by Brewster also showed that the prevalence of substance use and alcohol consumption was similar to that in physicians and the general population.[19] However, some studies observed that physicians have a higher prevalence of psychological distress, mental disorders and substance use disorders compared to those in the general population.[8–14] The similar prevalence of psychiatric diseases between physicians and the general population in our study might be explained by physicians being considered to be more cautious than the general population in going to a clinic for diagnoses and therapies due to fear of negative impacts on their medical licensing. In addition, some physicians might try to self-medicate with exercise, changing lifestyles or toughing it out without seeking treatment. Accordingly, the issue of physicians' mental health is still controversial and worth further discussion in the future.

Potential reasons for the lower prevalence of peripheral vascular disorders, diabetes and renal failure in physicians compared to the general population in our study might be due to lifestyles, healthy habits and dietary factors. Several studies reported that a healthy lifestyle decreases the incidence of heart disease, diabetes and renal failure.[20–22] Some studies also indicated that physicians have better health and lifestyles than the general population because of medical knowledge received from medical training.[7 9 15 18 23–25] Therefore, healthy behaviours might help physicians prevent chronic diseases such as congestive heart failure, diabetes and renal failure. Furthermore, studies have shown that physicians are less likely to be smokers than the general population.[23 26 27] The low prevalence of smokers among physicians may also be one of the major reasons contributing to the low prevalence of renal failure among physicians, because cigarette smoking was demonstrated to be a main risk factor for renal failure through increased renovascular resistance.[28–30] A prior study also reported that physicians have a tendency to eat more fruits and vegetables than the general population.[23] The dietary pattern of a higher consumption of fruits and vegetables is associated with a reduced risk for type 2 diabetes.[31 32] Nevertheless, most chronic diseases are considered to be results of multifactorial conditions. Lifestyle, healthy habits and dietary intake might not be absolute risk factors which contribute to the occurrence and progression of chronic diseases.

Moreover, the socioeconomic status (SES) is another factor which can explain physicians' better health compared to the general population. Some studies found that a higher SES was associated with lower morbidity.[33 34] A previous study also suggested that a high educational level may be a strong predictor of good health.[35] Although we took the monthly insured salary into consideration in this study, the data set used in this study did not contain data on the educational level. Education is considered to be one of the most significant items among components of SES. In contrast to the

general population, physicians usually have higher levels of education. Therefore, it is plausible that physicians are much healthier than the general population.

Additionally, this study also found that physicians had a lower prevalence of liver diseases and hepatitis B or C than the general population. In Taiwan, hepatitis B virus (HBV) and hepatitis C virus (HCV) are necessary items on physical examinations for medical students before they begin clinical training courses in hospitals. Medical students who are negative for antibodies to hepatitis B surface antigen and anti-HB antibodies have to receive hepatitis B vaccinations. Therefore, medical students would have a reduced chance of being infected with HBV because they have been vaccinated. In regard to HCV, a previous study found that people with higher education ran a lower risk of transmission.[36] Hence, education may be the reason why physicians had lower risks of liver diseases and hepatitis B or C in our study.

Nevertheless, in this study, the prevalence of hypertension and hyperlipidaemia was higher in physicians compared to the general population. The high levels of stress and psychological distress experienced by physicians might be possible reasons contributing to hypertension and hyperlipidaemia. Many studies indicated that physicians frequently have high weekly working hours and usually experience stress and psychological problems.[37 38] The previous literature further showed that stress might increase blood pressure and blood lipids and affect lipid metabolism.[39 40] Although the findings in this study did not show a consistently reduced or increased probability for different types of chronic diseases, this might have been due to the characteristics of these chronic diseases. Prior studies demonstrated that most chronic diseases are the result of multifactorial conditions.[41 42] Many extrinsic and intrinsic factors were indicated to lead to the incidence of these diseases. Each risk factor might play a very different role in the progression of dissimilar types of chronic diseases. Consequently, it is difficult to define the main reason for each disease, and it was difficult to realise potential influences of various risk factors in this study.

A specific strength of our study is the use of a population-based data set to investigate the prevalence of chronic diseases among physicians in Taiwan. This feature afforded sufficient statistical power and an adequate sample size to detect differences in chronic disease risks between physicians and matched controls from the general population after adjusting for confounders. We further examined the representativeness of the comparison group to the general population. According to previous studies, the respective prevalences of hypertension, diabetes and hepatitis B were about 25%, 12% and 10% in the general population of Taiwan.[43–45] These figures are very similar to those reported in the comparison group of our study, although they had different study designs, subject inclusion criteria and matching variables.[46]

Nevertheless, there are several limitations to this study. First, as mentioned above, the LHID2000 used in this study provided no information on the educational status, cigarette smoking, body mass index or health behaviour of participants, which were considered to affect the findings in this study. Second, this study used the personal monthly health insurance salary and location of the administrative office as respective surrogate variables for monthly income and urbanisation levels. Evaluation of the SES in this study might have had some confounding or intermediate effects on the findings of this study. Third, this study might have overestimated or underestimated the prevalence of several specific diseases. In general, physicians might be more alert to physical health problems due to their medical knowledge, so they are more likely to seek health services than the general population. Conversely, physicians might be less likely to exhibit mental health issues in this database, because they may be concerned that such records might impact their licensing or registration. Fourth, the sampled participants included many different ethnic groups in Taiwan, such as Fukien, Hakka, mainlander and Aborigine, and the LHID2000 database provides no records on ethnicity. Therefore, the internal validity of ethnic diversity could not be ascertained in this study. Finally, this study only employed 3 years of data on chronic diseases, and this might not fully represent long-term prevalence of chronic diseases of the sampled participants.

To the best of our knowledge, this is the first study to systematically investigate the prevalence of chronic diseases among practising physicians using a large population-based data set. Our study found that physicians have lower risks for peripheral vascular disorders, uncomplicated diabetes, complicated diabetes, renal failure, liver diseases and hepatitis B or C than the general population. Further, large-scale long-term epidemiological studies are suggested to explore differences in mental health between physicians and the general population in other regions and countries.

Author affiliations
[1]Graduate Institute of Life Science, National Defense Medical Center, Taipei, Taiwan
[2]School of Public Health, National Defense Medical Center, Taipei, Taiwan
[3]Sleep Research Center, Taipei Medical University Hospital, Taipei, Taiwan
[4]Department of Psychiatry and Medical Humanities, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
[5]Graduate Program in Biomedical Informatics, College of Informatics, Yuan-Ze University, Chungli, Taiwan
[6]Department of Surgery, Far Eastern Memorial Hospital, Banciao, Taipei, Taiwan

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REFERENCES

1. Frank E, Dresner Y, Shani M, *et al*. The association between physicians' and patients' preventive health practices. *CMAJ* 2013;185:649–53.
2. Wells KB, Lewis CE, Leake B, *et al*. Do physicians preach what they practice? A study of physicians' health habits and counseling practices. *JAMA* 1984;252:2846–8.
3. Oberg EB, Frank E. Physicians' health practices strongly influence patient health practices. *J R Coll Physicians Edinb* 2009;39:290–1.
4. Frank E, Segura C, Shen H, *et al*. Predictors of Canadian physicians' prevention counseling practices. *Can J Public Health* 2010;101:390–5.
5. Duperly J, Lobelo F, Segura C, *et al*. The association between Colombian medical students' healthy personal habits and a positive attitude toward preventive counseling: cross-sectional analyses. *BMC Public Health* 2009;9:218.
6. Shanafelt TD, Bradley KA, Wipf JE, *et al*. Burnout and self-reported patient care in an internal medicine residency program. *Ann Intern Med* 2002;136:358–67.
7. Stavem K, Hofoss D, Aasland OG, *et al*. The self-perceived health status of Norwegian physicians compared with a reference population and foreign physicians. *Scand J Public Health* 2001;29:194–9.
8. Wall TD, Bolden RI, Borrill CS, *et al*. Minor psychiatric disorder in NHS trust staff: occupational and gender differences. *Br J Psychiatry* 1997;171:519–23.
9. Toyry S, Rasanen K, Kujala S, *et al*. Self-reported health, illness, and self-care among Finnish physicians: a national survey. *Arch Fam Med* 2000;9:1079–85.
10. Gold KJ, Sen A, Schwenk TL. Details on suicide among US physicians: data from The National Violent Death Reporting System. *Gen Hosp Psychiatry* 2013;35:45–9.
11. Chen KY, Yang CM, Lien CH, *et al*. Burnout, job satisfaction, and medical malpractice among physicians. *Int J Med Sci* 2013;10:1471–8.
12. Gagné P, Moamai J, Bourget D. Psychopathology and suicide among Quebec physicians: a nested case control study. *Depress Res Treat* 2011;2011:936327.
13. Clarke D, Singh R. Life events, stress appraisals, and hospital doctors' mental health. *N Z Med J* 2004;117:U1121.
14. Cottler LB, Ajinkya S, Merlo LJ, *et al*. Lifetime psychiatric and substance use disorders among impaired physicians in a physicians health program: comparison to a general treatment population: psychopathology of impaired physicians. *J Addict Med* 2013;7:108–12.
15. Chung SD, Kang JH, Liao CH, *et al*. Increased risk for cancer following erectile dysfunction: a nationwide population-based follow-up study. *J Sex Med* 2011;8:1513–20.
16. Gau CS, Chang IS, Lin Wu FL, *et al*. Usage of the claim database of national health insurance programme for analysis of cisapride-erythromycin co-medication in Taiwan. *Pharmacoepidemiol Drug Saf* 2007;16:86–95.
17. Liu TC, Chen CS. An analysis of private health insurance purchasing decisions with national health insurance in Taiwan. *Soc Sci Med* 2002;55:755–74.
18. Lin CM, Yang CH, Sung FC, *et al*. Risks and causes of hospitalizations among physicians in Taiwan. *Health Serv Res* 2008;43:675–92.
19. Brewster JM. Prevalence of alcohol and other drug problems among physicians. *JAMA* 1986;255:1913–20.
20. Agha G, Loucks EB, Tinker LF, *et al*. Healthy lifestyle and decreasing risk of heart failure in women: the Women's Health Initiative observational study. *J Am Coll Cardiol* 2014;64:1777–85.
21. Stevens JW, Khunti K, Harvey R, *et al*. Preventing the progression to type 2 diabetes mellitus in adults at high risk: a systematic review and network meta-analysis of lifestyle, pharmacological and surgical interventions. *Diabetes Res Clin Pract* 2015;107:320–31.
22. Wakasugi M, Kazama JJ, Yamamoto S, *et al*. A combination of healthy lifestyle factors is associated with a decreased incidence of chronic kidney disease: a population-based cohort study. *Hypertens Res* 2013;36:328–33.
23. Frank E, Brogan DJ, Mokdad AH, *et al*. Health-related behaviors of women physicians vs other women in the United States. *Arch Intern Med* 1998;158:342–8.
24. Liu SH, Li TH, Lin YL, *et al*. Lower morbidity and disease risk among the Chinese medicine physicians in Taiwan. *Tohoku J Exp Med* 2009;219:207–14.
25. Rurik I, Kalabay L. Morbidity, demography, life style, and self-perceived health of Hungarian medical doctors 25 years after graduation. *Med Sci Monit* 2008;14:SR1–8.
26. McGrady FP, McGlade KJ, Cupples ME, *et al*. Questionnaire survey of PHysical activITy in General Practitioners (PHIT GP Study). *Ulster Med J* 2007;76:91–7.
27. Olsen AD, Dossing M, Danielsen US, *et al*. Smoking habits among hospital employees in 1992. *Ugeskr Laeg* 1995;157:1328–32.
28. Bleyer AJ, Shemanski LR, Burke GL, *et al*. Tobacco, hypertension, and vascular disease: risk factors for renal functional decline in an older population. *Kidney Int* 2000;57:2072–9.
29. McLigeyo SO. Smoking--an emerging risk factor for renal diseases. *East Afr Med J* 1998;75:171–4.
30. Orth SR. Smoking—a renal risk factor. *Nephron* 2000;86:12–26.
31. Montonen J, Knekt P, Härkanen T, *et al*. Dietary patterns and the incidence of type 2 diabetes. *Am J Epidemiol* 2005;161:219–27.
32. van Dam RM, Rimm EB, Willett WC, *et al*. Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. *Ann Intern Med* 2002;136:201–9.
33. Gold R, Michael YL, Whitlock EP, *et al*. Race/ethnicity, socioeconomic status, and lifetime morbidity burden in the women's health initiative: a cross-sectional analysis. *J Womens Health (Larchmt)* 2006;15:1161–73.
34. Sedlakova D. Low socioeconomic status and unhealthy lifestyle lead to high morbidity in young Roma of East Slovakia. *Cent Eur J Public Health* 2014;22(Suppl):S3–5.
35. Grossman M. On the concept of health capital and the demand for health. *J Polit Econ* 1972;80:223–55.
36. Li CP, Hwang SJ, Lu CL, *et al*. Risk factor analysis of patients with chronic hepatitis C in Taiwan. *Zhonghua Yi Xue Za Zhi (Taipei)* 1996;58:275–80.
37. Rovik JO, Tyssen R, Hem E, *et al*. Job stress in young physicians with an emphasis on the work-home interface: a nine-year, nationwide and longitudinal study of its course and predictors. *Ind Health* 2007;45:662–71.
38. Tucker P, Bejerot E, Kecklund G, *et al*. The impact of work time control on physicians' sleep and well-being. *Appl Ergon* 2015;47:109–16.
39. Pickering TG. Mental stress as a causal factor in the development of hypertension and cardiovascular disease. *Curr Hypertens Rep* 2001;3:249–54.
40. Stoney CM, West SG, Hughes JW, *et al*. Acute psychological stress reduces plasma triglyceride clearance. *Psychophysiology* 2002;39:80–5.
41. Etukumana EA, Puepet FH, Obadofin MO. Risk factors for diabetes mellitus among rural adults in Nigeria. *Niger J Med* 2014;23:213–19.
42. Mohammadifard N, Nazem M, Sarrafzadegan N, *et al*. Body mass index, waist-circumference and cardiovascular disease risk factors in Iranian adults: Isfahan healthy heart program. *J Health Popul Nutr* 2013;31:388–97.
43. Su TC, Bai CH, Chang HY, *et al*. Evidence for improved control of hypertension in Taiwan: 1993–2002. *J Hypertens* 2008;26:600–6.
44. Chang CH, Shau WY, Jiang YD, *et al*. Type 2 diabetes prevalence and incidence among adults in Taiwan during 1999–2004: a national health insurance data set study. *Diabet Med* 2010;27:636–43.
45. Hung CC, Loh el W, Hu TM, *et al*. Prevalence of hepatitis B and hepatitis C in patients with chronic schizophrenia living in institutions. *J Chin Med Assoc* 2012;75:275–80.
46. Chung SD, Chen PY, Lin HC, *et al*. Comorbidity profile of chronic rhinosinusitis: a population-based study. *Laryngoscope* 2014;124:1536–41.