Standing Posture at Work Does Not Increase the Risk of Varicose Veins among Health Care Providers in Taiwan

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Significance of the Study

- In this study, the cumulative varicose vein (VV) incidence of physicians, nonphysician health care providers, and the general population was 0.12, 0.13, and 0.13%, respectively, during the 5-year period.
- The VV risk among physician specialists was not different.
- Surgery had the highest incidence (0.22%) while pediatrics and emergency medicine had the lowest incidence (0%) of VV risk among physician specialists.

Keywords

Health care provider · Physician · Standing · Specialty · Varicose vein

Abstract

Objective: This study compared the risk of varicose veins (VV) among physicians, nonphysician health care providers (HCP), and the general population. **Subjects and Methods:** The Taiwan National Health Insurance Research Database was used to identify 28,844 physicians and 26,099 nonphysi-

cian HCP and an identical number of age- and sex-matched patients from the general population. Using logistic regression analyses, VV risks between physicians and the general population, nonphysician HCP and the general population, and physicians and nonphysician HCP, and among physician specialists were compared by tracing their medical histories between 2007 and 2011. **Results:** Physicians and nonphysician HCP had cumulative VV incidences of 0.12% (34/28,844) and 0.13% (33/26,099), respectively, during the 5-year period, compared to that of the general population within the same 5-year period. Physicians and nonphysician HCP did

not have a higher VV risk than the general population after adjusting for deep vein thrombosis (DVT) history (adjusted odds ratio [AOR] 0.86; 95% confidence interval [CI] 0.53–1.40, and AOR 1.43; 95% CI 0.82–2.50, respectively). Physicians did not have a higher VV risk than nonphysician HCP (AOR 0.80; 95% CI 0.43–1.51) after adjusting for age, sex, and DVT history. Surgery had the highest incidence (0.22%) while pediatrics and emergency medicine had the lowest incidence (0%) of VV risk among physician specialists; however, the difference was not significant (all p values >0.05). **Conclusion:** In this study, VV risk did not differ among physicians, nonphysician HCP, and the general population.

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Introduction

Varicose veins (VV) of the lower extremities are dilated, palpable, subcutaneous veins with a diameter of more than 3–4 mm [1, 2], and they are classified as class C2 among chronic venous diseases [1, 2]. In addition to VV, chronic venous diseases have other clinical manifestations such as telangiectasias, swelling, pigmentation, lipodermatosclerosis, and ulcer [1]. A descriptive clinical, etiological, anatomical, and pathophysiological classification provides an orderly framework for communication and decision making [1]. The pathogenesis of VV involves valve incompetence and venous wall dilation due to venous hypertension [2, 3]. The Framingham Study reported that the annual incidence of VV was 2.6% among women and 1.9% among men in the USA [1, 4]. VV are more prevalent in populations of European origin than in those of African origin or Asians [1, 5]. The risk factors for VV are age, family history, female sex, obesity, prolonged standing or walking, pregnancy, parity, deep vein thrombosis (DVT), surgery of the lower limbs, and a greater height [1, 6–13].

Prolonged standing or walking due to occupational exposure has been suggested to be a cause of VV [2, 11, 12]. In a longitudinal study with a large sample size in Denmark, workers who stood or walked for 6–7.3 h had a significantly higher risk of surgery of VV than workers who stood or worked for less than 4 h (adjusted hazard ratio 3.17 in men and 2.34 in women) [2]. In a study assessing VV risk among hairdressers, the monthly work involved 261–360 standing hours and had an odds ratio (OR) of 31.8 (95% confidence interval [CI] 25–120) [12]. In Taiwan, physicians have a heavy workload, with long working hours since the launch of the National Health Insurance (NHI) in 1995, which provides easy and equal

Fig. 1. Flowchart of this study. HCP, health care provider; LHID2000, Longitudinal Health Insurance Database 2000; VV, varicose vein; DVT, deep venous thrombosis; PER, Registry for Medical Personnel.

access to health care to all the citizens [14–16]. More than half of the attending physicians have to work for more than 262.4 h/month [17]. In certain specialties, physicians have to work for an average of 315.6 h/month [17]. Long working hours that involve standing or walking could contribute to an increased VV risk [12]. Currently, there is no available publication comparing VV risk among physicians, nonphysician health care providers (HCP), and the general population. Hence, this study was conducted to clarify this issue.

Table 1. Demographic characteristics and comorbidities of physicians, nonphysician HCP, and the general population

Characteristics	Physicians (<i>n</i> = 28,844)	General population (<i>n</i> = 28,844)	<i>p</i> value	Nonphysician HCP (<i>n</i> = 26,099)	General population (<i>n</i> = 26,099)	<i>p</i> value
Age, years	46.83 ± 10.72	46.83 ± 10.72	>0.999	33.97 ± 8.41	33.97 ± 8.41	>0.999
Age, years						
<35	3,608 (12.51)	3,608 (12.51)	>0.999	15,754 (60.36)	15,754 (60.36)	>0.999
35–64	23,418 (81.19)	23,418 (81.19)		10,277 (39.38)	10,277 (39.38)	
≥65	1,818 (6.30)	1,818 (6.30)		68 (0.26)	68 (0.26)	
Sex						
Male	24,802 (85.99)	24,802 (85.99)	>0.999	7,984 (30.59)	7,984 (30.59)	>0.999
Female	4,042 (14.01)	4,042 (14.01)		18,115 (69.41)	18,115 (69.41)	
Comorbidity						
HTN	6,820 (23.64)	5,509 (19.10)	<0.001	1,511 (5.79)	1,297 (4.97)	<0.001
DM	2,343 (8.12)	2,730 (9.46)	<0.001	532 (2.04)	671 (2.57)	<0.001
Hyperlipidemia	6,169 (21.39)	3,733 (12.94)	<0.001	1,573 (6.03)	1,009 (3.87)	<0.001
DVT history	35 (0.12)	32 (0.11)	0.714	12 (0.05)	9 (0.03)	0.513
Living area						
North	13,492 (46.78)	14,768 (51.20)	<0.001	12,541 (48.05)	14,484 (55.50)	<0.001
Center	5,723 (19.84)	5,072 (17.58)		5,063 (19.40)	4,492 (17.21)	
South	8,871 (30.76)	8,371 (29.02)		7,833 (30.01)	6,668 (25.55)	
East	758 (2.63)	633 (2.19)		662 (2.54)	455 (1.74)	

Values are presented as means ± SD or *n* (%) unless otherwise stated. HCP, healthcare providers; HTN, hypertension; DM, diabetes mellitus; DVT, deep vein thrombosis.

Materials and Methods

Data Source

Taiwan launched a single-payer NHI program in 1995. As of 2014, 99.9% of Taiwan's population was enrolled [18]. The NHI Research Database (NHIRD) contains registration files and original claim data for reimbursement, which can be provided to scientists in Taiwan for research purposes [18]. It provides the patient identification number, age, sex, date of visit, length of hospitalization, prescribed medication, treatment, and diagnoses using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) [15, 18]. The registration files of HCP obtained from the Registry of Medical Personnel (PER) of the NHIRD include residence area, hospital level, type of employment, specialty, date of HCP license, and encrypted identification number (Fig. 1). The general population was recruited from the Longitudinal Health Insurance Database 2000 (LHID2000), which is a data subset of the NHIRD that contains all of the data of 1,000,000 (4.34% of the total population) random beneficiaries [15, 18].

Selection of the Study Cohort and the Comparison Cohort (General Population)

A retrospective cohort study was conceived based on the NHIRD, which contains all of the disease diagnoses and data for reimbursement of 99.9% of Taiwan's population since 1995. Because the NHIRD has a comprehensive and prospectively collected database, it is a good choice for a retrospective cohort study. The

NHIRD was reviewed to identify physicians and nonphysician HCP (study cohort) from the 2009 PER (Fig. 1). The general population (comparison cohort) was identified from the LHID2000 (Fig. 1). Nonphysician HCP included technicians, rehabilitation therapists, audiologists, and social workers. The VV risk of nonphysician HCP was compared with that of physicians to evaluate the healthy-worker effect. Exclusion criteria were: having a history of VV (ICD-9-CM: 454) before 2007 and being a resident. Residents were excluded because they usually had rotating training specialties and insufficient experience. The HCP and the general population were matched at a 1:1 ratio for age and sex. Included in the analysis were comorbidities such as hypertension (ICD-9-CM: 401–405), diabetes mellitus (ICD-9-CM: 250), hyperlipidemia (ICD-9-CM: 272), DVT history (ICD-9-CM: 453.40), and living areas.

This study was approved by the Chi-Mei Medical Center Institutional Review Board and complied with the ethics principles of the Declaration of Helsinki. The Institutional Review Board waived the need for informed consent because the NHIRD consists of de-identified information for academic research. The patients' rights and welfare were unaffected.

Comparison between Physicians and Nonphysicians and among Physician Specialists

A total of 28,844 physicians and 26,099 nonphysician HCP and an identical number of patients from the general population (after being matched by age and sex) were identified (Table 1). Their

Table 2. Comparison of VV risk between physicians and the general population by conditional logistic regression

	<i>n</i> (%)	OR (95% CI)	AOR (95% CI) ^a
<i>Overall analysis</i>			
Physicians (<i>n</i> = 28,844)	34 (0.12)	0.92 (0.58–1.46)	0.86 (0.53–1.40)
General population (<i>n</i> = 28,844)	37 (0.13)	1.00	1.00
<i>Stratified analysis</i>			
<i>Age <35 years</i>			
Physicians	2 (0.06)	2.00 (0.18–22.06)	2.00 (0.18–22.06)
General population	1 (0.03)	1.00	1.00
<i>Age 35–64 years</i>			
Physicians	28 (0.12)	1.00 (0.59–1.69)	0.93 (0.54–1.58)
General population	28 (0.12)	1.00	1.00
<i>Age ≥65 years</i>			
Physicians	4 (0.22)	0.50 (0.15–1.66)	0.29 (0.06–1.38)
General population	8 (0.44)	1.00	1.00
<i>Male</i>			
Physicians	32 (0.13)	1.14 (0.69–1.9)	1.08 (0.63–1.84)
General population	28 (0.11)	1.00	1.00
<i>Female</i>			
Physicians	2 (0.05)	0.22 (0.05–1.03)	0.22 (0.05–1.03)
General population	9 (0.22)	1.00	1.00

CI, confidence interval; VV, varicose vein; OR, odds ratio; AOR, adjusted odds ratio; DVT, deep vein thrombosis. ^a Adjusted for DVT history.

medical history was traced from 2006 to 2011 to compare VV risk by cumulative incidence between HCP and the general population. Stratified analyses by age and sex were also performed. VV risk was compared between physicians and nonphysician HCP and among physician specialists, including 8 specialties: surgery, internal medicine, pediatrics, obstetrics and gynecology, emergency medicine, family medicine, dual specialists (e.g., a physician who has boards of both internal medicine and emergency medicine), and others. The comparison was performed among specialists because different specialists have different working hours that might contribute to the difference in VV risk.

Statistical Analyses

Student's *t* test (for continuous variables) and a χ^2 test (for categorical variables) were used to compare the differences among the demographic data, comorbidities, and living areas between HCP and the general population. Conditional logistic regression was used to compare VV risk between physicians and the general population and between nonphysician HCP and the general population after adjusting for DVT history, which was the only available and probable confounding factor in addition to age and sex in our study. Unconditional logistic regression was used to compare VV risk between physicians and nonphysician HCP and among physician specialists after adjusting for age, sex, and DVT history. SAS 9.3.1 for Windows (SAS Institute, Cary, NC, USA) was used for all analyses. *p* < 0.05 (2-tailed) was considered statistically significant.

Results

The number of physicians and nonphysician HCP identified was 28,844 and 26,099, respectively. The number of individuals from the general population from the LHID2000 was 28,844. The mean age of the physicians and nonphysician HCP was 46.83 ± 10.72 and 33.97 ± 8.41 years, respectively (Table 1). The mean age of the general population matched with physicians and nonphysician HCP was 46.83 ± 10.72 and 33.97 ± 8.41 years, respectively. Of the 28,844 physicians and 26,099 nonphysician HCP, 27,026 (94%) and 26,031 (99.7%) were in the age subgroup of 35–64 years and <35 years, respectively. Also, of the 28,844 physicians 24,802 (86%) were men, and of the 26,099 nonphysician HCP 18,115 (69.41%) were women. HCP including physicians and nonphysician HCP had a higher prevalence of hypertension (i.e., 23.64 and 19.10%, respectively) and hyperlipidemia (i.e., 21.39 and 6.03%, respectively) but a lower prevalence of diabetes mellitus (i.e., 8.12 and 2.04%, respectively) than the general population. There was no significant difference in DVT history between HCP and the general population (physicians vs. the general popula-

Table 3. Comparison of VV risk between nonphysician HCP and the general population by conditional logistic regression

	<i>n</i> (%)	OR (95% CI)	AOR (95% CI) ^a
<i>Overall analysis</i>			
Nonphysician HCP (<i>n</i> = 26,099)	33 (0.13)	1.50 (0.88–2.57)	1.43 (0.82–2.50)
General population (<i>n</i> = 26,099)	22 (0.08)	1.00	1.00
<i>Stratified analysis</i>			
<i>Age <35 years</i>			
Nonphysician HCP	14 (0.09)	2.00 (0.81–4.96)	1.71 (0.68–4.35)
General population	7 (0.04)	1.00	1.00
<i>Age 35–64 years</i>			
Nonphysician HCP	19 (0.18)	1.27 (0.64–2.49)	1.29 (0.64–2.59)
General population	15 (0.15)	1.00	1.00
<i>Age ≥65 years</i>			
Nonphysician HCP	–	–	–
General population	–	1.00	1.00
<i>Male</i>			
Nonphysician HCP	3 (0.04)	1.50 (0.25–8.98)	1.50 (0.25–8.98)
General population	2 (0.03)	1.00	1.00
<i>Female</i>			
Nonphysician HCP	30 (0.17)	1.50 (0.85–2.64)	1.42 (0.79–2.56)
General population	20 (0.11)	1.00	1.00

CI, confidence interval; HCP, healthcare providers; VV, varicose vein; OR, odds ratio; AOR, adjusted odds ratio; DVT, deep vein thrombosis. ^a Adjusted for DVT history.

tion: 0.12 vs. 0.11%; nonphysician HCP vs. the general population: 0.05 vs. 0.03%).

During the period of 2007–2011, physicians and nonphysician HCP had a cumulative VV risk incidence of 0.12% (34/28,844; Table 2) and 0.13% (33/26,099; Table 3), respectively. The cumulative VV incidence in the general population was 0.13% (37/28,844). Based on conditional logistic regression with adjustment for DVT history, physicians did not have a higher VV risk than the general population (adjusted odds ratio [AOR] 0.86; 95% CI 0.53–1.40) (Table 2). Stratified analysis by age and sex also showed no significant difference. Nonphysician HCP also did not have a higher risk than the general population (AOR 1.43; 95% CI 0.82–2.50) in the overall analysis or the stratified analysis (Table 3).

Based on an unconditional logistic regression with adjustment for age, sex, and DVT history, physicians did not have a higher VV risk than nonphysician HCP (AOR 0.80; 95% CI 0.43–1.51) (Table 4). In the stratified analysis for sex, female physicians had a significantly lower VV risk than female nonphysician HCP (AOR 0.22; 95% CI 0.05–0.94) (Table 4). Surgery had the highest incidence (0.22%) while pediatrics and emergency medicine had the

lowest incidence (0%) of VV risk among physician specialists; however, the difference was not significant (all *p* values >0.05) (Table 5).

Discussion

In this study physicians and nonphysician HCP had low cumulative VV risk incidences of 0.12 and 0.13% in Taiwan during the 5-year period, respectively. The cumulative VV incidence in the general population was 0.13%, indicating that physicians and nonphysician HCP did not have a higher VV risk than the general population. Equally important, there was also no significant difference in VV risk among physicians, nonphysician HCP, and physician specialists.

In this study, physicians in Taiwan did not have a higher VV risk than nonphysician HCP or the general population despite having long work hours. The probable explanation for this could be that physicians have better medical knowledge of how to prevent VV [16, 19, 20]. The 0.05% incidence of VV among female physicians seemed to indicate the risk of VV is different be-

Table 4. Comparison of the VV risk between physicians and nonphysician HCP by unconditional logistic regression

	<i>n</i> (%)	OR (95% CI)	AOR (95% CI) ^a
<i>Overall analysis</i>			
Physicians (<i>n</i> = 28,844)	34 (0.12)	0.93 (0.58–1.51)	0.80 (0.43–1.51)
Nonphysician HCP (<i>n</i> = 26,099)	33 (0.13)	1.00	1.00
<i>Stratified analysis</i>			
<i>Age <35 years</i>			
Physicians	2 (0.06)	0.62 (0.14–2.75)	0.90 (0.18–4.36)
Nonphysician HCP	14 (0.09)	1.00	1.00
<i>Age 35–64 years</i>			
Physicians	28 (0.12)	0.65 (0.36–1.16)	0.75 (0.37–1.51)
Nonphysician HCP	19 (0.18)	1.00	1.00
<i>Age ≥65 years</i>			
Physicians	4 (0.22)	–	–
Nonphysician HCP	0 (0.00)	1.00	1.00
<i>Male</i>			
Physicians	32 (0.13)	3.44 (1.05–11.23) ^a	2.28 (0.66–7.89)
Nonphysician HCP	3 (0.04)	1.00	1.00
<i>Female</i>			
Physicians	2 (0.05)	0.30 (0.07–1.25)	0.22 (0.05–0.94) ^b
Nonphysician HCP	30 (0.17)	1.00	1.00

AOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval; HCP, healthcare providers; VV, varicose vein; DVT, deep venous thrombosis. ^a Adjusted for age, gender, and DVT history. ^b *p* < 0.05.

Table 5. Comparison of the VV risk among physician specialists by unconditional logistic regression

Specialty	<i>n</i> (%)	OR (95% CI)	AOR (95% CI) ^a
Surgery (<i>n</i> = 4,071)	9 (0.22)	2.33 (0.90–6.05)	1.95 (0.73–5.18)
Internal medicine (<i>n</i> = 6,091)	2 (0.03)	0.35 (0.07–1.63)	0.34 (0.07–1.61)
Pediatrics (<i>n</i> = 2,769)	0 (0.00)	–	–
Ob/gyn (<i>n</i> = 1,969)	3 (0.15)	1.61 (0.43–6.06)	1.64 (0.43–6.24)
Emergency medicine (<i>n</i> = 479)	0 (0.00)	–	–
Family medicine (<i>n</i> = 2,564)	5 (0.20)	2.06 (0.67–6.30)	1.92 (0.61–6.00)
Dual specialists (<i>n</i> = 4,071)	7 (0.17)	3.00 (1.09–8.27)	2.65 (0.93–7.53)
Others (<i>n</i> = 8,434)	8 (0.09)	1.00	1.00

AOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval; VV, varicose vein; Ob/gyn, obstetrics and gynecology; DVT, deep venous thrombosis. ^a Adjusted for age, gender, and DVT history.

tween physicians and nonphysician HCP depending on the gender. It seems that female physicians have a lower risk of VV (AOR 0.22; 95% CI 0.05–0.94), which might have an association with the shorter standing time of female physicians compared to nonphysician HCP. As a fact, the incidence of VV in female physicians is 0.05% and in nonphysician HCP it is 0.17%. In

the contrast, male physicians had a trend of a higher risk of VV than male nonphysician HCP (AOR 2.28; 95% CI 0.66–7.89).

The strength of this study is that it provided cumulative incidence of VV risk among physicians and nonphysician HCP that was more specific than a previous study in Austria which reported that chronic venous diseases

were present in a total of 70 general hospital employees (34%), predominantly among women [21]. However, that study included all chronic venous diseases and not only VV and it did not depict the individual results of physicians or comparisons with other populations [21]. Our study used the diagnosis made by physicians as the outcome measurement, which was also more objective than the questionnaire used in the abovementioned study.

The limitations of this study include the nonavailability of detailed information regarding standing and walking hours, family history, body mass index, surgery of the lower limbs, and parity, which might have confounded the results. Secondly, the follow-up period of 5 years was short. Further studies including detailed information, a longer follow-up period, and more patients are warranted.

Conclusion

In this study, the incidences of VV in physicians, non-physician HCP, and the general population were low and comparable. There was also no significant difference in VV risk among physician specialists.

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Disclosure Statement

The authors declare no conflicts of interest.

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