A Comparison of Atrial Fibrillation Incidence Among Physicians and the General Population
A Taiwanese Cohort Investigation
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Summary
The aim of this study is to explore the association of atrial fibrillation (AF) among physicians in Taiwan. We used Cox proportional hazards models to estimate the incidence rate and the adjusted hazard ratios (aHRs) with 95% confidence intervals (CIs) to determine the risk of AF in the physician study cohort relative to the comparison cohort.
A total of 22,479 physicians and 22,479 matched controls for comparison were included in the study. The Cox proportional hazard regression model revealed that male physician was associated with a trend toward increased risk of AF than nonphysician after adjusting for potential confounders (aHR, 1.05; 95% CI: 1.00-1.11). In age-specific analysis, male physicians aged ≤45 years showed the stronger association with AF (aHR, 1.33; 95% CI: 1.22-1.45). Further stratification with medical categories, surgeons had a significantly higher risk of AF than nonphysicians group (aHR, 1.28; 95% CI: 1.18-1.39).

We reported a pivotal study that showed possible relation between physician specialists and AF in the large cohort.

Key words: Risk

Although physicians are caring for patients, previous studies have shown that awareness, compliance, and adherence of physicians are worsening when compared with the general population.1-4) Atrial fibrillation (AF) is increasingly recognized as a global risk factor for many major diseases.5-9) Once a physician having an event of AF, not only personal medical staff health status involved but also further caring behavior might be influenced.

AF has serious impacts on the clinical course and is even more deleterious when compared with other diseases in terms of long-term possible consequences.6,7) For most physicians, it might be of interest to understand the association of AF in this population and the susceptible at-risk subgroup. Thus, we present an observational study on the basis of a sample of claims data from Taiwan to estimate the association of AF among physicians, and further, stratified analysis was performed.

Methods
Data source: The Taiwan National Health Insurance (NHI) is a single-payer, nationwide, and compulsory health insurance system in Taiwan, implemented in 1995, which covers approximately 99% of the entire 23 million Taiwan residents.10) The present study was a retrospective cohort study using datasets of registry of beneficiaries, inpatient claims, and board-certified specialists from 2000 to 2011 from the National Health Insurance Research Database (NHIRD). Information in the NHIRD database includes sociodemographic factors, data of clinical visits, and medical history based on the codes of the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM). All personal identification in the NHIRD is available in electronic format to protect the privacy of the insured population. Thus, patient informed consent is not required. This study has been approved by the Research Ethics Committee at China Medical University Hospital (CMUH104-REC2-115-CR-4).

Study population: Physician specialists whose licenses had been issued before 2000 were selected as the physician study cohort from the registry for board-certified specialists. We excluded physicians with incomplete information. The index date of all the study population was set as...
Statistical analysis:

Results

A total of 22,479 physicians and 22,479 matched controls for comparison were included in the study. Table I presents the demographic characteristics and comorbidities of the two cohorts. After matching, there was no significant difference between the physician cohort and the nonphysician comparison cohort in the distribution of age, sex, and comorbidities (P > 0.05). The mean ages of the physician cohort and the comparison cohort were 44.0 ± 10.09 and 43.7 ± 10.8 years.

Table II demonstrates the hazard ratio and 95% CI for the risk of AF in the physician cohort and the nonphysician comparison cohort stratified by sex. Notably, we observed different associations in the male and female groups. The Cox proportional hazard regression model revealed that male physician was associated with a trend toward increased risk of AF than nonphysician after adjusting for potential confounders (aHR, 1.05; 95% CI: 1.00-1.11). Instead, the incidence of AF were significantly lower in female physicians than in the comparison cohort (aHR, 0.25; 95% CI: 0.12-0.32). In age-specific analysis, male physicians aged ≤ 45 years showed the stronger association with AF (aHR, 1.33; 95% CI: 1.22-1.45). When stratified by comorbidity, the male physician cohort exhibited a significantly higher risk of AF than controls (aHR, 1.45; 95% CI: 1.34-1.57) in the subgroup of no comorbid-

January 1, 2000. The nonphysician comparison cohort comprised subjects without physician licenses who were randomly selected from all NHI beneficiaries. To reduce the difference in disease severity between the two cohorts, the nonphysician comparison cohort was frequency-matched with the physician study cohort at a 1:1 ratio according to the following covariates: age, sex, diabetes, hypertension, hyperlipidemia, coronary artery disease, peripheral arterial occlusive disease, chronic obstructive pulmonary disease, heart failure, cancer, chronic kidney disease, hyperthyroidism, gout, sleep disorders, and stroke. Those comorbidities were defined before the end date, which refers to the date of AF diagnosis, the date the patient was lost to follow-up, the date of death, the date of withdrawal from insurance, or the end of 2011 in both cohorts. The diagnostic accuracy of comorbidities based on ICD-9 codes has been examined in previous studies. Subjects with AF history before the index date were also excluded from the two cohorts. The event of interest in the study was a new diagnosis of AF (ICD-9-CM codes 427.31).

**Statistical analysis:** The distributions of the demographic characteristics and comorbidities between the physician study cohort and the nonphysician comparison cohort were compared using the Chi-square test for categorical variables and a two-sample t-test for continuous variables. The incidence of developing AF is quantified per 10,000 person-years. We used Cox proportional hazards models to estimate the incidence rate and the adjusted hazard ratios (aHRs) with 95% confidence intervals (CIs) to determine the risk of AF in the physician study cohort relative to the comparison cohort and further analyzed stratified by age and comorbidities. Kaplan-Meier analysis was used to plot the cumulative incidence of AF in both cohorts, with significance based on the log-rank test. Association between the medical categories of physician and AF was also estimated, stratified by age and follow-up year. All statistical analyses were performed with SAS version 9.4 (SAS Institute Inc, Cary, NC, USA). The level of statistical significance was set at P < 0.05.

Table 1. Comparisons in Demographic Characteristics and Comorbidities Between Study Physician and Nonphysician Cohorts

| Comorbidity                  | Nonphysicians (n = 22479) | Physicians (n = 22479) | P-value |
|------------------------------|---------------------------|------------------------|---------|
| Age, mean ± SD*              | 43.7 ± 10.8               | 44.0 ± 10.9            | 0.02    |
| Stratified age (years)       |                           |                        |         |
| ≤ 45                         | 14140 (62.9)              | 14134 (62.9)           | 0.95    |
| > 45                         | 8339 (37.1)               | 8345 (37.1)            |         |
| Gender                       |                           |                        | 0.87    |
| Female                       | 2140 (9.52)               | 2150 (9.56)            |         |
| Male                         | 20339 (90.5)              | 20329 (90.4)           |         |

| Comorbidity                  | Nonphysicians (n = 22479) | Physicians (n = 22479) | P-value |
|------------------------------|---------------------------|------------------------|---------|
| Diabetest                    | 1064 (4.73)               | 1081 (4.81)            | 0.71    |
| Hypertension                 | 2393 (10.7)               | 2403 (10.7)            | 0.88    |
| Hyperlipidemia               | 864 (3.84)                | 881 (3.92)             | 0.68    |
| Coronary artery disease (CAD)| 1117 (4.97)               | 1126 (5.01)            | 0.85    |
| Peripheral arterial occlusive disease (PAOD) | 46 (0.20) | 52 (0.23) | 0.54 |
| Chronic obstructive pulmonary disease (COPD) | 211 (0.94) | 203 (0.90) | 0.69 |
| Heart failure                | 223 (0.99)                | 228 (1.01)             | 0.81    |
| Cancer                       | 1029 (4.58)               | 1068 (4.75)            | 0.38    |
| Chronic kidney disease       | 126 (0.56)                | 138 (0.61)             | 0.46    |
| Hyperthyroidism              | 42 (0.19)                 | 38 (0.17)              | 0.65    |
| Gout                         | 312 (1.39)                | 318 (1.41)             | 0.81    |
| Sleep disorders              | 157 (0.70)                | 151 (0.67)             | 0.73    |
| Stroke                       | 765 (3.40)                | 766 (3.41)             | 0.98    |

*Chi-square test; *Two-sample t-test.
Table II. Incidence, Incidence Rate Ratio, and Adjusted Hazard Ratio of Subdivisions of Atrial Fibrillation Between Study Physician and Non-physician Cohorts by Sex

| Variable       | Male Nonphysician Event Ratea | Male Physician Event Rateb | Crude HR (95% CI) | Adjusted HR† (95% CI) | Female Nonphysician Event Ratea | Female Physician Event Rateb | Crude HR (95% CI) | Adjusted HR† (95% CI) |
|----------------|-------------------------------|-----------------------------|-------------------|-----------------------|--------------------------------|-------------------------------|-------------------|-----------------------|
| All            | 176                           | 7.93                        | 1.13 (1.06, 1.21) *** | 1.05 (1.00, 1.11)     | 8                               | 3.36                         | 3.19 (1.03, 1.19) | 0.35 (0.27, 0.46) *** |
| Stratified age |                               |                             |                   |                       |                                |                              |                   |                       |
| ≤ 45           | 26                            | 1.92                        | 1.30 (1.18, 1.42) *** | 1.33 (1.22, 1.45) *** | 5                               | 2.56                         | 0.00              |
| > 45           | 150                           | 17.4                        | 1.12 (1.02, 1.24) * | 1.11 (1.02, 1.21) *   | 3                               | 6.99                         | 3.76 (1.97, 7.18) | 0.97 (0.58, 1.61) (0.60, 1.40) |
| Comorbidity    |                               |                             |                   |                       |                                |                              |                   |                       |
| No             | 26                            | 1.43                        | 1.45 (1.34, 1.58) *** | 1.45 (1.34, 1.57) *** | 4                               | 1.86                         | 0.00              |
| Yes            | 150                           | 37.6                        | 1.09 (0.96, 1.24)   | 1.00 (0.88, 1.12)     | 4                               | 16.9                         | 3.16 (1.16, 8.78) | 0.69 (0.36, 1.30) (0.32, 1.00) |

*aIncidence rate, per 10,000 person-years. †Multivariable analysis including age and comorbidities. *P < 0.05, ***P < 0.001

Table III. Incidence, Crude, and Adjusted Hazard Ratios of AF Among Medical Categories Between Study Physician and Nonphysician Cohorts by Age

| Variable       | Event Ratea | Crude HR (95% CI) | Adjusted HR† (95% CI) |
|----------------|-------------|-------------------|-----------------------|
| Control        | 184         | 7.49              | 1 (Reference)         |
| Internist      | 29          | 5.05              | 0.67 (0.60, 0.76) *** |
| Surgeon        | 57          | 9.40              | 1.26 (1.15, 1.38) *** |
| Stratified age |             |                   |                       |
| ≤ 45 years     | 31          | 2.00              | 1 (Reference)         |
| Internist      | 7           | 1.73              | 0.87 (0.75, 1.00)     |
| Surgeon        | 10          | 2.58              | 1.29 (1.14, 1.47) *** |
| Stratified age |             |                   |                       |
| > 45 years     | 153         | 16.9              | 1 (Reference)         |
| Internist      | 22          | 12.9              | 0.77 (0.64, 0.92) **  |
| Surgeon        | 47          | 21.5              | 1.27 (1.11, 1.46) **  |

*aIncidence rate, per 10,000 person-years. †Multivariable analysis including sex, age, and comorbidities. **P < 0.01; ***P < 0.001.

Discussion

A large number of subjects involving the majority of this population in Taiwan is probably a major advantage. Moreover, statistical methods with baseline characteristics matching, crude and adjusted Cox hazard models, and stratified estimation are other strengths of this analysis.

Once AF happens, it has a serious impact on physician health performance. Generally, AF occurs as a reflection of the promotion of disease state. For example, the prevalence of AF increases in heart failure according to the increment of NYHA class. AF increases in patients with hypertension in comparison with those without hypertension, but even in hypertension patients, AF increases according to the levels of blood pressure. Interestingly, the association is even stronger among those without medical comorbidity among male doctors. On a reasonable basis, the difference between physicians and nonphysicians in demographic-matched populations could be possibly explained by some kinds of confounding unrecognized by the described patient characteristics, such as blood pressure control, the longevity of the history of diabetes, amount of drinking, amount of smoking, the disease state of cardiovascular diseases including CAD or others, and the stage of cancer. Although focusing on the clinical implication of AF, it might not be avoidable to discuss the
patient background that causes AF. Among those without comorbidity, a physician may receive more health checkup programs than the general population. Such medical bias would happen, and it may be one of the causes of the strong association of AF in those without comorbidity. However, there may be a significant difference in terms of diagnostic chance of AF between physicians and non-physicians, which should be a nonnegligible bias to the whole studied population not only to those without comorbidity. Furthermore, the observation that young male physicians and surgeons are at an enhanced risk of AF happens among physician specialists. Not only the medical bias might be involved. Additionally, the high-risk susceptible subgroup, such as younger male sex and surgeon were also found. Taken together, more awareness and attention should be given to this group, especially those without comorbidity, a physician may receive more health checkup or prescription of how people were handled if they were in the end stage of health system might be involved. Additionally, the high-risk susceptible subgroup, such as younger male sex and surgeon were also found. Taken together, more awareness and attention should be given to this group, especially while arrhythmia or arrhythmia-like symptoms attack. Once AF was documented, the CHA2DS2-VASc scoring system should be applied immediately so that further anticoagulation strategies can be determined.

**Limitations:** Details were not given on whether AF was paroxysmal, persistent, or permanent and a clearer description of how people were handled if they were in the end stage of AF. Additionally, the high-risk susceptible subgroup, such as younger male sex and surgeon were also found. Taken together, more awareness and attention should be given to this group, especially while arrhythmia or arrhythmia-like symptoms attack. Once AF was documented, the CHA2DS2-VASc scoring system should be applied immediately so that further anticoagulation strategies can be determined.

**Conclusion**

This study showed possible relation between physician specialists and AF.

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**Table IV.** Incidence, Crude, and Adjusted Hazard Ratios of AF Among Medical Categories Between Study Physician and Nonphysician Cohorts by Follow-Up

| Variable | Event Rate | Crude HR (95% CI) | Adjusted HR† (95% CI) |
|----------|------------|------------------|----------------------|
| Follow-up ≤ 8 years | | | |
| Control | 108 | 36.7 | 1 (Reference) | 1 (Reference) |
| Internist | 19 | 33.9 | 0.92 (0.84, 1.02) | 0.96 (0.88, 1.04) |
| Surgeon | 26 | 42.3 | 1.15 (1.05, 1.26) ** | 1.21 (1.12, 1.31) *** |
| Follow-up > 8 years | | | |
| Control | 76 | 9.83 | 1 (Reference) | 1 (Reference) |
| Internist | 10 | 5.35 | 0.54 (0.47, 0.63) *** | 0.59 (0.52, 0.66) *** |
| Surgeon | 31 | 15.8 | 1.61 (1.46, 1.77) *** | 1.53 (1.40, 1.67) *** |

*Incidence rate, per 10,000 person-years. †Multivariable analysis including sex, age, and comorbidities. **P < 0.01; ***P < 0.001.

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**Disclosure**

**Conflicts of interest:** None.

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