

Prevalence of metabolic syndrome among employees of a taiwanese hospital varies according to profession

Wei-Chung Yeh, MD^{a,b}, Hai-Hua Chuang, MD^c, Mei-Chun Lu, MD^d, I-Shiang Tzeng, PhD^e, Jau-Yuan Chen, MD^{a,b,*}

Abstract

This study aimed to explore the prevalence of metabolic syndrome (MS) among various employee groups at a Taiwan hospital.

We retrospectively compared the prevalence of MS, as defined by the Taiwan Department of Health, among employee groups (physicians, nurses, medical technicians, and administrative staff) at a medical center in northern Taiwan in 2011. Total cholesterol was used in lieu of high-density lipoprotein cholesterol values.

The overall prevalence of MS among the 1673 men and 5117 women investigated was 12.0%. Physicians had the highest prevalence of MS (18.3%). Abdominal obesity and high blood sugar were the most (29.3%) and least (10.5%) prevalent abnormalities, respectively.

The hospital employees had a moderate prevalence of MS. Physicians and administrative staff members had higher prevalence of MS than the other populations.

Abbreviations: HDL = high-density lipoprotein, MS = metabolic syndrome, OR = odds ratio.

Keywords: health promotion, hospital employees, metabolic syndrome, physicians

1. Introduction

Metabolic syndrome (MS) is one of the most important worldwide health issues. In Taiwan, 25.5% of men and 31.5% of women have MS, and its prevalence is increasing.^[1] The same is also true in the United States.^[2] MS encompasses a collection of abnormalities including central obesity, high blood pressure, hyperglycemia, hypertriglyceridemia, and low levels of high-density lipoprotein (HDL). These abnormalities normally lead to cardiovascular disease and diabetes mellitus.^[3–7] In 1988, Reaven reported a relationship between insulin resistance and cardiovascular disease, and named the cluster of associated abnormalities “Syndrome X,” which is now known as MS.^[8,9] Obesity, old age, sedentary lifestyle, smoking, postmenopausal status, high carbohydrate and soft drink intake,

and low income are proven risk factors for MS.^[10–12] Furthermore, hospital workers appear to be at higher risk of adverse health effects, including MS because of the strain of heavy workloads, long working hours, and shift work.^[13–15] Previous studies have shown that obesity and MS are prevalent in hospital workers^[16,17]; however, such studies have seldom compared prevalence across different departments. Therefore, the purpose of this study was to explore and compare the prevalence of MS among the different employee groups at a hospital in Taiwan.

2. Materials and methods

2.1. Data sources

According to occupational health regulations in Taiwan, workers across the country require periodic health checks. The frequency of the health check is based on a worker’s age, and is performed as often as once a year to once every 5 years. To enroll as many hospital workers as possible in our study, we retrospectively collected health examination results obtained between 2007 and 2012, and chose the most recent data available for each worker during this period. Employees were divided into 4 groups: nurses, physicians, medical technicians, and administrative staff. The project was approved by the Institutional Review Board of Linkou Chang Gung Memorial Hospital (103-4326B), and all participants provided written informed consent before enrolling in the study. The final group enrolled in the analysis included 6790 participants. Such enrolled data through project stored and managed solely to Chang Gung Memorial Hospital in Linkou. Note that data cannot be publicly deposited.

2.2. Diagnosis of MS

MS was diagnosed according to the American Heart Association/National Heart, Lung, and Blood Institute criteria, when a person presented with ≥ 3 of any of the following five

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^a Department of Family Medicine, Chang-Gung Memorial Hospital, Linkou Branch, ^b Chang Gung University College of Medicine, Taoyuan, ^c Department of Family Medicine, Chang-Gung Memorial Hospital, Taipei Branch, Taipei, ^d Department of Family Medicine, Chang-Gung Memorial Hospital, Taoyuan Branch, Taoyuan, ^e Department of Research, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, New Taipei City, Taiwan (R.O.C.).

* Correspondence: Jau-Yuan Chen, MD. Department of Family Medicine, Chang-Gung Memorial Hospital, Linkou Branch, No.5, Fuxing St., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) (e-mail: welins@cgmh.org.tw).

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abnormalities: central obesity (waist circumference ≥ 102 cm in men or ≥ 88 cm in women; waist circumference ≥ 90 cm in men or ≥ 80 cm in women for Asian Americans), hypertriglyceridemia (triglycerides ≥ 150 mg/dL or the subject was taking lipid-controlling medication), low HDL (HDL; < 40 mg/dL in men, < 50 mg/dL in women, or the subject was taking lipid-controlling medication), high blood pressure (systolic ≥ 130 mmHg/diastolic ≥ 85 mmHg, or the subject was taking hypertension medication), and hyperglycemia (fasting glucose ≥ 100 mg/dL or subject was on medication for diabetes).^[18] As Taiwan is an Asian country, central obesity in Taiwanese national MS criteria was defined as waist circumference ≥ 90 cm in men and ≥ 80 cm in women by the Taiwan Department of Health. Moreover, HDL is not included in the health check parameters mandated by occupational health regulations; therefore, high total cholesterol (≥ 200 mg/dL or taking lipid-controlling medication) was the criterion used instead of low HDL value.

2.3. Statistical analysis

Data were summarized as mean and standard deviation for continuous variables or frequency and percentage for categorical variables. The trend across different professions (the order is set as nurse, medical technician, administration and physician) on continuous data was tested using linear contrast in the general linear model. Likewise, the trend across professions on distribution of categorical data was tested using Cochran-Armitage χ^2 trend test. Finally, we evaluated the association between professions and prevalence of MS in the stratum of age and sex by using logistic regression analysis. All tests were 2-tailed and $P < .05$ was considered statistically significant. Data analyses were conducted using SPSS 22 (IBM SPSS Inc., Chicago, IL).

3. Results

The study included 1673 men and 5117 women with complete biochemistry data. Nurses comprised the largest group in this cohort with 2333 workers (34.4%) and were the youngest group

with 81.3% younger than 40 years. Approximately two-thirds of the physicians (63.5%) were male, whereas the other professions were majority female. Physician and administrative staff employees had higher prevalence of overweight (50.3% and 46.3%). In general, the values of waist circumference, systolic blood pressure, diastolic blood pressure, and level of biochemistry data were highest in physician, following by administrative staff, medical technician, and nurse (Table 1).

The overall prevalence of MS was 12%. Among the 5 components of MS, central obesity was the most prevalent abnormality (29.3%), followed by high blood pressure (26.7%) and hypercholesterolemia (25.9%), whereas high blood sugar was the least prevalent abnormality (10.5%). The prevalence of components of MS (except for central obesity) and number of MS were highest in physician, following by administration staff, medical technician, and lowest in nurse. Administration staff had the highest prevalence of central obesity (34%) compared to other professions (Table 2).

After stratifying age and sex, the results suggested that female administration staff had higher prevalence of MS than female medical technician in either younger cohort (odds ratio [OR] 2.57, 95% confidence interval [CI] 1.40–4.72) or elder cohort (OR 1.81, 95% CI, 1.28–2.56). Regarding the male cohort, the prevalence of MS was significantly higher in physician than that in medical technician for the elder cohort (OR 1.94, 95% CI, 1.24–3.04), whereas these difference was not observed in either younger or elder cohorts of female population (Table 3).

4. Discussion

A previous study revealed that 25.5% of men and 31.5% of women in Taiwan have MS.^[11] The prevalence of MS in the hospital investigated in this study was lower than that of the general population. This might be owing to workers in the hospital being younger and exhibiting a healthy worker effect. However, compared to other occupations in Taiwan, the prevalence of MS in hospital workers was not lower. For example, a study of a labor force population in Taiwan showed the prevalence of MS was 12.1%.^[19] Therefore, hospital workers

Table 1

Demographics, anthropometrics, substance use, and biochemistry data of the study participants stratified by different professions.

Variable	Total (N = 6790)	Nurse (n = 2333)	M-technician (n = 1271)	Administration (n = 1578)	Physician (n = 1608)	P trend
Male sex, n (%)	1673 (24.6)	14 (0.6)	266 (20.9)	372 (23.6)	1021 (63.5)	<.001
Age, y	38.7 \pm 9.0	34.4 \pm 7.0	40.7 \pm 7.6	42.9 \pm 9.2	39.3 \pm 9.7	<.001
Age ≥ 40 years, n (%)	2583 (38.0)	437 (18.7)	629 (49.5)	887 (56.2)	630 (39.2)	<.001
Height, cm	161.7 \pm 7.7	159.0 \pm 5.4	161.1 \pm 7.3	160.6 \pm 7.6	167.2 \pm 8.0	<.001
Weight, kg	62.0 \pm 12.7	57.9 \pm 10.7	61.1 \pm 12.4	62.5 \pm 12.2	68.2 \pm 13.4	<.001
Body mass index, kg/m ²	23.6 \pm 3.9	22.9 \pm 4.0	23.4 \pm 3.7	24.2 \pm 4.0	24.3 \pm 3.6	<.001
Overweight (BMI > 24), n (%)	2726 (40.1)	724 (31.0)	462 (36.3)	731 (46.3)	809 (50.3)	<.001
Waist circumference, cm	78.5 \pm 10.1	75.2 \pm 9.2	78.1 \pm 9.8	79.5 \pm 9.9	82.5 \pm 10.3	<.001
Systolic blood pressure, mmHg	120.1 \pm 14.7	116.4 \pm 12.8	119.1 \pm 14.0	122.6 \pm 16.1	123.6 \pm 14.8	<.001
Diastolic blood pressure, mmHg	73.8 \pm 10.8	71.4 \pm 9.8	73.3 \pm 10.6	75.2 \pm 11.4	76.4 \pm 10.9	<.001
Smoking, n (%)	355 (5.2)	14 (0.6)	77 (6.1)	176 (11.2)	88 (5.5)	<.001
Alcoholic drinking, n (%)	1880 (27.7)	443 (19.0)	340 (26.8)	466 (29.5)	631 (39.2)	<.001
Biochemistry data						
Fasting glucose, mg/dL	88.5 \pm 15.7	86.4 \pm 13.6	88.2 \pm 13.0	90.5 \pm 18.5	90.0 \pm 17.1	<.001
Total cholesterol, mg/dL	181.2 \pm 31.9	177.0 \pm 31.5	180.8 \pm 30.9	184.7 \pm 32.1	184.3 \pm 32.3	<.001
Triglycerides, mg/dL	91.2 \pm 68.2	77.0 \pm 52.6	87.0 \pm 46.7	97.2 \pm 60.3	109.3 \pm 98.3	<.001
ALT, U/L	20.9 \pm 23.7	17.5 \pm 17.4	21.0 \pm 28.2	21.3 \pm 29.8	25.5 \pm 20.1	<.001
Creatinine, mg/dL	0.69 \pm 0.21	0.61 \pm 0.12	0.67 \pm 0.16	0.69 \pm 0.27	0.81 \pm 0.21	<.001

ALT = alanine aminotransferase, BMI = body mass index, M-technician = medical technician. Continuous data were presented as mean \pm standard deviation.

Table 2
Prevalence of metabolic syndrome, components of metabolic syndrome, and number of components of metabolic syndrome stratified by different professions.

Variable	Total (N=6790)	Nurse (n=2333)	M-technician (n=1271)	Administration (n=1578)	Physician (n=1608)	P trend
Central obesity, n (%) [*]	1987 (29.3)	613 (26.3)	362 (28.5)	536 (34.0)	476 (29.6)	<.001
High blood pressure, n (%) [†]	1810 (26.7)	384 (16.5)	306 (24.1)	528 (33.5)	592 (36.8)	<.001
Hypercholesterolemia, n (%) [‡]	1758 (25.9)	486 (20.8)	321 (25.3)	461 (29.2)	490 (30.5)	<.001
Hyperglycemia, n (%) [§]	716 (10.5)	173 (7.4)	124 (9.8)	205 (13.0)	214 (13.3)	<.001
Hypertriglyceridemia, n (%)	750 (11.0)	129 (5.5)	110 (8.7)	208 (13.2)	303 (18.8)	<.001
MetS, n (%) [¶]	813 (12.0)	155 (6.6)	120 (9.4)	243 (15.4)	295 (18.3)	<.001
Number of component of MetS	1.03±1.14	0.77±0.99	0.96±1.06	1.23±1.20	1.29±1.24	<.001

M-technician = medical technician, MetS = metabolic syndrome. Continuous data were presented as mean ± standard deviation.

^{*} Waist circumference ≥90 cm in men or ≥80 cm in women.

[†] Systolic blood pressure ≥130 mmHg/diastolic blood pressure ≥85 mmHg.

[‡] Total cholesterol ≥200 mg/dL.

[§] Fasting glucose ≥100 mg/dL.

^{||} Triglycerides ≥150 mg/dL.

[¶] ≥3 Components.

still have risk of MS even they have more knowledge of it. This phenomenon possibly could be explained by the job stress of hospital employee in Taiwanese. According to a study on job stress and burnout among workers at another Taiwanese hospital, more than half of the employees had shift work and long working hours; the rate of burnout was >50% in nurses and physician assistants.^[20] Additionally, nurses in Taiwan were found to have greater work pressure, and physicians had a higher depression rate (13.3%) than the general population (3.7%).^[21,22] As for pressure-related symptoms, a study of 775 health workers at 2 Taiwanese hospitals revealed nervousness in 64.4%, nightmares in 33.7%, irritability in 44.1%, headaches in 40.8%, insomnia in 35.0%, and gastrointestinal distress in 41.4% of workers.^[23] Many studies have shown that job stress and long working hours can lead to MS.^[24-28] Therefore, job strain appears to increase the risk of MS in Taiwanese health workers.

Table 3
The association between professions and prevalence of metabolic syndrome by using logistic regression analysis stratified by age and sex.

Subgroup/profession	No. of MetS (%)	OR (95% CI)	P
20–40 years and female (n=3431)			
Nurse	93 (4.9)	1.74 (0.99–3.02)	.051
Medical technician	15 (2.9)	Ref.	Ref.
Administration	40 (7.1)	2.57 (1.40–4.72)	.002
Physician	18 (3.8)	1.34 (0.67–2.69)	.412
41–65 years and female (n=1686)			
Nurse	60 (13.9)	1.29 (0.87–1.91)	.200
Medical technician	54 (11.1)	Ref.	Ref.
Administration	119 (18.4)	1.81 (1.28–2.56)	.001
Physician	15 (12.6)	1.16 (0.63–2.14)	.635
20–40 years and male (n=776)			
Nurse	1 (10.0)	0.52 (0.06–4.32)	.545
Medical technician	22 (17.6)	Ref.	Ref.
Administration	20 (15.3)	0.84 (0.44–1.64)	.615
Physician	91 (17.8)	1.02 (0.61–1.70)	.949
41–65 years and male (n=897)			
Nurse	1 (25.0)	1.29 (0.13–12.84)	.830
Medical technician	29 (20.6)	Ref.	Ref.
Administration	64 (26.6)	1.40 (0.85–2.30)	.189
Physician	171 (33.5)	1.94 (1.24–3.04)	.004

CI = confidence interval, MetS = metabolic syndrome, OR = odds ratio.

The most prevalent components of MS in our study were central obesity (29.3%) and high blood pressure (26.7%). Similar results were shown in other international studies.^[2,13,16,17] Therefore, controlling waist circumference and blood pressure are vital for improving the health status of hospital workers.

Besides, we found that the nurses had the lowest prevalence of MS. It was probably because most of them were female and younger. A study of 5936 Taiwanese individuals showed that the prevalence of MS was higher in men (18.3%) than in women (13.6%).^[29] Some Taiwanese and European studies also showed similar trends,^[30–32] but some studies did not.^[33,34] A Taiwanese study by Hwang et al^[35] showed that women younger than 50 years had lower prevalence of MS than men with same age, but women older than 50 years had higher prevalence than men with same age. The reason was attributed to men being more insulin-resistant than women in lower age groups,^[36] whereas the protective effect of sex hormone decreases in women after menopause, leading to weight gain and insulin resistance. Therefore, postmenopausal women are more readily afflicted with MS.^[37,38] Of note, most of the nurses in our study were females younger than 40 years, and it may contribute to nurse having the lowest prevalence of MS.

We also found that physicians and administrative staff members have higher prevalence of MS than the other populations. In Taiwan, most physicians have long working hours; in a study by Chou et al,^[20] 48.5% of hospital physicians worked >44 hours per week. In another hospital in Taiwan, Wang et al^[22] found that 45.67% of physicians worked 9–12 hours/day, and 16.07% of physicians worked >16 hours. Japanese and Taiwanese studies have shown that longer working hours (>10 hours/day) produce a higher risk of MS and cardiovascular disease.^[39,40] Long working hours, such as those of physicians, result in less sleep and exercise, and even change eating habits; these may contribute to higher prevalence of MS. Other contributors to the physician's higher prevalence of MS are likely to be the depressed mood and burnout caused by job stress. Physicians in Taiwan were found to have higher depression rates than the general population and a US study showed that physicians were easy to be burnout than people of other professions (37.9% vs. 27.8%, respectively).^[22,41] Besides, the elder male physicians had higher prevalence of MS than elder male medical technician, whereas the female physicians did not in either younger or elder cohorts. This might be because of the sex difference in specialty, working hours, and biological response

for Taiwanese physicians. Taiwanese female physicians tend to choose their specialty as pediatrics or internal medicine, whereas the male physicians choose internal medicine or surgery.^[42] Besides, compared to male physicians, female physicians have less working hours in average (62.7 hours/week vs. 66.2 hours/week).^[43] Additionally, higher glucocorticoid response to stress was found in male but not in female physicians according to a Germany study.^[44] This finding showed a certain stress resistance in women. No difference was observed in the age group of 20 to 40 years, which in itself is likely to vastly lower the risk of MS.

According to an occupational study in the United States, administrative staff had more sedentary hours and lower physical job demands than individuals holding other jobs.^[45] In a Dutch study, 76% to 80% of working hours among financial service provider employees and institutional researchers comprised of sedentary time.^[46] Furthermore, an Australian study of office workers showed that sedentary time accounted for 81.8% of their working hours.^[47] As separate studies have revealed that sedentary lifestyles may be a risk factor for MS,^[48,49] the fact that the administrative staff in our study had a higher prevalence of MS than medical technicians may be attributable to their sedentary working style.

4.1. Limitations

This is a single-institution study as a limitation. Besides, using hypercholesterolemia in lieu of the actual MS criterion of low levels of HDL could have skewed our results. Furthermore, there was a lack of information regarding working hours, working conditions, and lifestyles of hospital workers; therefore, some of the parameters that may have helped explain MS prevalence in the high-risk groups of our study remained unknown. Finally, sample size of some population was very small (i.e., male nurses) and the sample size of populations differs largely, which may produce inaccurate results.

5. Conclusions

MS was prevalent in the Taiwanese hospital workers investigated in this study. Physicians and administrative staff members had higher prevalence of MS than the other populations. Further studies ought to focus on the working conditions and lifestyles of individuals in these high-risk groups.

Author contributions

Conceptualization: Hai-Hua Chuang, Jau-Yuan Chen.

Data curation: Hai-Hua Chuang, Jau-Yuan Chen.

Methodology: Mei-Chun Lu, I-Shiang Tzeng, Jau-Yuan Chen.

Resources: Hai-Hua Chuang, Jau-Yuan Chen.

Software: Mei-Chun Lu, I-Shiang Tzeng.

Validation: I-Shiang Tzeng.

Writing – original draft: Wei-Chung Yeh.

Writing – review & editing: Hai-Hua Chuang, Jau-Yuan Chen.

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