Incidence and Factors Associated with Overweight and Obesity, and Hypertensive Disorder, among Staff in a Private Healthcare Setting: A Retrospective Cohort Study

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Objective: *To determine the incidence and factors associated with overweight and obesity, and hypertensive disorder, among staff in a private healthcare setting.*

Material and Method: *The present retrospective cohort study examined the computerized data of Bumrungrad International (BI) Hospital staff that had undergone pre-employment and annual/bi-annual check-ups, between January 2000 and June 2006.*

Results: *Data for the 3,678 staff surveyed comprised 7,338 visits, with a median follow-up time of 1.9 years; 81.9% were females, and the mean age (SD) was 27.1 (6.8) years. On their first visit, 8.5% could be classified as overweight or obese (Body Mass Index-[BMI] of 25.0+ kg/m²). The overall incidence of these conditions was 22.2/1,000 person-years (95%; Confidence Interval [CI] = 18.8-26.1). Cox's regression analysis revealed that incidence increased with age (Relative Hazard [RH] = 4.4 for age 20-44 years [95% -CI 1.6-12.2], and RH = 8.2 [95% CI 2.4-27.5] for age ≥ 45 years, reference: < 20 years), but decreased among the registered nurses and ancillary professional staff (RH = 0.3, 95% CI 0.2-0.6). At cohort entry, 41.0% could be classified as pre-hypertensive (blood pressure 120-139/> 80-89 mmHg) and 1.9% as stages I and II hypertension. The overall incidence of hypertensive disorder was 16.9/1,000 person-years (95%; CI 13.6-20.9). Baseline pre-hypertensive (RH 4.9, 95%; CI 2.6-9.3), males (RH 1.7, 95%; CI 1.1-2.7), age ≥ 45 years (RH 3.2, 95%; CI 1.0-10.5), and BMI (RH ranges 3.3-6.4) were identified as independent risk factors for incident hypertension. In addition, 2.5% were HBsAg-positive, and 33.3% had HBsAb antibody.*

Conclusion: *The present retrospective cohort study was instituted in a private healthcare setting, information generated resulted in changes to the health-promotion programs of the organization.*

Keywords: *Hypertension, Obesity, Health Provider, Thailand*

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In 2008, Thailand, a developing country, had a reported life expectancy of 66.0 years for males and 74.0 years for females; these figures are relatively low, compared with Malaysia, Singapore, Vietnam, the People's Republic of China, and the Republic of Korea[1]. Although recent studies have shown that Thailand's mortality data are limited and imperfect, it has been found consistently that stroke, diabetes, liver cancer, and ischaemic heart disease, are among the top ten causes of mortality[2-4]. Except for hepatitides, the risk factors for these conditions include sedentary lifestyle, increased consumption of saturated fat and cholesterol, low intake of polyunsaturated fat, increasing obesity, hypertension, cigarette smoking, and diabetes mellitus, contributing to a wide variety of metabolic-syndrome-related diseases[5-10]. Most of these conditions can easily be detected by routine blood tests. Early identification and management can prevent progression to the more severe manifestations of disease. A study in Thailand has estimated that the prevalence of diabetes among Thai adults was 9.6%, with an estimated 5.4% of the Thai population showing impaired fasting glucose[11]. The cross-sectional National Health Examination Survey II (NHESII) documented the prevalence of overweight (body mass index (BMI) ≥ 25 kg/m²) as 28.3% and obesity (BMI ≥ 30 kg/m²) as 6.8% among 3,220 Thai adults aged 20-59 years[12]. A cross-sectional survey

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reported prevalence of 1.5% for cardiovascular diseases among adult Thai men, and 1.7% among women[13]. The Shinawatra Employee institutional study using actual check-up data recommended routine blood pressures measurements for males aged $\geq$ 25 years and females aged $\geq$ 40 years[14]. Hepatitis B virus (HBV) infection is considered a risk to healthcare workers (HCW), particularly when the at-risk population is not fully immunised. Examples may be found among Thai medical students or workers undergoing physical check-ups[15,16]. A recent study in Thailand estimated that about 80% of people not covered by the national Expanded Program of Immunizations (EPI) with hepatitis B vaccination are at risk of hepatitis B infection, and its complications[17].

Bumrungrad International (BI) Hospital, in downtown Bangkok, Thailand, is a private hospital in Southeast Asia, with 554 acute beds (http://www.bumrungrad.com/). It also has private clinics with international-standard diagnostic and therapeutic facilities in the region and has a capacity of 3,500 patients per day. In 2006, it had about 2,800 staff, of whom about one-third (excluding physicians) were HCW, another third were workers or skilled staff, with direct/indirect patient contact.

With substantial increases in the volume of patients under care and the numbers of staff each year, together with management concern about its staff's well-being, senior Bumrungrad International administrators launched a retrospective study of selected staff health profiles. It was believed that many of the above conditions could be prevented via interventions, and that HCW could be potential cohorts for epidemiological studies, as had been done elsewhere[18-20].

The present study thus aimed to document the prevalence and incidence of overweight, obesity, hypertension (HT), diabetes mellitus (DM), impaired fasting glucose (IFG), abnormal lipid and uric acid profiles, and hepatitis B virus (HBV) markers among Hospital staff who underwent routine their pre-employment and/or physical check-ups between January 2000 and June 2006. It also explored factors associated with the incidence of hypertensive disorder, overweight, and obesity.

Material and Method

Setting

The present study, of retrospective cohort design[21], used the health data of Bumrungrad International staff data gathered at different annual/bi-annual check-ups, compiled onto computerized medical records. All staff with Bumrungrad Employee identification (ID) cards, which had had their annual/bi-annual check-ups recorded in the hospital computerized medical records between January 2000 and June 2006, and those who had undergone pre-employment physical check-ups, were eligible for inclusion in the present study. Excluded were physicians' check-up data, since physicians were considered not to be the Hospital staff, and records without staff identification numbers. Staff IDs and hospital numbers (HN) were used as unique identifiers for data management purposes; study IDs were created to permit non-nominal, anonymous data links. The Hospital Administration approved the conduct of the study, and the Bumrungrad International Institutional Review Board (IRB) provided scientific and ethical approval. Staff were counseled, referred, and/or treated after their check-ups using standard Bumrungrad International practices.

Study variables

The study variables included date of birth, sex, employment status at BI, job title, vital signs, selected laboratory results (complete blood count, blood sugar, lipid and uric acid profiles, and serological hepatitis-B test). Neither Human Immunodeficiency Virus (HIV) serology nor serological tests for syphilis (if any) were retrieved.

Data management

The laboratory data were archived by the computerized system (formerly Hospital 2000 Health Information System, Bangkok; currently, Microsoft Amalga Health Information System version 6.0 SP3, http://www.microsoft.com/amalga/default.mspx). Therefore, there was little need for new manual data entry. Only the relevant study data that had been recorded onto non-digitized scanned documents were extracted onto Case Report Forms (CRF) and entered manually twice using a customized program, created by the Hospital Information System (IS) Department.

Data analysis

The prevalence of each condition was described as percentage (%) with 95% confidence interval (CI). Incidence was calculated using incidence density and 95% CI[22]. Chi-square (χ^2) tests, with 95% CI, were used for bi-variable comparisons of proportions and rates, and Student's t-test or analysis of variance (ANOVA) were used for mean differences, where appropriate[23]. Since overweight, obesity, and hypertensive disorders, are conditions that can be considered a continuum in disease progression, ordinal logistic regression was used[24] to determine factors associated with these conditions. Cox's proportional hazard model was used to determine factors associated with the incidence of these conditions[22,25]. Spearman's correlation was used to analyze trends in annual prevalence. The statistical package Stata/SE version 9.2 (StataCorp, College Station, TX, USA) was used for data analysis. Statistical significance was based on $\alpha = 0.05$, with 2-sided testing.

Results

General description

The present study data were extracted from the health records of 3,678 staff from four Bumrungrad International associated companies, comprising a total of 7,338 visits (median 2 visits, range 1-7 visits), and a median follow-up period of 1.9 years (range 0-5.9 years). Most of the study population was female (81.9%); their mean age ($\pm$ SD) was 27.1 $\pm$ 6.8 years, with most (89.0%) aged between 20-44 years. Regarding their job type, 31.3% were nurses and professional staff, 30.9% skilled workers (drivers, nursing assistants, porters, etc), 17.5% front-office staff (interpreters, patient services, receptionists, etc), 11.5% back-office staff (clerks, communication officers, secretaries, etc.) and 8.8% administrative staff.

Of the total sample, 888 (24.1%) reported they had been smokers and 5.0% of these were still smokers. Similarly, 24.0% reported that they had consumed alcohol and 95 (10.7%) were current alcohol drinkers. Among these staff, 0.9% reported diabetes mellitus (DM), and 0.9% took lipid-lowering drugs.

Complete blood counts (CBC) showed that most of the females (72.9%) and males (75.8%) were not anemic. Of these CBC results (n = 2,955 for females and n = 654 for males), 10.5 and 8.7%, respectively, suggested iron-deficiency anemia.

Overweight and obesity

On their first visit, 67.2% of the staff were classified as having Body Mass Index (BMI) measurements in the normal range (18.5-24.9 kg/m^2), while 24.4% were underweight (BMI < 18.5 kg/m^2), 7.0% overweight (BMI 25.0-29.9 kg/m^2), and 1.5% obese (BMI $\geq$ 30.5 kg/m^2). Table 1 shows the factors associated with obesity on the first visit, *i.e.*, sex, age, and job type. Ordinal logistic regression, treating the above BMI categories as an ordinal scale, showed that males had a 3.2-fold higher risk of obesity than females; those aged > 45 years had a 4-fold greater risk than those aged < 20 years, while registered nurses and ancillary professional staff were about 1.5-2.0-fold leaner than the other job categories.

During the study period, the average prevalence of these conditions was 8.8%, but there was no significant trend (p = 0.76). The overall incidence of overweight and obesity in this cohort was 22.2/1,000 person-years (95%; CI 18.8-26.1). Cox's regression analysis, controlling for sex, revealed that the incidence of these conditions increased significantly with age (Relative Hazard (RH) = 4.4 for

Table 1. Factors associated with overweight and obesity, on the first visit*

Variables	Odds ratio	95% CI (LL)**	95% CI (UL)**	p-value
Sex				
Female	1.0			<0.001
Male	3.2	2.6	3.9	
Age (years)				
< 20	1.0***			<0.001
20-44	1.2	0.9	1.5	
45+	4.0	2.4	6.7	
Job type				
Others	1.0***			<0.001
Registered nurses & ancillary professional staff	0.5	0.4	0.6	
Front office	0.6	0.5	0.7	

* Ordinal logistic regression model
** 95% confidence interval (CI) with lower limit (LL) and upper limit (UL)
*** Referent

age 20-44 years, and RH = 8.2 for age 45 years), but decreased significantly (about 3-fold) among the registered nurses and ancillary professional staff, RH = 0.3, Table 2).

Hypertension

On the first visit, 0.9% reported a history of hypertension; 57.1% had normal blood pressures < 120/80 mmHg), 41.0% pre-hypertensive (120-139/ > 80-89 mmHg), 1.8% stage I hypertension (140-159/ 90-99 mmHg), and 0.1% stage II hypertension (≥ 160-179/ ≥ 100-109 mm Hg)[26]. Ordinal logistic regression analysis indicated that sex, age, job type, and BMI were independently associated with increased hypertension (Table 3). Males had about five-fold higher risk of hypertensive disorder; a similar trend was seen in age, particularly age ≥ 45 years (odds ratio [OR] 6.0, 95% CI 3.5-10.3), registered nurses (RN)

Table 2. Risk factors for overweight and obesity; Bumrungrad International staff retrospective cohort*

Variables	Relative hazard	95% CI (LL)**	95% CI (UL)**	p-value
Sex				
Female	1.0***			0.44
Male	1.2	0.8	1.8	
Age (years)				
< 20	1.0***			0.003
20-44	4.4	1.6	12.2	
45+	8.2	2.4	27.5	
Job type				
Others	1.0***			<0.001
Registered nurses & ancillary professional staff	0.3	0.2	0.6	
Front office	0.7	0.4	1.2	
Back office	0.6	0.3	1.1	
Skilled/workers	0.9	0.6	1.4	

* Cox's proportional hazard model (Schoenfeld's residual Goodness-of-Fit, p = 0.42)
** 95% confidence interval (CI) with lower limit (LL) and upper limit (UL)
*** Referent

Table 3. Factors associated with hypertension, on the first visit*

Variables	Odds ratio	95% CI (LL)**	95% CI (UL)**	p-value
Sex				
Female	1.0***			<0.001
Male	4.9	4.0	6.0	
Age (year)				
< 20	1.0***			<0.001
20-44	1.6	1.2	2.0	
45+	6.0	3.5	10.2	
Job type				
Others	1.0***			<0.001
Registered nurses & ancillary professional staff	0.7	0.6	0.8	
Front office	0.8	0.7	1.03	
BMI (kg/m2)	<18.5	1.0***		<0.001
18.5-24.9	1.4	1.2	1.7	
25-29.9	3.7	2.7	5.0	
30+	9.4	5.1	17.5	

* Ordinal logistic regression model
** 95% confidence interval (CI) with lower limit (LL) and upper limit (UL)
*** Referent

and ancillary professional staff had about 1.4-fold lower risk than the other job types; a significant trend was noted with increased BMI.

The annual prevalence of pre-hypertensive disorder between 2000 and 2006 was 43.2, 46.4, 45.4, 39.5, 32.9, 31.4, and 30.6%, respectively, with a significantly decreasing trend (Spearman's correlation = -0.89, $p < 0.01$). Meanwhile, the annual prevalence of hypertension for the same period was 2.2, 2.8, 1.4, 3.0, 0.7, 2.6, and 3.3%, respectively, with no significant trend (Spearman's correlation = 0.32, $p = 0.48$). The overall incidence of hypertensive disorder in the present cohort was 16.9/1,000 person-years (95% CI 13.6-20.9), and the incidence of pre-hypertension becoming hypertension was 38.3/1,000 person-years (95% CI 30.3-48.4). A retrospective cohort study was then conducted to determine risk factors for the incidence of hypertension. Table 4 shows the results of Cox's regression analysis; baseline pre-hypertensive (RH 4.9), male gender (RH 1.7), age $\geq$ 45 years (RH 3.2), and BMI (RH range 3.3-6.4) were found to be independent risk factors for hypertension.

Diabetes mellitus

Fasting Blood Sugar (FBS) and lipid profiles were only assessed for staff aged $\geq$ 40 years, at total of only 210 examinations. Of these, 80% had FBS < 100 mg/dL, 17% had 100-125 mg/dL, and 3.0% had $\geq$ 126 mg/dL. No significant trend was found over time ($p = 0.3$)

Lipid and uric acid profiles

Of 209 cholesterol-test samples, 87 (42.0%) had results < 200 mg/dL, 80 (38%) 200-239 mg/dL, and 42 (20.0%) $\geq$ 240 mg/dL. For triglyceride (n = 208), 85.0% were < 150 mg/dL, 9.0% 150-199 mg/dL, and 6.0% $\geq$ 200 mg/dL. Of 207 samples examined for blood uric acid, only 2 (1.0%) were > 8 mg/dL. There was no significant trend over time for any of these lipids ($p > 0.2$ for all variables).

Hepatitis B serology

For hepatitis B surface antigen (HBsAg) and antibody (HBsAb) tests: of 2,608 blood samples, 2.5% were HBsAg-positive and 33.3% already had antibody.

Discussion

The present study documents prevalence and incidence of selected health profiles of healthcare workers during the periods of their active working and sexual lives. Some still engaged in risk behaviours such as smoking, and substantial percentages were current alcohol drinkers, although the prevalence of smoking was about 3-fold lower than the Shinawatra Employee study[27]. Recent studies found similar problems among medical students and physicians, even in developed countries[28-30]. These phenomena would require appropriate interventions. The presented anemia data cannot be compared with the Shinawatra study, since different cut-off points were used, but they may be considered as much lower than

Table 4. Risk factors for hypertension; Bumrungrad International staff retrospective cohort*

Variables	Relative hazard	95% CI (LL)**	95% CI (UL)**	p-value
BP status at baseline				
Normotensive	1.0***			<0.001
Pre-hypertensive	4.9	2.6	9.3	
Sex				
Female	1.0***			0.026
Male	1.7	1.1	2.7	
Age (years)				
< 20	1.0***			0.031
20-44	1.3	0.5	3.7	
45+	3.2	1.0	10.5	
Body mass index (BMI) (kg/m2)	<18.5	1.0***		0.006
18.5-24.9	3.3	1.01	10.6	
25.0-29.9	6.5	1.9	22.6	
30+	6.4	1.4	29.3	

* Cox's proportional hazard model (Schoenfeld's residual Goodness-of-Fit, p = 0.35)
** 95% confidence interval (CI) with lower limit (LL) and upper limit (UL)
*** Referent

national estimates, particularly among non-pregnant women[31].

The presented data showed that the prevalence of overweight and obesity combined (8.5%) was also less than reported in the Thai enterprise referred to above (13.9%)[27], in the NHESII survey[12], and was much lower than the Royal Thai Army personnel (overweight 27.1%; obesity 4.9%)[32]. The prevalence of these conditions was also about 2-fold lower than those reported in Italian and Turkish healthcare workers[33,34]. However, the incidence of overweight and obesity was rather high (22.2/1,000 person-years), and needed appropriate interventions. The risk factors identified by the presented data were consistent with previous health-risk studies-and many of these diseases are preventable[5,7]. Since the available data did not indicate a clear overweight/obesity BMI cut-off points for all Asians, no attempt was made to redefine cut-off points for Asians separately. Thus, the WHO BMI cut-off points were used to facilitate international data comparison[35].

The present study found the prevalence of stage I hypertension to be about 4.1-fold lower than that found in the Shinawatra Employee Study[14], about 15-fold lower than the survey made in an accredited community pharmacy[36], and about 9.3-fold lower than among people in Thai rural communities[37]. The lower prevalence found in the present study population may be attributed to the "healthy worker effect[38]". However, the alarmingly high incidence is of concern, and would require appropriate interventions. The decline in prevalence, despite the high incidence, may be attributable to appropriate treatment of the staff affected.

The samples tested for FBS were limited, and the lipid results were only for subjects aged $\geq$ 40 years. Thus, the data cannot be compared with prevalence estimates from other studies. However, they were relatively high, compared with the available data from the Shinawatra study.

The prevalence of hepatitis B markers found in the present study was slightly lower than data obtained from community surveys for both HBsAg (2.5% vs. 4.3%) and its antibody (33.3% vs. 58.8%)[39] but much lower antibody than the medical students in another study[40] (33.3% vs. 69.6%), who may have already been vaccinated. However, it was not possible to document the history of immunization in the present study.

The present study caught the attention of hospital administrators, together with the medical decision, and then resulting in changes to the check-up and health-promotion programs at BI. For example, check-up programs changed from bi-annual to annual, and FBS testing was extended to those aged < 40 years. Activities, including small-group exercises and the Bumrungrad International Smart Healthy Project were established for the obese and/or overweight, and those with related problems, and a quit-smoking program was started for cigarette smokers[41]. Staff directly involved in patient care were given free hepatitis B vaccinations, with discounted prices offered to staff involved indirectly in patient care. The present study showed that the Hospital computerized medical and laboratory records were potentially rich sources of clinical information for healthcare evaluation and clinical research. The present study required substantial data-management skills, since it involved 690,311 records and more than 100 database fields. It also demonstrated that a study could be conducted in a private setting, information generated was used to change the health-promotion programs of the organization.

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Potential conflicts of interest

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อุบัติการณ์และปัจจัยที่สัมพันธ์กับภาวะน้ำหนักเกิน ความอ้วน และความดันโลหิตสูง ในประชากรที่ให้บริการสุขภาพภาคเอกชน: การศึกษาติดตามแบบย้อนหลัง

ทวิป กิตยาภรณ์, นิตย์ สุดหล้า, ไกรฤกษ์ อธิรกุล, กัลยา เจนกลรบ, สิน อนุราษฎร์, จิตรา อนุราษฎร์

วัตถุประสงค์: *เพื่อหาอุบัติการณ์และปัจจัยที่สัมพันธ์กับภาวะน้ำหนักเกิน ความอ้วน และความดันโลหิตสูง ในพนักงานของสถานพยาบาลเอกชน*

วัตถุและวิธีการ: *ใช้การศึกษาย้อนหลังโดยใช้ฐานข้อมูลการตรวจร่างกายแรกรับเข้าทำงาน และการตรวจร่างกายรายปี/ ราย 2 ปี ของพนักงานโรงพยาบาลบำรุงราษฎร์ อินเตอร์เนชั่นแนล ระหว่างมกราคม พ.ศ. 2543 ถึงมิถุนายน พ.ศ. 2549*

ผลการศึกษา: *ข้อมูลได้จากพนักงาน 3,678 ราย มารับการตรวจ 7,338 ครั้ง โดยมีมัธยฐานของการติดตาม 1.9 ปี ร้อยละ 81.9 เป็นหญิง อายุเกณฑ์เฉลี่ย (ส่วนเบี่ยงเบนมาตรฐาน) 27.1 (6.8) ปี พบว่าในการตรวจร่างกายครั้งแรก ร้อยละ 8.5 จัดได้ว่ามีน้ำหนักเกินหรืออ้วน (ดัชนีมวลกายตั้งแต่ 25 กิโลกรัม/ตารางเมตร) อุบัติการณ์ของภาวะน้ำหนักเกิน และอ้วนอยู่ที่ 22.2/1,000 person-years (95%; Confidence Interval (CI) = 18.8-26.1) การวิเคราะห์ด้วย Cox's regression พบว่า อุบัติการณ์ของภาวะน้ำหนักเกินหรืออ้วน เพิ่มขึ้นตามอายุ (Relative Hazard (RH) = 4.4 ในช่วงอายุ 20-44 ปี, 95%; CI 1.6-12.2) RH = 8.2 (95%; CI 2.4-27.5) ที่อายุตั้งแต่ 45 ปี ขึ้นไป เทียบกับอายุน้อยกว่า 20 ปี และพบว่าอุบัติการณ์ลดลงในกลุ่มพยาบาลวิชาชีพและสหสาขาวิชาชีพ (RH 0.3, 95% CI 0.2-0.6) ในขณะที่เริ่มตรวจครั้งแรกร้อยละ 41.0 พบว่าอยู่ในระยะ pre-hypertensive (ความดันโลหิต 120-139/ > 80-89 mmHg) และร้อยละ 1.9 มีภาวะความดันโลหิตสูงระยะที่ 1 หรือ 2 อยู่แล้ว อุบัติการณ์ของภาวะความดันโลหิตสูงอยู่ที่ 16.9/1,000 person-years (95%; CI 13.6-20.9) และสัมพันธ์กับภาวะพื้นฐานที่มี pre-hypertension อยู่แล้ว (RH 4.9, 95%; CI 2.6-9.3) เพศชาย (RH 1.7, 95%; CI 1.1-2.7) อายุตั้งแต่ 45 ปีขึ้นไป (RH 3.2, 95%; CI 1.0-10.5) และค่าดัชนีมวลกาย (RH มีค่าตั้งแต่ 3.3-6.4) นอกจากนี้ ยังพบว่าร้อยละ 2.5 มีผลการตรวจ HBsAg เป็นบวก และร้อยละ 33.3 มีภูมิคุ้มกัน HBsAb อยู่แล้ว*

สรุป: *การศึกษาแบบย้อนหลังสามารถทำได้ในสถานพยาบาลเอกชนและมีผลทำให้เกิดการเปลี่ยนแปลงในโครงการส่งเสริมสุขภาพในองค์กร*