Cardiovascular Disease Risk Factors Among Blue and White-collar Workers in Indonesia

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ABSTRAK

Latar belakang: *penyakit kardiovaskular (PKV) adalah penyebab kematian yang paling umum di Indonesia. Tujuan penelitian ini adalah mempelajari faktor risiko PKV pada pekerja umur 40 – 69 tahun yang dikaitkan dengan status pekerjanya.* ***Metode:*** *studi potong lintang pada seluruh provinsi di Indonesia. Studi ini menganalisis faktor-faktor yang berhubungan dengan penyakit kardiovaskular. Data berasal dari survei kesehatan nasional/ RISKESDAS (Riset Kesehatan Dasar). Analisis terbatas pada populasi pekerja usia 40-69 tahun. Terdapat 137.378 subyek yang dianalisis. Analisis cox's regression yang dimodifikasi digunakan untuk menghitung rasio prevalensi hubungan antara penyakit kardiovaskular (PKV) dengan diabetes melitus (DM), hipertensi, stres, indeks massa tubuh (IMT), merokok dan faktor demografi lainnya.* ***Hasil:*** *PKV berhubungan dengan pekerjaan; pekerja white collar berisiko 1.6 kali terdiagnosis PKV dibandingkan dengan pekerja blue collar. Namun, pekerja blue collar lebih cenderung melaporkan gejala PKV dibanding dengan pekerja white collar. Prevalensi PKV lebih tinggi pada wanita dibandingkan dengan laki-laki. PKV meningkat berdasarkan usia dan pendidikan. Hipertensi, DM, stres, dan peningkatan IMT merupakan prediktor dari PKV: prevalence ratio (PR) 1,72 (95% CI 1,59-1,86), 3,89 (95% CI 3,43-4,44), 3.02 (95% CI 2,77-3,29) dan 1.42 (95% CI 1,28-1,57) pada IMT ≥27 dibandingkan <25 kg/m^2. Studi ini tidak menjelaskan hubungan antara PKV dengan merokok.* ***Kesimpulan:*** *studi ini membuktikan bahwa faktor risiko utama dapat dimodifikasi untuk menurunkan CVD. Beberapa hubungan mungkin mencerminkan akses ke pelayanan kesehatan.*

Kata kunci*: penyakit kardiovaskular, pekerja, studi populasi, Indonesia.*

ABSTRACT

Background: *cardiovascular diseases (CVD) is the most common cause of death in Indonesia. We aimed to examine risks of CVD in workers aged 40 to 69 year related to their occupational status.* ***Methods:*** *a cross-sectional study in all provinces of Indonesia. Data from a large-scale national health survey called RISKESDAS were used to analyze factors associated with CVD. Analysis was restricted to the working population aged 40 to 69 year. There were 137,378 subjects included in the analysis. Cox's regression analysis was modified to calculate prevalence ratio for the association of CVD with diabetes mellitus (DM), hypertension, stress, body mass index (BMI), smoking, and particular demographic factors.* ***Results:*** *CVD was associated with occupation; white collar workers were about 1.6 times as likely to be diagnosed with CVD as to blue collar workers. However, blue collar workers were more likely to report symptoms of CVD than white collar workers. Prevalence of CVD was higher in women than men, increasing by age and education attainment. Hypertension, DM, stress, and increased BMI added the prediction of CVD: prevalence ratio (PR) was 1.72 (95% CI 1.59-1.86), 3.89 (95% CI 3.43-4.44), 3.02 (95% CI 2.77-3.29) and 1.42 (95% CI 1.28-1.57) for BMI ≥27 relative to <25 kg/m^2, respectively.*

The study could not explain the association with smoking. ***Conclusion:*** *this study added evidence of major risk factors which could be modified to reduce CVD. Some associations were likely to reflect access to health care.*

Keywords: *cardiovascular disease, worker, population-based study, Indonesia.*

INTRODUCTION

Epidemiologic transition indicated by a shift in the leading causes of mortality and morbidity from communicable disease to non-communicable disease has been occuring in Indonesia since 1995. The proportion of mortality by non-communicable disease has increased from 43% in 1995 to 60% in 2007.[1] Cardiovascular disease (CVD), a class of non-communicable diseases which includes heart disease and stroke, is the leading cause of death globally. Indonesian Household Health Survey shows that the number of death caused by CVD was increasing; it ranked 11 in 1972 and climbed to number 3 in 1986, and become the leading cause of death ever since.[2] It is etimated that 17.3 million people died from CVD in 2008.[3]

Cardiovascular disease is recognized as the degenerative condition that mostly affects older adults and the work force. Numerous studies have been conducted to investigate the risk factors of CVD. Biological and behavioral risk factors for CVD include older age, smoking, hypercholesterolemia, hypertension, diabetes, obesity, lack of exercise, psychosocial factors, and heredity.[4] Studies that examined determinants of CVD in workers show similar risk factors to those in the general population.[5,6] Furthermore, CVD studies among workers revealed an association between socio-economic status and CVD.[7,8] This difference may be due to a disparity in educational background and health related lifestyle among socio-economic groups.

Efforts to reduce CVD risks and mortality have been successfully achieved in many developed countries.[9] However, information on CVD risk factors among workers in Indonesia is limited. The aim of this study was to examine factors associated with CVD in Indonesia among workers aged 40 to 69 year, which is the age group with high-risk according to WHO. Specifically, we aimed to determine whether there was a difference in prevalence of CVD between blue collar workers and white collar workers, and to explore factors contributing to the disparities of cardiovascular risks related to occupational status.

METHODS

We used data from the 2007 Indonesian National Health Survey (RISKESDAS). The study design was a cross-sectional in all provinces of Indonesia. Details of the Household Health Survey were described in a previous study.[10] The study population were all households in Indonesia. Block census in each district/town was selected by probability proportional to size (PPS) to the total households of the district/town. Sixteen households were then selected from block census by simple random sampling. All members of the selected households were included.

Trained interviewers used a structured and standardized questionnaire to obtain information. Cardiovascular disease status was assessed from the subject's report, based on diagnosis of a health provider or admission of symptoms of CVD (e.g. heart disease or stroke). Employment status was assessed and categorized into white-collar worker, blue-collar worker, and other. The white-collar workers include government/private official, army force, trader, and services. Blue-collar workers were those who work as laborer, farmer or fishermen. Others were those who were not specified as white collar or blue collar worker. Other information was also assessed such as demograhic characteristics (e.g. age, sex, level of education), smoking status (ever versus never), BMI (according to 2010 BMI Indonesia Ministry of Health category: <25, 25-26.9 and ≥27), hypertension and diabetes. Hypertension was assessed from subject's report, based on blood pressure measurement, a previous hypertension diagnosis, and current consumption

of anti-hypertension drugs. We used JNC VII 2003 criteria to define hypertension as systolic blood pressure >140 mmHg or diastolic blood pressure >90 mmHg.

In this analysis, 150,395 subjects aged 40 to 69 year old and currently employed were eligible. However, some subjects could not be analyzed because of missing information: 317 subjects had no information on education, 563 subjects missing smoking status, 1,883 subjects missing diabetes status, 4,345 subjects missing hypertention status, 749 subjects missing height and weight status, 2,617 subjects missing information on stress, and 2,543 subjects missing information on CVD. This led to 137,378 subjects to be included in the analysis.

The prevalence of cardiovascular disease according to diagnosis and symptoms by putative risk factors and subgroup of workers were examined. We calculated adjusted prevalence ratio (and 95% Confidence interval) derived from a modified Cox regression to estimate the risk of CVD.[11]

RESULTS

The study revealed that 2,754 (2%) respondents had been diagnosed with CVD and 14,595 (10.6%) respondents reported symptoms of CVD (**Table 1**). The prevalence of CVD based on diagnosis were higher in those aged 60–69 year, female, college graduated, white collar and other employment, BMI ≥27, history of stress, and history of hypertension and diabetes. The prevalence of CVD based on reported symptoms showed a similar pattern, however there was a difference according to education and smoking in which the prevalence of CVD was higher in workers with primary school education or less (11.8%), smokers (11.1%), and blue collar worker (12%).

Multivariable adjusted estimates are shown in **Table 2**. The data show an approximately 2-fold increased risk of CVD among those aged 60-69 year in comparison to those aged 40-49 year (PR 2.21, 95% CI 1.99-2.44). Workers aged 50-59 were 1.5 times more likely to have CVD (PR 1.58, 95% CI 1.44-1.72). Similarly, those who had a high level of education compared to those who completed primary education or less were 1.6 times more likely to develop CVD (PR 1.59, 95% CI 1.39-1.82). White collar workers had an approximately 40% increased risk in the prevalence of CVD compared to blue collar workers (PR 1.42, 95% CI 1.29-1.55). Those who had BMI ≥ 27 were 1.4 times more likely to have CVD than the lowest BMI category (PR 1.42, 95% CI 1.28-1.57) while the risk of CVD was only slightly increased in those with BMI of 25.0 – 26.9 (PR 1.19, 95% CI 1.06-1.34). There was 3-fold increased risk of having CVD in workers who had stress compared to those who did not have stress (PR 3.04, 95% CI 2.77-3.29). Additionally, there was an increased prevalence of CVD in those with hypertension compared to those who did not have hypertension (PR 1.72, 95% CI 1.59-1.86). The workers who had diabetes were 3.9 times more likely to have CVD compared to workers who did not have diabetes (PR 3.289, 95% CI 3.43-4.44). Smoking was not associated with prevalence of CVD (PR 0.95, 95% CI 0.86 – 1.05). However, those who previously smoked had approximately 2-fold increase prevalence of CVD than those who never smoke (PR 1.94, 95% CI 1.71 – 2.21), and current smoker had 24% reduced prevalence of CVD compared to non-smoker (PR 076, 95% CI 0.68 – 0.84). The study did not find a difference in risk of CVD between male and female workers.

When stratified by occupational status (while collar and blue collar), all risk estimates were elevated among white collar workers but were strongest in association with older age, college education, hypertension and diabetes. Among the blue collar workers, BMI, stress, and diabetes showed the strongest associations (**Table 3**). The CVD risk factors associated with level of education among blue collar workers could not be evaluated as there were a very small number of subjects (6 respondents) in the high level education category.

DISCUSSION

This study provides additional evidence on CVD risks among workers in Indonesia. The prevalence of CVD among workers aged 40 to 69 year was 12.6% based on previous diagnosis and reported symptoms. Factors contributing to an increased prevalence of CVD include older age,

Table 1. Prevalence of CVD based on demographical characteristics

Variables	Subject N = 137378	Diagnosis n = 2754 (%)	Symptoms n = 14595 (%)
Age (Years)			
- 40-49	69859	958 (1.4)	6320 (9.2)
- 50-59	45221	1046 (2.3)	5161 (11.7)
- 60-69	22298	750 (3.4)	3114 (14.5)
Sex			
- Male	88670	1679 (1.9)	8634 (9.9)
- Female	48709	1075 (2.2)	5961 (12.5)
Education			
- Non to Junior HS	107230	1908 (1.8)	12404 (11.8)
- High School	20370	532 (2.6)	1517 7.6)
- College	9778	314 (3.2)	674 (7.1)
Job			
- Blue-collar	82088	1268 (1.5)	9724 (12.0)
- White-collar	50385	1285 (2.6)	4330 (8.8)
- Others	4932	201 (4.1)	541 (11.4)
BMI (kg/m^2)			
- <25	107745	1906 (1.8)	11508 (10.9)
- 25.0 – 26.9	14486	353 (2.4)	1413 (10.0)
- ≥ 27	15147	495 (3.3)	1674 (11.4)
Smoking Status			
- Ever	73743	1356 (1.8)	8051 (11.1)
- Current	65557	917 (1.4)	6901 (10.7)
- Past	8186	439 (5.4)	1150 (14.8)
- Never	63635	1398 (2.2)	6544 (10.5)
Stress			
- Yes	13919	726 (5.2)	4250 (32.2)
- No	123459	2028 (1.6)	10345 (8.5)
Hypertension			
- Yes	62951	1761 (2.8)	7425 (12.1)
- No	74427	993 (1.3)	7170 (9.8)
Diabetes Mellitus			
- Yes	2297	273 (11.9)	352 (17.4)
- No	135081	2481 (1.8)	14243 (10.8)

education, education attainment, BMI levels, stress, hypertension or diabetes, similar to CVD risk factors in the general population. Present study contrast previous studies reporting that high level of education increase the prevalence of CVD among white collar workers.

Another interesting finding from this study was that the prevalences of CVD were different between white collar and blue collar workers when information on CVD was derived from diagnosis by health provider or by reported symptoms. Prevalence of CVD assessed in diagnosis was higher among white collar workers than blue collar workers. However, when the CVD was assessed by reported symptoms only, a higher prevalence of CVD was found among blue collar workers than white collar workers. This difference in prevalence of CVD based on diagnosis and symptoms reported between two subgroups of workers might be due to the difference in socio-econonmic status which play a role in access to health services.

Table 2. Prevalence ratios (PR) of diagnosed CVD according to risk factors

Variables	CVD Diagnosis		Crude PR (95% CI)	Adjusted PR (95% CI)
	Yes (n=2754 (%))	No (n=134624 (%))		
Age (Years)				
- 40-49	958 (1.4)	69859 (98.6)	1	1
- 50-59	1046 (2.3)	45221 (97.7)	1.67 (1.53,1.82)	1.58 (1.44,1.72)
- 60-69	750 (3.4)	22298 (96.6)	2.41 (2.19,2.64)	2.21 (1.99,2.44)
Sex				
- Female	1075 (2.2)	48708 (97.8)	1	1
- Male	1679 (1.9)	88670 (98.1)	0.86 (0.80,0.93)	0.92 (0.85,0.99)
Education				
- Non to Junior HS	1908 (1.8)	105322 (98.2)	1	1
- High School	532 (2.6)	19838 (97.4)	1.47 (1.33,1.61)	1.37 (1.23,1.53)
- College	314 (3.2)	9464 (96.8)	1.80 (1.60,2.03)	1.60 (1.41,1.83)
Job				
- Blue-collar	1268 (1.5)	82008 (98.5)	1	1
- White-collar	1285 (2.6)	50358 (97.4)	1.65 (1.53,1.78)	1.41 (1.29,1.55)
- Other	201 (4.1)	4932 (95.9)	2.63 (2.27,3.06)	1.68 (1.44,1.97)
BMI (kg/m2)				
- < 25	1906 (1.8)	105839 (98.2)	1	1
- 25.0 – 26.9	353 (2.4)	14133 (97.6)	1.38 (1.23,1.54)	1.19 (1.06,1.34)
- ≥ 27	495 (3.3)	14652 (96.7)	1.85 (1.67,2.04)	1.42 (1.28,1.57)
Smoking Status				
- Never	1398 (2.2)	62237 (97.8)	1	1
- Ever	1356 (1.8)	72387 (98.2)	0.84 (0.78,0.90)	0.95 (0.86,1.05)
- Current	917 (1.4)	64640 (98.6)	0.64 (0.59,0.69)	0.76 (0.68,0,84)
- Past	439 (5.4)	7747 (94.6)	2.44 (2.19,2.72)	1.94 (1.71,2,21)
Stress				
- No	2028 (1.6)	123459 (98.4)	1	1
- Yes	726 (5.2)	12919 (94.8)	3.17 (2.92,3.46)	3.02 (2.77,3.29)
Hypertension				
- No	993 (1.3)	74427 (98.7)	1	1
- Yes	1761 (2.8)	82951 (97.2)	2.09 (1.94,2.67)	1.72 (1.59,1.86)
Diabetes Mellitus				
- No	2481 (1.8)	135081 (98.2)	1	1
- Yes	273 (11.9)	2297 (88.1)	6.47 (5.71,7.33)	3.89 (3.43,4.44)

Previous studies in the US and Japan showed that blue collar workers had higher prevalence and higher mortality caused by CVD than white collar workers.[12-14] Background characteristics as well as working environment exposures were among factors that contribute to the difference in prevalence. It is established that CVD is related to lifestyle and individual behavior. A previous study revealed that blue collar workers had a low education and low salaries were more likely to be exposed to unhealthy life styles and poor living conditions compared to white collar workers.[15] A study done by Nakamura et al found that obesity was more prevalent among blue collar workers than the white collar.[12] The condition may escalate the risk of chronic diseases such diabetes and CVD, leading to a high risk of mortality.[16,17] Another study by Greenlund et al supports these findings that low education and unhealthy life style were associated with CVD.[18] The association between an increased risk of CVD and high education levels among

Table 3. Adjusted prevalence ratio of risk factors in diagnosed CVD based on employment

Variables	White-Collar Worker n=1285 (%)	Adjusted PR in White-Collar Worker	Blue-Collar Worker n=1268 (%)	Adjusted PR in Blue-Collar Worker
Age (Years)				
- 40-49	513 (1.7)	1	423 (1.1)	1
- 50-59	514 (3.3)	1.67 (1.48-1.89)	470 (1.7)	1.39 (1.22-1.59)
- 60-69	258 (5.2)	2.57 (2.20-3.01)	375 (2.4)	1.81 (1.57-2.09)
Education				
- Non-Junior HS	607 (2.3)	1	1207 (1.6)	1
- High School	404 (2.7)	1.44 (1.26-1.64)	55 (1.4)	1.05 (0.80-1.38)
- College	274 (3.1)	1.69 (1.46-1.96)	6 (1.9)	1.21 (0.54-2.69)
BMI (kg/m^2)				
- < 25	748 (2.2)	1	1026 (1.5)	1
- 25.0 – 26.9	206 (2.7)	1.12 (0.96-1.31)	117 (1.9)	1.26 (1.04-1.53)
- ≥ 27	331 (3.6)	1.37 (1.20-1.57)	125 (2.4)	1.49 (1.23-1.79)
Stress				
- No	1001 (2.2)	1	875 (1.2)	1
- Yes	284 (6.8)	2.95 (2.58-3.38)	393 (4.3)	3.18 (2.82-3.58)
Hypertension				
- No	439 (1.6)	1	495 (1.2)	1
- Yes	846 (3.6)	1.84 (1.64-2.08)	773 (2.1)	1.63 (1.45-1.83)
Diabetes Mellitus				
- No	1114 (2.3)	1	1204 (1.5)	1
- Yes	171 (11.7)	3.62 (3.08-4.27)	64 (10.3)	5.04 (3.91-6.49)

white collar workers in this study may be related to the accessibility of healthcare among those with high education, as observed in the study by Dunlop et al.[19] Because very few subjects held college degrees among blue collar workers, the association of CVD with level of education could not be identified. In addition, chemical and physical hazards in the workplace are potential contributor to the risk of modifiable CVD such as hypertension, hypercholesterolemia or diabetes.[20]

This study found that higher BMI increased the prevalence of CVD both in white collar and blue collar workers. The findings were consistent with previous studies which observed increased risk of CVD in overweight groups.[6,21] A study by Kokkinos discovered that every increase in BMI increased CVD-related mortality, especially those with BMI >29 kg/m^2 had the highest CVD-related mortality.[22] Another study found other factors correlated with obesity including low income and low education.[23]

About 46% of the workers had hypertension. This study showed that those who had hypertension were 1.6 to 1.8 times more likely to have CVD. The result was in agreement with the study conducted by Conen et al that observed an increase of CVD by 56% among those who had hypertension compared to no hypertension over 4 years of follow-up.[24] That study also found that those who had hypertension were more likely to have diabetes and hypercholesterolemia. Diabetes appeared to be the strongest risk factor of CVD among workers; there was 3 to 5 times greater prevalence of CVD among workers who had diabetes compared to non-diabetes. It is postulated that insulin deficiency led to an increased blood glucose that influence glucose intolerance which is a predisposing factor of vascular disease.[25]

Psychosocial hazards at work have been recognized as a risk factor of CVD. This study did not measure stress specifically related to work environment. However, about 10% of workers reported to experience stress; those who were reported with stress were 3 times

more likely to have CVD. A study conducted by Hirokawa et al on job-related stress in relation to cardiovascular stress reactivity found that job stressors contributed to the change of cardiovascular reactivity including blood pressure and heart rate.[26] Another study added to the evidence that job-related stress affected development of CVD through other CVD risk factor, namely smoking.[27] Smoking has been proved as a major risk of CVD. Previous study found that smoking was the second largest risk of CVD.[28] The present study observed about 54% of workers had history of smoking, but did not detect any association between history of smoking and prevalence of CVD. When smoking status was categorized into past and current smokers, however, those who smoked in the past had higher prevalence compared to current smokers. The results reflected the limitation of the cross-sectional study design in which those who develop CVD may change their risk factor. Moreover, the findings are subjected to limitation as other risk factors, such as diet, cholesterol levels, and sedentary life style were not taken into account since they were not measured in present study. Nevertheless, this analysis was done on a large sample representing workers in Indonesia.

CONCLUSION

This study indicates that increased prevalence of CVD was associated with diabetes, stress, hypertension, high level of BMI, and high education attainment among workers. However, it is not clear from this data whether high education attainment correlated with unhealthy lifestyles or healthcare accessibility. In addition, the higher prevalence of CVD among blue-collar workers assessed by self-reported symptoms need further study to clarify health care accessibility and lifestyles in the low income segment of workers.

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REFERENCES

1. Ministry of Health, Republic of Indonesia. Report of National Basic Health Research (Riskesdas 2007). Jakarta: Indonesia; 2008.
2. Ministry of Health, Republic of Indonesia. Indonesian Health Profile 2003. Jakarta: Indonesia; 2003.
3. World Health Organization. Global atlas on cardiovascular disease prevention and control. World Health Organization. Geneva; 2011.
4. HS Buttar, T Li, N Ravi. Prevention of cardiovascular diseases: Role of exercise, dietary interventions, obesity and smoking cessation. Exp Clin Cardiol. 2005;10(4):229-49.
5. Pyakuel P, Karki P, Lamsal M, Ghimire A, Phokarel K. Cardiovascular risk factors among industrial workers a cross-sectional study from eastern Nepal. J Occup Med Toxicol.2016;11(25):1-7.
6. Kaur P, Rao TV, Sankarasubbaiyan S, et al. Prevalence and distribution of cardiovascuar risk factors in an urban industrial population in south India. J Assoc Physicians India. 2007;55:771-6.
7. Davey Smith G, Carroll D, Rankin S. Socio-economic differentials in mortality: evidence from Glasgow graveyards. BMJ. 1992;305:1554-7.
8. Fukuda Y, Nakamura K, Takano T. Accumulation of health risk behaviours is associated with lower socio-economic status and women's urban residence: a multilevel analysis in Japan. BMC Public Health. 2005;5(53):1-10.
9. World Health Organization. Global status report on non-communicable disease 2014. Switzerland: WHO Press, World Health Organization; 2014.
10. The National Institute of Health Research and Development, Ministry of Health. Republic of Indonesia. Result of National Basic Health Research (RISKESDAS 2007). Jakarta, Indonesia, 2008.
11. Lee J, Tan CS, Chia KS. A practical guide for multivariate analysis of dichotomous outcomes. Ann Acad Med Singapore. 2009;38(8):714-9.
12. Nakamura S, Nakamura K, Tanaka M. Increased risk of coronary heart disease among in Japanesse blue-collar workers. Occup Med. 2000;50(1):11-7.
13. Buring JE, Evans DA, Fiore M, Rosner B, Hennekens CH. Occupation and risk of death from coronary heart disease. JAMA. 1987;258:791-2.
14. Lukhaupt SE, Calvert GM. Prevalence of coronary heart disease or stroke among workers aged <55 years - United States, 2008–2012". Centers for Disease Control and Prevention: Morbidity and Mortality Weekly Report. 2014;60(30):645-9.
15. Clougherty JE, Souza K, Cullen MR. Work and its role in shaping the social gradient in health. Ann N Y Acad Sci. 2010;1186:102-24.
16. Davey Smith G, Hart C, Blane D. Lifetime socioeconomic position and mortality: prospective observational study. BMJ. 1997;314:547-52.
17. Lynch JW, Kaplan GA, Shema SJ. Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. N Eng J Med. 1997;337:1889-95.
18. Greenlund KJ, Zheng ZJ, Keenan NL, Giles WH,

Casper ML, Mensah GA, Croft JB. Trends in self-reported multiple cardiovascular disease risk factors among adults in the United States, 1991-1999. Arch Intern Med. 2004;164:181-8.

19. Dunlop S, Coyteb PC, McIsaac W. Socio-economic status and the utilisation of physicians' services: results from the Canadian National Population Health Survey. Soc Sci Med. 2000;51:123-33.
20. Bhatnagar A. Environmental cardiology: studying mechanistic links between pollution and heart disease. Circulation Res. 2006;99:692–705.
21. Suka M, Miwa Y, Ono Y, Yanagisawa H. Impact of weight gain on cardiovascular risk factors in Japanese male worker. J Occup Environ Med. 2012;54:1288-92.
22. Kokkinos P. Pysical activity and cardiovascular disease prevention. United States: Jones and Bartlett Publisher; 2010.
23. Harrell JS, Gore SV. Cardiovascular risk factors and socioeconomic status in African American and Caucasian women. Res Nurs Health. 1998;21:285-95.
24. Conen David, Ridker PM, Buring JE, Glynn RJ. Risk of cardiovascular events among women with high normal blood pressure or blood pressure progression: prospective cohort study. BMJ. 2007;335:452.
25. Brownson, Ross C, Patrick L. Remington, Davis JR. Chronic disease and control: diabetes. Washington: American Public Health Association; 1993.
26. Hirokawa K, Ohira T, Nagayoshi M, et al. Occupational status and job stress in relation to cardiovascular stress reactivity in Japanese workers. Preventive Med Rep. 2016;4:61-17.
27. Green KL, Johnson JV. The effect of social work organization on patterns of cigarette smoking among male chemical plant employees. Am J Public Health. 1990;80:1368-71.
28. National Center for Cardiovascular Diseases, China. Report on cardiovascular diseases in China. Encyclopedia of China Publishing House; 2010. p. 62-2.