

Association of Organizational Factors With the Proportion of Healthy Behaviours and Control of Blood Pressure at a Company Level

Masako Nagata, MD, PhD, Tomohisa Nagata, MD, PhD, Hirotsuke Takahashi, MD, and Koji Mori, MD, PhD

Objectives: The study examined a relationship between organizational factors and the health outcomes (health behaviors and blood pressure control) at a company level. **Methods:** This cross-sectional study using data from listed corporations on a stock exchange with 1000 to 30,000 employees that completed the health and productivity management survey of Japan in 2019. **Results:** We analyzed 886 companies. The presence of occupational health staff was associated with good health behaviors (no smoking and healthy body mass index) and good control of blood pressure. Implementation of education for manager was associated with low smoking rates. **Conclusion:** The implementation of organizational factors by corporations may improve the lifestyle behaviors and disease management of their employees.

Keywords: blood pressure control, health and productivity management, health behaviors, health promotion, organization factors

Cardiovascular and cerebrovascular diseases are major health problems in developed nations. In 2019, the World Health Organization (WHO) announced that ischemic heart disease and cerebral stroke were among the top three leading causes of death in high-income nations, and in 2019, a total of over 2.5 million people died of such causes.¹ Most instances of cardiovascular and cerebrovascular diseases are preventable and can be prevented by managing risk factors such as tobacco use, unhealthy diet and obesity, lack of physical activity, and alcohol consumption.^{2–4} Furthermore, individuals with hypertension, diabetes, and hyperlipidemia who are at high risk of developing cardiovascular diseases require health guidance and treatment aimed at early detection and improvement of lifestyle. In Japan, a health examination for employee is

performed by employers as a legal obligation.⁵ Based on the results of these examination, most companies provide feedback to employees to promote lifestyle improvements and encourage hospital visits.⁶ Furthermore, as a population approach, health promotion has been underway for workers.^{7,8}

In work places, it has been found that the achievement of results is greatly affected by the effectiveness of the health promotion program for employees, as well as organizational factors such as the employee support from manager and the scheme by which the programs are offered.^{9,10} Various studies have analyzed the factors that affect the outcomes of health promotion programs in the workplace, collected data on examples of good practice, and investigated common factors between them.^{11–13} Terry et al divided health promotion programs into best practice and general practice according to nine indices and reported significant differences in the program completion rate and health risk-lowering effect in the participants.¹⁴ In their study, the elements of the indices used in the evaluation of the practice level included 1) comprehensive program design, 2) support of the executives and managers, 3) integrated incentives, 4) comprehensive communications, 5) dedicated onsite staff, 6) multiple program modalities, 7) health awareness programs, 8) biometric health screenings, and 9) vendor integration. Goetzel et al reported that the elements required for best practice included a) integrating health productivity management (HPM) programs into the organization's operations; b) simultaneously addressing individual, environmental, policy, and cultural factors affecting health and productivity, c) targeting several health issues; d) tailoring programs to address specific needs; e) attaining high participation; f) rigorously evaluating programs; g) communicating successful outcomes to key stakeholders.¹³ Among these, common elements of the organizational factors are the support by executives and managers and presence of occupational health specialists.¹³ However, such evidence is mainly from studies examining good practices, wherein the outcomes were defined by the participation rate and health outcomes of participated individuals. Very few studies have evaluated the relationship of employee support system, lifestyle practices, and the effectiveness of disease management at the company level.

Japan is faced with the challenge of a rapidly decreasing and aging population; hence, major issues such as ensuring a healthy workforce and maintaining the medical insurance system need to be addressed.¹⁵ Therefore, the government introduced the extension of healthy life expectancy as a policy issue, and as one of these policies, the government has been promoting HPM in corporations. In response to this, an increasing number of companies are proactively engaging in support to improve the lifestyle practices of employees and disease management for all employees including the young generation.¹⁶ An award system, which was established in 2015, had selected the good practice companies based on a HPM survey.¹⁷ This has been implemented every year by an increasing number of participating corporations. The HPM survey was consisted of four elements: policy, organization, system/policy practice, and evaluation improvement. In the event of challenges in risk management, such as legal violations and frequent worker

From the Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan (Dr Nagata, Dr Nagata, Dr Takahashi, and Dr Mori).

These organizational factors have the potential to improve the health of workers. Therefore, it is important for companies to take initiatives to enhance organizational factors.

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The authors report no conflicts of interest.

Clinical significance: The presence of full-time occupational health staff was correlated with proportion of nonsmoker, proportion of employees with healthy BMI, and indicators of good control of blood pressure.

Education of managers at promotion was also correlated with the proportion of nonsmokers.

Address correspondence to: Masako Nagata, MD, PhD, Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, 1–1 Iseigaoka, Yahatanishi-ku, Kitakyushu 807–8555, Japan (m-nagata@med.uoeh-u.ac.jp).

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accidents, they are excluded. The survey also includes items with which organizational factors can be evaluated, such as employee support system and program provision framework, which are the aforementioned items of the best practice model, that is, the involvement of specialists participating on an executive level and the presence or absence of implementation of education for managers. Furthermore, as an indicator of outcomes that enables the evaluation of employees' health, descriptions of the numerical data are required with regard to the proportion of employees with good lifestyle habits, the proportion of receiving health examination, and the state of blood pressure and blood glucose management.

Therefore, we examined a relationship between organizational factors and the health outcomes (health behaviors and blood pressure control) at a company level.

METHODS

Study Design and Sample

We utilized and analyzed the HPM surveys submitted to the Ministry of Economy, Trade and Industry (METI) during September to October 2019. In this year, surveys were submitted from 2328 corporations (964 companies listed on the Tokyo, Osaka, and Nagoya Stock Exchanges and 1364 unlisted companies). Furthermore, 3706 companies were listed on the Japan Exchange Group at the year-end of 2019, 26.0% of which submitted the surveys. We applied to the METI for the disclosure of information and obtained the survey data with appropriate consent. The present study only includes company data and does not include any personal information. Companies with 1000 to 30,000 employees were included in the analyses.

Explanatory Variables

We selected three explanatory variables from organizational factors for analysis. In the area of "the positioning of HPM in the corporation's philosophy and policies," we used whether there was a "HPM policy written in executive's own words" to measure the organization's commitment. In the "organized frameworks" area, the presence or absence of an "education for managers on health maintenance and promotion measures at promotion" (written education for managers at promotion) was used to measure support for middle management as leaders. The presence or absence of a "full-time occupational physician and occupational health nurse" (full-time occupational health staff) was also assess the assignment of dedicated departments and staff.

Outcome Variables

The outcome variables were classified into indicators of good health behaviors and indicators of good control of blood pressure. In the HPM Survey Sheets, the presence or absence of aggregation of the numerical indicators is first confirmed, and if aggregated, the numerical values are entered.

The indicators of good health behaviors were evaluated by four; smoke, body mass index (BMI), exercise, and sleep. In Japan, corporations have tended to use the standardized questionnaires set as a part of the specific health examination program based on the Elderly Medical Care Security Act. Therefore, many companies use questionnaires with the same wording to ascertain the lifestyle habits of their employees. We categorized the companies into two groups: those with many employees with good lifestyle habits or not, and created a binary outcome variable for each habit. First, we evaluate companies with low smoking rate in one-third from the good side, called "low smoking rate" outcome. Second, we evaluated companies with high proportion of healthy BMI (≥ 18.5 , < 25.0) in one-third from the good side, called "healthy BMI." Third, we evaluated companies with high proportion of individual exercising to the extent of sweating slightly for ≥ 30 min twice per

week in one-third from the good side, called "exercise habits." Fourth, we evaluated companies with high proportion of individuals getting adequate rest by sleeping in one-third from the good side, called "good sleep."

The indicators of good control of blood pressure were evaluated by three; at low risk for high blood pressure, crude coverage, and effective coverage. The crude coverage and effective coverage are indicators of medical service quality recommended by the WHO. The crude coverage reflects the utilization of services by individuals requiring medical services, and the effective coverage indicates the quality of medical services. The two indicators can also be used to evaluate the quality of occupational health services in promoting treatment enhancement.¹⁸ The crude coverage was the proportion of individuals under medical treatment among individuals with state of requiring medical services (high blood pressure $\geq 160/100$ mm Hg). The effective coverage was the proportion of individuals under good control of blood pressure ($< 140/90$ mm Hg) among individuals with state of requiring medical services (as defined the same). First, we evaluated companies with low proportion of individuals at risk of high blood pressure ($\geq 180/110$ mm Hg) in quarter from the good side, called "at low risk for high blood pressure." Second, we evaluated companies with high crude coverage in quarter from the good side, called "good crude coverage." Third, we evaluated companies with high effective coverage in quarter from the good side, called "good effective coverage."

Other Variables

The activities underlying HPM and health promotion were expected to be influenced by the industry sector, the number of employees, mean age, and proportion of women in each company. We used information from the questionnaire about industrial classification, mean age, and proportion of women, while we did not use the number of employees because we only included companies with more than 1000 employees in the analysis.

Statistics

We confirmed the distribution for the two outcomes (indicators of good health behaviors and indicators of good control of blood pressure) by creating box plots and identified the median and first/third quartiles. We classified all points outside the interval (the first quartile—1.5IQR [inter quarter range]; the third quartile + 1.5IQR) as outlier.¹⁹ We used multiple logistic regression analysis to examine the relationship between each of the outcome indicators and the explanatory variables exclude the outlier.

We calculated odds ratio and 95% confidential interval adjusted for industrial classifications, mean age, and proportion of women (Model 1) and additionally adjusted for all other explanatory variables (Model 2). We used Stata 16 (StataCorp LLC, College Station, TX) for all statistical analyses.

RESULTS

We included 886 companies in our analyses. The most common industry was the manufacturing industry, accounting for 40.5%, followed by the transportation industry (14%) and the retail/wholesale and financial industries (each approximately 10%). The proportion of female employees was 24.6% (Table 1).

Table 2 shows the relationships between organizational factors and indicators of good health behaviors. In the logistic regression analysis (Model 1) that included the proportion of employees having good health behaviors as the outcome variable, compared to companies that did not provide education for managers at promotion, a correlation was found between companies that did provide education for managers at promotion and a high proportion of nonsmokers (odds ratio [OR]: 6.72; 95% CI: 2.69–16.81). Furthermore, a high proportion of nonsmokers was significantly correlated with full-time occupational health nurse (OR: 2.77; 95%

TABLE 1. Company Characteristics

	N	%	Median	First Quartile, Third Quartile	Missing Value
Total	886				
Industrial classification					
Manufacturing	359	40.5			
Construction	45	5.1			
Electricity and gas	17	1.9			
Transportation, information and communication	142	16.0			
Commerce	109	12.3			
Finance and insurance	101	11.4			
Real estate	16	1.8			
Services	69	7.8			
Unknown	28	3.2			
Mean age			40.9	38.9, 42.9	
The proportion of female workers			20.8	13.1, 35.2	
Health behavior					
Smoking rate			26.6	21.3, 32.4	67
The proportion of workers with healthy body mass index			64.7	62.1, 67.6	70
The proportion of workers having exercise habits			21.4	18.1, 25.3	97
The proportion of workers having good sleep			58.6	52.9, 63.5	100
Good control of blood pressure					
The proportion of workers at risk of blood pressure (180/110 mm Hg)			0.6	0.4, 1.1	70
Crude coverage			83.2	78.0, 87.9	242
Effective coverage			55.8	46.1, 62.4	242

CI: 1.52–5.06) and with full-time occupational physician and nurse (OR: 2.89; 95% CI: 1.55–5.40). A high proportion of healthy BMI was significantly correlated with full-time occupational health nurse (OR: 1.86; 95% CI: 1.08–3.23) and marginally significantly with full-time occupational physician and nurse (OR: 1.65; 95% CI: 0.92–2.94), while that was not correlated with education for managers at promotion. HPM policy written in executive's own words was not correlated with all indicators of good health behaviors. The indicators of exercise habits and good sleep were not correlated with all explanatory variables. Model 2 had the same results as Model 1 for statistical significance in all analyses.

Table 3 shows the relationships between organizational factors and indicators of good control of blood pressure. In the multiple regression analysis, we found that the presence of a full-time occupational physician and nurse was correlated with all indicators of good control of blood pressure. The presence of a full-time occupational nurse was not correlated with low proportion of individuals at risk of high blood pressure, while it was correlated with high crude coverage (OR: 2.12; 95% CI: 1.01–4.48) and high effective coverage (OR: 2.10; 95% CI: 1.02–4.35) (Model 2). Other explanatory variables (HPM policy written in executive's own words, and education for managers at promotion) were not correlated with all indicators of good control of blood pressure.

DISCUSSION

In the present study, we examined the relationship between organizational factors included in the best practices of the health promotion program and the health outcomes.

With regards to the correlation between organizational factors and the proportion of employees maintaining good lifestyle habits, we found a significant correlation between education for managers and the proportion of nonsmokers. This result supports previous studies that examined the effect on smoking behavior.^{9,20} Moreover, in Japan, a law has been passed to prevent passive smoking in the workplace,²¹ and it is possible that measures to separate smoking and nonsmoking areas and the harmful effects of smoking are included in the education for managers, which could

have resulted in managers supporting their subordinates' smoking cessation efforts. Conversely, there was no relationship between organizational factors and high proportion of healthy BMI, exercise habits and good sleep. In a previous study, superiors reportedly felt an ethical dilemma in getting involved in the health-related behavior of their subordinates,²² and it was inferred that superiors had more difficulty in pointing out obesity to their subordinates and supporting them to participate in a weight loss program than in supporting them to participate in a smoking cessation program. Furthermore, no relationships were found with regard to exercise habits. This may be attributed to a discrepancy between the goals of the exercise program provided and the evaluation items. In Japan, a walking program is generally implemented to increase the number of steps taken daily, but the intensity of exercise to the degree defined in the questionnaire is usually not targeted (exercise to the extent of sweating slightly for 30 min twice a week).¹⁶

The relationship was observed, albeit not significant, between getting good sleep and HPM policy written in executive's own words. In Japan, short sleeping hours have been reported as an issue in sleep disturbances.²³ Sleep duration is greatly affected by working hours and commuting time. In Japan, long working hours and exhaustion from overwork (this is called "karoshi"), which is a health hazard caused by long working hours, have become public health problems,^{24,25} and measures taken to reduce long working hours are included in the HPM survey.²⁶ Commitment by the company's top executives is important to reduce long working hours.²⁷ The contents of the HPM policies conveyed by the top executives also include commitment to cut overtime work, which may ensure getting adequate sleep.

With regards to the control of blood pressure, a relationship was present between the presence of full-time occupational health staff and all outcome indicators. In Japan, employee health examination is a legal obligation of the companies; the occupational physician is required to evaluate the results when an abnormality is observed during a health check-up and subsequently provide instructions,⁶ such as recommending a medical examination; thus the results could be considered reasonable. In particular, the OR of

TABLE 2. Relationships Between Organizational Factors and Indicators of Good Health Behaviors

	Model 1												Model 2																											
	Nonsmoker ^a				Healthy BMI ¹				Exercise Habits ²				Good Sleep ³				Nonsmoker ^a				Healthy BMI ¹				Exercise Habits ²				Good Sleep ³											
	N	%	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P								
HPM policy written in executive's own words																																								
No	311	35.1	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	
Yes	576	64.9	1.34	0.89, 2.01	0.155	0.86	0.59, 1.25	0.425	0.90	0.63, 1.29	0.571	1.43	0.98, 2.09	0.062	1.17	0.77, 1.77	0.465	0.83	0.57, 1.21	0.340	0.82	0.57, 1.19	0.310	1.41	0.95, 2.07	0.080														
Education for managers at promotion																																								
No	122	13.8	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	765	86.3	6.72	<0.001	1.01	0.57, 1.81	0.950	1.84	0.97, 3.48	0.060	1.48	0.80, 2.76	0.208	5.28	2.08, 13.35	<0.001	0.93	0.51, 1.68	0.804	1.70	0.88, 3.29	0.111	1.27	0.67, 2.41	0.462															
Full-time occupational health staff																																								
None	212	23.9	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	
Occupational physician only	9	1.0	0.54	0.05, 5.74	0.605	2.13	0.32, 14.05	0.431	1.56	0.21, 11.45	0.624	1.03	0.12, 9.12	0.941	0.39	0.03, 4.43	0.453	2.08	0.33, 13.31	0.438	1.37	0.81, 2.31	0.245	1.35	0.78, 2.20	0.260														
Occupational nurse only	310	35.0	2.77	1.52, 5.06	<0.001	1.86	1.08, 3.23	0.026	1.49	0.88, 2.50	0.137	1.39	0.84, 2.32	0.202	2.24	1.22, 4.13	0.009	1.89	1.08, 3.30	0.025	1.37	0.81, 2.31	0.245	1.35	0.78, 2.20	0.260														
Occupational physician and nurse	356	40.1	2.89	1.55, 5.40	<0.001	1.65	0.92, 2.94	0.088	1.56	0.91, 2.65	0.105	1.23	0.72, 2.09	0.441	2.03	1.11, 3.74	0.022	1.49	0.85, 2.63	0.159	1.25	0.75, 2.11	0.394	1.17	0.70, 1.97	0.537														

Model 1: adjusted for industrial classifications, mean age, and proportion of women.
 Model 2: adjusted for Model 1 and additionally all explanatory variables.
 CI, confidence interval; BMI, body mass index; HPM, Health and Productivity Management.
^aNonsmoker: low smoking rate in one-third from the good side.
¹Healthy BMI: high proportion of healthy BMI (≥ 18.5 , < 25.0) in one-third from the good side.
²Exercise habits: high proportion of individual exercising to the extent of sweating slightly for ≥ 30 min twice per week in one-third from the good side.
³Good sleep: high proportion of individuals getting adequate rest by sleeping in one-third from the good side.
⁴Unable to analyze because of small numbers in each group.

TABLE 3. Relationships Between Organizational Factors and Indicators of Good Control of Blood Pressure

	Model 1												Model 2																									
	At Low Risk for High Blood Pressure ^a				High Crude Coverage ¹				High Effective Coverage ²				At Low Risk for High Blood Pressure ^a				High Crude Coverage ¹				High Effective Coverage ²																	
	N	%	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P	aOR	95% CI	P									
HPM policy written in executive's own words																																						
No	311	35.1	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	576	64.9	1.12	0.76, 1.66	0.570	1.20	0.79, 1.83	0.850	1.35	0.89, 2.06	0.159	1.06	0.71, 1.59	0.775	1.20	0.78, 1.85	0.399	1.35	0.88, 2.07	0.169																		
Education for managers at promotion																																						
No	122	13.8	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	765	86.3	1.12	0.61, 2.06	0.709	0.84	0.42, 1.69	0.624	1.03	0.50, 2.13	0.941	0.88	0.46, 1.67	0.696	0.73	0.35, 1.51	0.398	0.89	0.43, 1.89	0.782																		
Full-time occupational health staff																																						
None	212	23.9	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Occupational physician only	9	1.0	3.46	0.59, 20.46	0.171	3.04	0.48, 19.33	0.238	2.98	0.44, 19.78	0.258	3.31	0.56, 19.49	0.185	2.85	0.44, 18.3	0.268	2.93	0.44, 19.32	0.265																		
Occupational nurse only	310	35.0	1.63	0.88, 3.02	0.124	2.08	0.99, 4.36	0.053	2.07	1.01, 4.28	0.048	1.64	0.87, 3.06	0.122	2.12	1.01, 4.48	0.047	2.10	1.02, 4.35	0.045																		
Occupational physician and nurse	356	40.1	3.13	1.68, 5.81	<0.001	2.49	1.18, 5.22	0.016	2.29	1.11, 4.76	0.026	2.98	1.61, 5.49	<0.001	2.49	1.20, 5.19	0.014	2.30	1.13, 4.71	0.022																		

Model 1: adjusted for industrial classifications, mean age, and proportion of women.
 Model 2: adjusted for Model 1 and additionally all explanatory variables.
 CI, confidence interval; HPM, Health and Productivity Management.
^aAt low risk for high blood pressure: low proportion of individuals at risk of high blood pressure ($\geq 180/110$ mm Hg) in quarter from the good side.
¹High crude coverage: high crude coverage in quarter from the good side (the crude coverage was the proportion of individuals under medical treatment among individuals with state of requiring medical services ($\geq 160/100$ mm Hg)).
²High effective coverage: high effective coverage in quarter from the good side (the effective coverage was the proportion of individuals under good control of blood pressure [$< 140/90$ mm Hg] among individuals with state of requiring medical services).

the group with severe hypertension was high; therefore, it is possible that the full-time occupational health staff would give priority to intervention for individuals with severe conditions as a measure of secondary prevention. Moreover, even for workers with mild to moderate hypertension, it is inferred that by proactively providing health guidance and recommending to see a doctor, the state of blood pressure management became good for companies overall. A previous study on male workers in a company compared two groups: one belonging to an office with full-time occupational health staff and one without occupational health staff; it was reported that the group at the office with occupational health staff had better blood pressure management.¹⁸ This is supported by the results of the present study, which included data of multiple companies.

The present study has several limitations. First is the accuracy of the questionnaire data used in this study. The questionnaire serves as a resource to approve companies implementing HPM, and therefore, some companies might provide responses that make them appear to have adequate activities. However, if critical reporting mistakes are uncovered, the approval is withdrawn. Hence, this is intentional data. Next, only the presence or absence of efforts performed for HPM was evaluated and the quality of efforts was not evaluated. We did not determine whether the publication of HPM policies by top executives served to clearly inform the employees, whether the educational content for managers was adequate, and whether it helped managers to be supportive. Third, with regard to the companies included in the analysis, the data was only of large Japanese companies undertaking HPM efforts, and thus due care is warranted with the generalization of this data. Despite these limitations, not many surveys have examined the correlation between HPM efforts at the company level and the health status and lifestyle habits of employees. Hence, we believe that the findings of this study are valuable in that they suggest that HPM efforts can affect the lifestyle habits and disease-management behavior of employees.

CONCLUSION

We elucidated the relationship between organizational factors and the health indicators including lifestyle habits of employees and control of blood pressure at the company level. The presence of full-time occupational health staff was correlated with proportion of nonsmoker, proportion of employees with healthy BMI, and indicators of good control of blood pressure. Education of managers at promotion was also correlated with the proportion of nonsmokers. As this was a cross-sectional study and the causal relationship remains unclear, in the future, a longitudinal study studying HPM efforts performed by more companies is needed.

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