




Risk factors of prehypertension and hypertension among workers at public elderly welfare facilities in Taiwan

A cross-sectional survey

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Abstract

The prevalence and factors that influence prehypertension and hypertension in workers at elderly welfare facilities remain unknown. This study investigated prehypertension and hypertension as well as the relevant factors affecting the development of these conditions in workers at elderly welfare facilities.

A cross-sectional survey was conducted among 242 workers at 3 elderly welfare facilities in northern Taiwan. A structured questionnaire survey comprising demographic characteristics, job characteristics, burnout inventory, and health information was employed for data collection. Chi-Squared tests and multinomial logistic regression were adopted to analyze the correlation between research variables and blood pressures as well as relevant factors influencing prehypertension and hypertension.

The results indicated that sex, age, education level, type of work shift, work-related burnout, and body mass index of the research participants were significantly correlated with prehypertension and hypertension. The results of multinomial logistic regression demonstrated that being male, being older, being a nonnurse assistant, being obese, working in shifts, and having moderate or severe work-related burnout were associated with higher risks of prehypertension and hypertension. The interaction between age and being a nonnurse assistant was statistically significant. Compared with nonnurse assistants, nurse assistants aged ≥ 55 years had a relatively low risk of prehypertension and hypertension.

Age, job characteristics, work-related burnout, and obesity of workers in elderly welfare facilities were the major risk factors for prehypertension and hypertension.

Abbreviations: AOR = adjusted odds ratio, BMI = body mass index, CI = confidence interval, DBP = diastolic blood pressure, SBP = systolic blood pressure.

Keywords: burnout, elderly, hypertension, prehypertension, workers

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1. Introduction

Hypertension is the leading cause of mortality worldwide. The 2014 Global Status Report on Noncommunicable Diseases by the World Health Organization proposed a voluntary global target of a 25% relative reduction in the prevalence of hypertension by 2025.^[1] Consequently, the prevention and control of hypertension have become a primary task in the international public health field. The global prevalence of hypertension among adults older than 18 years was 22% in 2014.^[1] An average of 1 in 4 Taiwanese adults has hypertension,^[2] which indicates that the prevalence of hypertension in Taiwan is slightly higher than that in other countries. Because the diet of Asian people generally involves a high sodium intake, they are more likely than Westerners to develop hypertensive cardiovascular diseases.^[3] The top 10 leading causes of death in Taiwan include heart disease, cerebrovascular disease, hypertensive disease, nephritis, nephrotic syndrome, and nephropathy, all of which are related to excessively high blood pressure.^[4] In Taiwan, the average number of annual outpatient visits for a patient with hypertension (23.15) is higher than that for an individual with chronic kidney disease (20.70) or diabetes (21.67).^[5] Furthermore, the average number of outpatient visits for a patient with hypertension when also considering other chronic diseases is up to 33.20

per year, which constitutes an excessive use of medical resources and affects such patients' quality of life.^[5]

Hypertension is an invisible killer, considering that most healthy people with high blood pressure do not experience any obvious symptoms of discomfort. Between 2013 and 2016, the prevalence of prehypertension in Taiwan was 23.8%, and 30.0% of men and 17.8% of women in Taiwan had prehypertension.^[6] People who are overweight, obese, or have diabetes in addition to prehypertension have an increased risk of cardiovascular disease and sudden hypertension.^[7] Experts have suggested that those with prehypertension should adjust their lifestyle or take medicine to lower their blood pressure as instructed by a doctor.^[8] Multifaceted psychosocial stress—concerning individuals' workplace, personality, mental health, social relationships, and low socioeconomic status—arises from rapid societal and lifestyle changes; it has gained increased attention from workplace health advocates and is related to the development of hypertension.^[9] Studies have revealed that workers with hypertension are at high risk of hyperuricemia,^[10] which increases workplace absence and productivity loss.^[11]

Taiwan has officially become an aged society, with those 65 years or older comprising 15.3% of the population.^[12] As the number of older people increases each year, the number of workers at elderly welfare facilities also increases.^[13] In Hungary^[14] and China,^[15] the prevalence of workers with prehypertension is 39.8% and 41.5% and that of workers with hypertension is 22.6% and 28.1%, respectively. However, few studies have investigated the related prevalence of prehypertension and hypertension in workers at elderly welfare facilities in Taiwan. A US survey^[16] indicated that 47.4% and 18.4% of female long-term-care nursing assistants had prehypertension and hypertension, respectively, and that hypertension is related to sex, age, educational level, job characteristics, and body mass index (BMI).^[15,17] Faced daily with residents in need of care because of multiple chronic diseases and limited mobility, 20% of facility workers reported being exposed to ≥ 3 physiological or occupational stressors, such as increased workload, limited decision-making scope, lack of support from fellow workers, regular night shifts, and physical attacks by residents.^[18] Accordingly, working conditions, working environment, and occupational safety^[9] have considerable effects on the health as well as job satisfaction of workers at elderly welfare facilities.^[19] In Taiwan's aged society, the care providers at elderly welfare facilities are more vital than ever after promulgation of the Long-Term Care Services Act. Therefore, government agencies and stakeholders should closely consider the health status of care providers. Relevant studies have rarely focused on the blood pressure of workers at elderly welfare facilities in Asia, and the correlation between their mental workload and blood pressure has yet to be explored. This study thus aimed to explore factors that influence prehypertension and hypertension among those working at elderly welfare facilities. Thus, the prevalence of prehypertension and hypertension in these workers were examined in addition to the relevant risk factors for such conditions. The current results may assist facilities to identify high-risk groups and adopt corresponding workplace health promotion intervention measures to control workers' blood pressure, thereby limiting diseases caused by hypertension, which may harm worker productivity.

2. Methods

2.1. Participants

This study, which employed a cross-sectional design, selected as its study population the 14 public elderly welfare facilities in Taiwan on the list declared by the Social and Family Affairs Administration under the Ministry of Health and Welfare.^[20] The location of a facility (i.e., northern, central, southern, or eastern Taiwan, or the outlying islands of Taiwan) and its affiliated agency (the Ministry of Health and Welfare or local government) may affect its business model and manpower allocation, which potentially affect the working characteristics and health status of its workers. Therefore, this study included facilities

1. that are affiliated to the Taipei City or New Taipei City Government and
2. that admit New Taipei City or Taipei City citizens aged ≥ 65 years from low-income households.

Phone calls were made to relevant authorities, requesting the participation of their facilities in this study. This study performed purposeful sampling to select 3 public elderly welfare facilities in Taipei or New Taipei City, each of which accommodated ≥ 300 beds. The 342 workers from these 3 facilities were recruited as participants.

Because the majority of workers at the 3 public elderly welfare facilities were relatively old and unfamiliar with the Internet or computer operations, questionnaires were distributed and their answers verified on site. The contact person of each facility was responsible for distributing the questionnaires and reviewing the questionnaire responses for completeness. After workers on leave, on shift work, and who were unwilling to participate were excluded, questionnaires were distributed to 295 workers; in total, 253 questionnaires were returned between October and November 2018. The exclusion criteria of this study were workers who had held their current position for less than 3 months and those who were pregnant. In total, 242 (82%) valid questionnaires were obtained. This accounted for 70.8% of the total number of workers from the 3 facilities. The participants presented no substantial difference with workers at the 3 public elderly welfare facilities in terms of the proportion of sex. Therefore, the participants were representative of all workers at public elderly welfare facilities in northern Taiwan. This study was approved by the Human Research Ethics Review Committee of Taipei City Hospital (case number: TCHIRB-10708114-E). All participants consented to providing their information for analysis.

2.2. Measurements

A structured questionnaire, entitled Health and Lifestyle Questionnaire, was used for the survey. The questionnaire content was reviewed by 6 experts and scholars specializing in workplace health promotion and welfare for older adults to ensure its appropriateness, relevance, and preciseness of wording. The content was further modified with reference to the experts' opinions, and favorable content validity was obtained, ranging between 0.93 and 1.00. To assess the respondents' understanding of the questionnaire content with the given wording, the time they required to complete the questionnaire, and problems they may face during the survey, a pretest was conducted with 35 workers

at an elderly welfare facility in New Taipei City. The pretest questionnaire was distributed on site by the current researchers, who also responded to any doubts or opinions raised by the respondents, assisted with interpretation, and recorded the response process as a reference for the questionnaire's revision. After the pretest questionnaires were returned, the researchers performed internal consistency testing of the subscales, "Personal burnout" and "Work-related burnout," Cronbach alpha values for these scales were 0.916 and 0.945, respectively. The questionnaire covered dimensions such as demographic characteristics, job characteristics, personal burnout, and work-related burnout, systolic blood pressure (SBP) and diastolic blood pressure (DBP), and height and weight.

2.2.1. Demographic characteristics. The demographic characteristics section of the questionnaire queried the respondents' sex, age, and educational level. The majority (73.6%) of the respondents were women. The respondents were aged between 23 and 70 years. Based on the age groups in the population and in accordance with the age grouping results of a nutrition and health survey in Taiwan,^[6] 66, 72, and 104 of the respondents were assigned to the following age groups: 23 to 44 years, 45 to 54 years, and ≥ 55 years. Among all respondents, 49, 115, and 78 had an educational level of junior high school or lower, senior high school/vocational high school or junior college, and college or above, respectively.

2.2.2. Job characteristics. Respondents had 2 types of work shifts: fixed and rotational. Rotational shifts were further divided into 2, 3, and 4 shifts. Positions at the elderly welfare facilities included permanent, contract, or outsourced nurse assistants, supervisors, administrative staff (including maintenance workers), social workers, counselors, medical staff, and nursing staff, and others (e.g., security guards, cleaning staff, kitchen workers, drivers, and handypersons). The respondents were categorized into nurse assistants and nonnurse assistants (i.e., supervisors, medical staff, administrative staff, social workers, counselors, and others).

2.2.3. Personal burnout and work-related burnout. These subscales were developed according to the Chinese version of the Copenhagen Burnout Inventory^[21] to query respondents on their burnout condition in the preceding month. The questionnaire comprised 13 items under 2 dimensions, namely personal burnout and work-related burnout, and the response options were converted into scores of 100, 75, 50, 25, or 0. Personal burnout scores were calculated by averaging the scores of items 1 to 6. According to the burnout score interpretation by the Ministry of Labor,^[22] scores of < 50 denoted mild personal burnout, 50.0 to 69.9 denoted moderate personal burnout, and ≥ 70 denoted severe of personal burnout. The same calculation method was applied for the first 6 items of work-related burnout; item 7 was a reverse question scored on a 0–25–50–75–100 scale. Work-related burnout scores were calculated by averaging the scores of items 1 to 7; scores of < 45 denoted mild work-related burnout, 45.0 to 59.9 denoted moderate work-related burnout, and ≥ 60 denoted severe work-related burnout.^[22] Cronbach's alpha values for both subscales were ≥ 0.86 , indicating favorable internal consistency.

2.2.4. Systolic blood pressure and diastolic blood pressure. The SBP and DBP of participants were measured using each facility's blood pressure instruments and then recorded.

Multiparameter patient monitors, automatic blood pressure monitors, and arm-type digital blood pressure monitors were used by residents and workers; these monitors were regularly calibrated and maintained. According to the Seventh Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure^[23] and suggestions of the Health Promotion Administration of the Ministry of Health and Welfare,^[24] this study defined normal blood pressure as SBP < 120 mm Hg and DBP < 80 mm Hg, prehypertension as SBP = 120 to 139 mm Hg or DBP = 80 to 89 mm Hg, and hypertension as SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg.

2.2.5. Height and weight. The respondents self-reported their height and weight to determine their BMI, which was calculated by dividing weight in kg by height in m^2 . The Health Promotion Administration of the Ministry of Health and Welfare uses BMI to classify adults aged ≥ 18 years as underweight (BMI < 18.5), healthy ($18.5 \leq$ BMI < 24.0), overweight ($24.0 \leq$ BMI < 27.0), or obese ($27.0 \leq$ BMI).^[25] Because only 6 respondents in this study were underweight, the categories of underweight and healthy adults were combined for data analysis.

2.3. Statistical analysis

IBM SPSS Statistics (version 22; IBM Corporation, NY) was used for data analyses. A Chi-Squared test was performed to examine the correlation between the research variables and prehypertension and hypertension. Multinomial logistic regression was performed to explain the odds ratio and 95% confidence interval of the risk factors influencing prehypertension and hypertension; with other variables controlled, an interaction effect existed between demographic and job characteristics. The explanatory power of the research variables for predicting prehypertension and hypertension outcomes reached a significant level; statistical significance was defined as $P < .05$.

3. Results

The average age of the 242 respondents was 50.4 years. Among the respondents, 33.5%, 51.6%, and 14.9% had normal blood pressure, prehypertension, and hypertension, respectively (Table 1). The blood pressure of the respondents differed significantly by sex, age, education level, type of work shift, work-related burnout, and BMI. Hypertension was observed in 25% of the male respondents and 11.2% of the female respondents ($P = .013$). Among respondents aged ≥ 55 years, 62.5% had prehypertension, and 40.9% of those aged 23 to 44 years had prehypertension ($P = .005$). The percentage of prehypertension in respondents with an education level of junior high school or lower was 75.5%, which was significantly higher than that of those with an education level of college or above (46.2%) and that of those with an education level of senior high school/vocational high school or junior college (45.2%; $P = .003$). Prehypertension was observed in 63.7% of respondents who worked a rotating shift and 45.7% of respondents who worked fixed shifts ($P = .027$). Of the respondents reported moderate or severe work-related burnout, 25.9% had hypertension; by contrast, this proportion was 11.7% among those reported mild work-related burnout ($P = .023$). In terms of BMI, 60% and 21.5% of respondents who were obese exhibited prehypertension and hypertension, respectively, whereas only 8.3% of respondents with normal BMI had hypertension ($P = .001$).

Table 1
Relationships among demographic characteristics, burnout, body mass index, and hypertension for workers in elderly welfare facilities.

Characteristics	Normal blood pressure n (%)	Prehypertension n (%)	Hypertension n (%)	P
Total	81 (33.5)	125 (51.6)	36 (14.9)	
Sex				.013
Female	66 (37.1)	92 (51.7)	20 (11.2)	
Male	15 (23.4)	33 (51.6)	16 (25.0)	
Age (years)				.005
23–44	32 (48.5)	27 (40.9)	7 (10.6)	
45–54	27 (37.5)	33 (45.8)	12 (16.7)	
≥ 55	22 (21.2)	65 (62.5)	17 (16.3)	
Education level				.003
College or above	32 (41.0)	36 (46.2)	10 (12.8)	
Senior high school/vocational high school or junior college	43 (37.4)	52 (45.2)	20 (17.4)	
Junior high school or lower	6 (12.2)	37 (75.5)	6 (12.2)	
Type of work shifts				.027
Fixed shift	62 (38.3)	74 (45.7)	26 (16.0)	
Rotating shift	19 (23.8)	51 (63.7)	10 (12.5)	
Nurse assistants				.669
No	45 (31.5)	75 (52.4)	23 (16.1)	
Yes	36 (36.4)	50 (50.5)	13 (13.1)	
Personal burnout				.799
Mild	62 (33.5)	97 (52.4)	26 (14.1)	
Moderate or severe	19 (33.3)	28 (49.1)	10 (17.5)	
Work-related burnout				.023
Mild	68 (36.2)	98 (52.1)	22 (11.7)	
Moderate or severe	13 (24.1)	27 (50.0)	14 (25.9)	
BMI				.001
Healthy	50 (45.9)	50 (45.9)	9 (8.3)	
Overweight	19 (27.9)	36 (52.9)	13 (19.1)	
Obese	12 (18.5)	39 (60.0)	14 (21.5)	

BMI = body mass index.

The results of multinomial logistic regression demonstrated that when sex, educational level, type of work shift, the nurse assistant work category, personal burnout, work-related burnout, and BMI were defined as control variables, the risk of prehypertension in those aged ≥ 55 years was 4.11 times higher than that in those aged 23 to 44 years, compared with respondents with normal blood pressure (95% confidence interval [CI]: 1.58–10.68, $P = .004$; Table 2). When other variables were controlled, the risk in those on rotating shifts was 2.24 times higher than that for those on fixed shifts (95% CI: 1.05–4.78, $P = .038$). The risk of prehypertension in nurse assistants was 0.40 times that of nonnurse assistants (95% CI: 0.18–0.88, $P = .023$), and the risk in those who were obese was 2.49 times that of those with a healthy weight (95% CI: 1.09–5.72, $P = .031$). When other variables were controlled, respondents with hypertension were significantly more susceptible to factors such as sex, age, work-related burnout, and BMI level compared with respondents with normal blood pressure. The risk of hypertension in male respondents was 3.31 times that in female respondents (95% CI: 1.24–8.85, $P = .017$); the risk in those aged 45 to 54 was 2.97 times that of those aged 23 to 44 years (95% CI: 0.81–10.87, $P = .100$), and the risk in those aged ≥ 55 years was 4.08 times that of those aged 23 to 44 years (95% CI: 1.02–16.37, $P = .047$). These findings suggest that the risk of hypertension rises as age increases. Furthermore, respondents with moderate or severe work-related burnout were 7.78 times more likely to have hypertension than were those with mild work-related burnout (95% CI: 2.01–30.02, $P = .003$), and respond-

ents who were obese had a 5.23 times greater risk of hypertension than those with a healthy weight (95% CI: 1.68–16.32, $P = .004$). The interaction between age and being a nurse assistant was statistically significant ($P < .01$). Compared with nonnurse assistants, when other variables were controlled, the risk of prehypertension (adjusted odds ratio [AOR] = 0.04, 95% CI: 0.01–0.21, $P < .001$) and hypertension (AOR = 0.04, 95% CI: 0.01–0.29, $P = .001$) in nurse assistants aged ≥ 55 years was significantly lower; however, being a nurse assistant aged 23 to 54 years had a nonsignificant influence on the risk of prehypertension and hypertension (Table 3).

4. Discussion

The overall prevalence of hypertension among respondents was 14.9%, which is lower than that among nurse assistants in elderly welfare facilities in the United States and among Taiwanese people aged ≥ 18 years.^[2,16] However, the prevalence of prehypertension among respondents (51.6%) was much higher than that among the general population of Taiwan (23.8%)^[6] and the working population in Hungary (39.8%)^[14] and China (41.5%).^[15] Studies have reported that people with prehypertension have a 26.1% risk of hypertension and even a 2.95 times higher risk of cardiovascular diseases^[26] and stroke.^[27] The current study also investigated other factors influencing prehypertension and hypertension and discovered that being male, being older, having a rotating shift, being a nonnurse assistant, having moderate or severe work-related burnout, and being

Table 2
Multinomial logistic regression analysis of factors influencing prehypertension and hypertension in workers at elderly welfare facilities.

Variables	Prehypertension vs normal blood pressure [†]		Hypertension vs normal blood pressure [†]	
	AOR (95% CI)	P	AOR (95% CI)	P
Sex				
Female	1.00		1.00	
Male	1.62 (0.75–3.50)	.220	3.31 (1.24–8.85)	.017
Age (years)				
23–44	1.00		1.00	
45–54	2.02 (0.85–4.83)	.112	2.97 (0.81–10.87)	.100
≥ 55	4.11 (1.58–10.68)	.004	4.08 (1.02–16.37)	.047
Education level				
College or above	1.00		1.00	
Senior high school/vocational high school or junior college	0.85 (0.35–2.06)	.721	2.11 (0.59–7.61)	.253
Junior high school or lower	3.38 (0.95–12.06)	.061	4.56 (0.78–26.80)	.093
Type of work shifts				
Fixed shift	1.00		1.00	
Rotating shift	2.24 (1.05–4.78)	.038	0.84 (0.28–2.54)	.763
Nurse assistants				
No	1.00		1.00	
Yes	0.40 (0.18–0.88)	.023	0.44 (0.15–1.31)	.140
Personal burnout				
Mild	1.00		1.00	
Moderate or severe	0.74 (0.28–1.94)	.539	0.45 (0.12–1.69)	.237
Work-related burnout				
Mild	1.00		1.00	
Moderate or severe	2.08 (0.72–5.96)	.175	7.78 (2.01–30.02)	.003
BMI				
Healthy	1.00		1.00	
Overweight	1.09 (0.51–2.32)	.829	2.27 (0.77–6.71)	.138
Obese	2.49 (1.09–5.72)	.031	5.23 (1.68–16.32)	.004

AOR = adjusted odds ratio (adjusted for all variables in this table), BMI = body mass index, CI = confidence interval.

[†] Outcome variables were normal blood pressure, prehypertension, and hypertension.

obese increased the risk of prehypertension and hypertension. The findings of this study were compared with those of other research for further discussion.

The main finding of the study – that older people are at higher risk of prehypertension and hypertension – is consistent with the findings of other studies.^[6,10,14] Statistical data obtained by the present researchers indicated that the prevalence of prehypertension (40.9%) and hypertension (10.6%) in respondents aged 23 to 44 years was higher than that in Taiwanese adults aged 19 to 44 years (23.3% and 7.1%, respectively).^[6] Compared with middle-aged and older adults in Taiwan aged 45 to 64 years and

with a prehypertension prevalence of 25.5%, respondents aged ≥45 years had higher prehypertension prevalence but lower hypertension prevalence.^[6] This study discovered that prehypertension and hypertension are becoming increasingly prevalent among young workers at elderly welfare facilities; regardless of age, prehypertension prevalence was higher in facility workers than in the general public. Studies have revealed that younger people are generally less aware of hypertension than are their older counterparts, and young people rarely adopt healthy behaviors to control their blood pressure.^[28,29] Welfare facility workers with a high risk of hypertension can be identified

Table 3
Multinomial logistic regression analysis on the effect of being a nurse assistant on the risk of prehypertension and hypertension by age group.

Age group	Nurse assistants	Prehypertension vs normal blood pressure [†]				Hypertension vs normal blood pressure [†]					
		Prehypertension		Normal blood pressure	AOR (95% CI)	P	Hypertension		Normal blood pressure	AOR (95% CI)	P
		n (%)	n (%)				n (%)	n (%)			
23–54 years	No	39 (47.6)	43 (52.4)	1.41 (0.51–3.94)	.508	12 (21.8)	43 (78.2)	3.50 (0.63–19.36)	.152		
	Yes	21 (56.8)	16 (43.2)							7 (30.4)	16 (69.9)
≥ 55 years	No	36 (94.7)	2 (5.3)	0.04 (0.01–0.21)	<.001	11 (84.6)	2 (15.4)	0.04 (0.01–0.29)	.001		
	Yes	29 (59.2)	20 (40.8)							6 (23.1)	20 (76.9)

Control variables: sex, education level, type of work shift, personal burnout, work-related burnout, and BMI.

AOR = adjusted odds ratio (adjusted for all variables in this table), BMI = body mass index, CI = confidence interval.

[†] Outcome variables were normal blood pressure, prehypertension, and hypertension.

through regular health examinations. If workers at elderly welfare facilities take early precautions or control their blood pressure, they can reduce the possibility of blood pressure increases due to aging and mitigate the risk of cardiovascular diseases caused by arteriosclerosis.^[30]

In addition, this study found that respondents on a rotational shift had a significantly higher risk of prehypertension than did those on a fixed shift. The long-established abnormal circadian rhythm of rotational shift workers leads to increases in high-sensitivity C-reactive protein, causing inflammation and increasing their risk of hypertension and cardiovascular diseases.^[31] In elderly welfare facilities, nurse assistants, security guards, or drivers often work on a rotational shift, which is a major risk factor for increased hypertension.^[32] Workplace health promotion is the most effective method for reducing the risk of noncommunicable diseases among rotational shift workers. However, the implementation of workplace health promotion requires overcoming difficulties concerning shift schedules, time, self-discipline, and workers' lack of willingness due to work fatigue.^[33] The current researchers suggest the arrangement of flexible, diverse, and engaging activities to increase facility workers' participation in physical activities (e.g., walking or aerobic exercise).^[33]

The characteristics of each job in the studied facilities differed. Nurse assistants perform labor-intensive tasks, and thus might decide to retire early and leave the industry for health reasons.^[34] However, middle-aged and older nurse assistants have stronger vitality in the workplace and might continue working to sustain their family. By contrast, nonnurse assistants mostly include civil servants (i.e., supervisors, administrative staff, medical staff, social workers, and counselors), maintenance workers, and technical workers, who might prefer a one-time retirement on the appointed date. They also value stable jobs and high work autonomy and have a passive attitude toward a healthy life. Hence, nonnurse assistants ≥ 55 years old had a higher risk of prehypertension and hypertension with increasing age. Facilities are advised to arrange more health promotion events that cultivate middle-aged and older workers' attitude toward life by establishing individual or group objectives and providing rewards to further improve their health status.^[35]

In this study, respondents with moderate or severe work-related burnout were found to have a higher risk of hypertension than those with mild work-related burnout. Consistent with the current results, another study also revealed the negative effects of emotional labor on health.^[19] High work stress leads to increased work-related burnout, and the annual costs of an employee's productivity loss and absence from work are much higher than their medical expenses.^[36,37] To mitigate work-related burnout, workplace stress management interventions and the provision of more social support are encouraged.^[37] Promoting hypertension awareness and lifestyle changes among workers in elderly welfare facilities might help lower their blood pressure. Taiwanese government agencies have developed a workplace health management system called we care to collect individuals' health information and assess their cardiovascular disease risk and overwork status.^[38] After evaluating the risk of occupational cerebrovascular disease, health care staff refer individuals to doctors who provide consultation and advice on lifestyle changes, and work patterns. Elderly welfare facilities may adopt this system to monitor and manage the health of facility workers, thereby improving productivity.

In this study, 28.1% and 26.9% of respondents were overweight and obese, respectively. Compared with healthy

respondents, obese respondents had significantly higher risks of prehypertension and hypertension. Relevant literature, both domestic and foreign has highlighted the effect of BMI on prehypertension and hypertension in workers.^[14–16] The unhealthy lifestyles (excessive sodium intake and low physical activity) of obese people represent another factor contributing to hypertension.^[16,39] Maintaining a healthy BMI and increasing physical activity can help prevent cardiovascular diseases,^[40] but the causal relationship between obesity and hypertension requires further exploration.

The current researchers suggest that hypertension prevention and intervention in elderly welfare facilities begin with the formation of relevant policies and improvement of work environments. All initiatives should involve hypertension-related health promotion and health management measures and adopt the PRECEDE–PROCEED model to enhance predisposing factors (awareness and attitude), reinforcing factors, and enabling factors, thereby improving workers' lifestyles.^[41] Information systems can be incorporated for monitoring changes in blood pressure indexes or controlling hypertensive diseases to confirm the effectiveness of workplace hypertension management strategies. Long-term interventions might help control facility workers' blood pressure stability and improve their health and productivity, which ultimately benefit both the elderly welfare facilities and their workers.

This study has the following limitations. Few studies have examined prehypertension and hypertension in workers at elderly welfare facilities in Taiwan. To collect relevant data, this study conducted a cross-sectional survey of public elderly welfare facilities in northern Taiwan. Because the current sample cannot fairly represent the entire working population, statistical generalization to other areas of Taiwan could be problematic. The facility workers' health indicators (e.g., blood pressure and weight) were measured using the facilities' equipment. Because uncontrollable blood pressure requires multiple measurements to ensure accuracy, overestimation or underestimation may have occurred.^[42] Hyperuricemia, dyslipidemia, and chronic kidney diseases were associated with hypertension.^[10,24] The present study failed to collect data on other health indicators of the respondents, such as the serum uric acid, low-density lipoprotein cholesterol, and estimated glomerular filtration rate.^[10,24] Consequently, the relationship between hypertension and these conditions was not determined in this study. Because of its cross-sectional design, this study only addressed the correlation of risk factors with prehypertension and hypertension but failed to estimate causal relationships. Future studies could adopt a longitudinal design to monitor long-term trends in blood pressure changes, thereby exploring the short and long-term effects of blood pressure changes.

5. Conclusions

This study found that workers at public elderly welfare facilities were generally older and exhibited a high prevalence of prehypertension; furthermore, prehypertension, and hypertension have begun to occur in younger populations. Being male, being older, working on rotating shifts, and as nonnurse assistants, and having moderate or severe work burnout and obesity were the main factors affecting the prevalence of prehypertension and hypertension in workers at elderly welfare facilities. The workplace is an essential area for effective promotion of workers' health. To prevent workers at elderly

welfare facilities from developing prehypertension or hypertension, facilities should consider relevant risk factors, identify high-risk groups through health monitoring approaches, and adopt suitable intervention measures.

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Author contributions

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