Prevalence of Prehypertension and its Associated Factors among Health Workers in Nepalese Central Hospitals

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Abstract

Prehypertension is the window of opportunity to prevent people from getting hypertension, a silent killer disease, which is commonly found in adults. Health workers are a vital workforce of the nation which belongs to an adult population that could have a chance to get hypertension. Nevertheless, there is a lack of information on prehypertension among health workers in Nepal. This study aimed to determine the prevalence of prehypertension and its associated factors among health workers in Nepalese central hospitals. A cross-sectional study was conducted in 273 Nepalese health workers from 7 central hospitals. The validated questionnaire was used to collect data using face-to-face interviews. The physical measurements, i.e., weight, height, and blood pressure of the participants were measured based on the WHO manual. In this study, prehypertension was defined based on the JNC 7th report. The logistic regression was used to analyze the factors associated with prehypertension.

The study showed that there were 63.37% female, 76.20% aged 30-39 years, 78.39% married, and 43.59% nurses among participants. The prevalence of prehypertension was 67.40% (95% CI:61.50-72.90). The predictors of prehypertension were 40-49 years age group (AOR:2.40, 95% CI:1.07-5.39), male sex (AOR:2.18, 95% CI:1.18-4.03), contract employment (AOR:2.73, 95% CI:1.28-5.83), overweight (AOR:1.86, 95% CI:1.02-3.39), and moderate perceived stress (AOR:2.48, 95% CI:1.39-4.42). There is a high prevalence of prehypertension in Nepalese health workers. It calls for urgent need to implement effective health promotion activities focusing on screening of blood pressure, weight reduction, and stress management to prevent the progression of hypertension among Nepalese health workers.

Keywords**:** *Associated factors, Central hospitals, Health workers, Prehypertension, Prevalence, Nepal*

1. Introduction

Cardiovascular disease (CVD) is a major global health concern accountable for more than half of NCD deaths worldwide, where hypertension is the leading risk factor for it (World Health Organization, 2018a; World Health Organization 2018b). Hypertension, also known as a silent killer disease, is primarily affecting the working-age group residing in developing countries through its devastating burden (Zhou et al, 2017; World Health Organization, 2018a). Prehypertension is a common health condition in the Asian population, associated with several CVD complications, including hypertension (Assadi, 2014; Huang et al, 2014).

According to the seventh report of the Joint National Committee (JNC), prehypertension was defined as a state where an individual has either systolic blood pressure (SBP) of 120-139 mmHg and/or diastolic blood pressure (DBP) of 80-89 mmHg. (Chobanian et al, 2003). Whereas, the recent JNC 8 report does not clarify the definition of prehypertension & hypertension and focuses on defining the thresholds for pharmacological treatment (Joseph et al, 2018). In 2017, American College Cardiology/American Heart Association (ACC/AHA) published the hypertension guideline where the concept of prehypertension was changed into elevated blood pressure means SBP 120-129 mmHg and DBP <80 mmHg (Williams et al, 2018). Furthermore, European Society of Cardiology and European Society of Hypertension (ESC/ESH) 2018 described SBP 130-139 mmHg and/or 85-89 mmHg as high normal blood pressure (Whelton et al, 2018). Although there are updated information of hypertension guideline, JNC 7th report is still considered as a comprehensive guideline, widely acceptable & used in the studies worldwide.

The National Health and Nutrition Examination Survey (NHANES) 1999-2006 shown the worldwide prevalence of prehypertension among healthy adults at 36.30% (Gupta et al, 2010). Furthermore, a systematic review revealed that the prevalence of prehypertension among the adult population of SAARC (South Asian Association for Regional Cooperation) countries was 29.10% (Neupane et al, 2014).

Nepal is a small, low-income country located in the South East Asia Region, currently facing a devastating burden of Non-Communicable Diseases (NCD), particularly hypertension. The pooled prevalence of prehypertension among the adult population from different regions in Nepal was 35.40%, i.e., higher than the rate of hypertension (27.3%) (Huang et al, 2019). Furthermore, Nepal demographic and health survey 2016 indicated the prehypertension rate among the Nepalese adult population at 26.90% (Agho et al, 2018).

Prehypertension is a preliminary stage of hypertension where an individual can become hypertensive as well as suffer from other CVD complications if no preventive measures are taken out (Arima et al, 2012; Fukuhara et al, 2012; Assadi, 2014; Huang et al, 2014). Julius et al. (2006) reported that the rate of transformation from blood pressure above normal to hypertension level among patients was 37% in four years. In addition, 2 out of 3 prehypertensive patients were found to have stage 1 hypertension over four years of period. Similarly, previous studies mentioned that prehypertension is responsible for 1.4 times increment of coronary artery disease and 2.5 times increment of myocardial infarction (Hu et al, 2017). Thus, prehypertension is considered a window of opportunity to prevent the morbidity and mortality related to hypertension and other CVD complications if screened on time.

Health workers are the vital workforce of the nation which belongs to the working-age group; people shading under the risk of hypertension. Knowingly or unknowingly, health workers are practicing unhealthy behaviors that could induce hypertension among them. Several studies around the world evident that CVD risk factors, including hypertension, are inclining among health workers as similar to or higher than the general population and other occupational groups (Sumaila et al, 2016). The health of health workers is often neglected and overlooked by themselves and their nation because they are thought to be kin to maintain health. The previous studies indicate the prevalence of prehypertension among health workers at 37% in Iran, 52.68% in Ghana, and 54.03% in Angola (Sahebi, Vahidi & Mousavi, 2010; Osei-Yeboah et al, 2018; Paquissi et al, 2016). In Nepal, no studies have been conducted that show the direct figure of prehypertension among health workers.

Several non-modifiable and modifiable risk factors including occupational factors found to be associated with hypertension among health workers in previous studies (Sumaila et al, 2016; Nugraha, Pratama & Turmudzi, 2017; Muzzi, Pawlina & Schnorr, 2018; Ahmed, Jadhav & Sobagaiah, 2018; Egbi, Rotifa & Jumbo, 2015; Phiri et al, 2014; Kakunje, 2011; Sahebi, Vahidi, & Mousavi, 2010; Monakali et al, 2018; Kaur et al, 2014). The identified modifiable factors were alcohol use, tobacco use, level of physical activity, dietary intake, and high body mass index, whereas age, sex, marital status, family history of hypertension, and ethnicity were found as modifiable factors of hypertension. In addition, some factors related to occupation such as shift work, high workload, stress, deprived sleep, and long work duration were also revealed as significant inducers of hypertension. Nonetheless, limited studies have been carried out that indicate the associated factors of prehypertension among health workers. Thus, a study to assess the associated factors of prehypertension among health workers is needed that could help to reduce uncertain health complications.

Central hospitals are the tertiary level health organization under the health system of Nepal located in Kathmandu valley, comprised of a large network of Nepalese health workers (23.00%) (Government of Nepal, Ministry of Health and Population, 2013). Health workers of these hospitals tend to have a high burden of workload, shift work, deprived sleep, and practicing unhealthy lifestyle due to their busyness. In addition, Nepal PEN (Package of Essential Non-communicable Diseases) program is limited to the primary level of health organization, so that, these health workers unaware about that program and lacks the opportunity to acquire NCD specific training (Government of Nepal, Ministry of Health and Population, EDCD, 2018). This scenario lodged the health workers of central hospitals into the susceptible of

prehypertension; above-normal blood pressure, which needs to be explored in order to set the platform for planning, implementation, and evaluation of hypertension control interventions focusing Nepalese health workers.

2. Objectives

1. To determine the prevalence of prehypertension among health workers of central hospitals in Nepal.

2. To assess the associated factors of prehypertension among health workers of central hospitals in Nepal.

3. Materials and Methods

3.1 Study design

It was an analytical cross-sectional study carried out among health workers of central hospitals in Nepal from September 2019 until November 2019.

3.2 Study settings

Seven government based central hospitals listed under the Ministry of health and population, Nepal were taken as study settings in this study. These central hospitals were located in the Kathmandu valley; Lalitpur and Kathmandu district of Bagmati Province, Nepal.

3.3 Study population

The study population of this research was the health workers aged ≥ 30 years and who were doctors, nursing staff, paramedic staff, radiological staff, dentists, laboratory staff, anesthesia staff, pharmacy staff, ophthalmic staff, and other health staff working in central hospitals of Nepal. Based on the data obtained from the respective central hospitals (Central Hospitals of Nepal, 2019), there was a 1,942 study population in the study settings.

3.4 Eligibility criteria

Health workers who were working in allopathic medicine based central hospital, have a willingness to participate in the study, aged ≥30 years, and working since at least one year in their current job position were inclusion criteria whereas pregnant health workers, hypertensive health workers (both previously diagnosed by doctor and newly diagnosed by blood pressure measurement), health workers who were unable to respond, and health workers who were on leave or training were the exclusion criteria of the study.

3.5 Sample size and sampling technique

A sample size was estimated based on Cochran formula ($n=Z^2pq/e^2$) in which z= desired confidence interval (1.96), p=expected prevalence (0.5), q=1-p (0.5), and e= allowable error (0.05). A total of 422 health workers were selected using a proportionate stratified systematic random sampling technique from the sampling frame of the study population. However, only 273 health workers met the eligibility criteria and enrolled as participants in the study.

3.6 Data collection instruments and methods

A questionnaire was developed in reference to the WHO STEP Surveillance manual (World Health Organization, 2017), Cohen's perceived stress scale-10 (Cohen, Kamarck & Mermelstein, 1983) and thorough literature review whereas physical measurements tools; digital BP set, digital weighing machine, and standard stature scale was identified based on the guideline of WHO (World Health Organization, 2017). The internal validity and reliability of the questionnaire were tested by the IOC method and Cronbach's alpha value, respectively.

The data on socio-demographic characteristics (age, sex, educational level, monthly family income, type of employment, type of health worker) clinical characteristics (family history of hypertension, history of diabetes) perceived stress level, behavioral characteristics (fruit and vegetable consumption level,

amount of salt intake, physical activity level) and occupational characteristics (work duration, sleep duration, shift work) of the participants were obtained by face-to-face interview using a questionnaire. Participant's physical activity was assessed by self-reported duration and intensity of their physical activity in a week and converted into Metabolic Equivalent Task (MET)-minute/week. METs-Value was calculated with the reference of 4 MET-Value per minute for moderate-intensity activity and 8 MET-value per minute for vigorous-intensity activity. The normal physical activity level was adopted as ≥600 MET-minute/week. Similarly, the consumption of <5 servings of fruits and vegetables per day was termed as Low consumption level.

The three readings of participant's blood pressure were obtained in which first reading after 15 minutes of rest followed by 3 minutes rest between the readings. The mean of the 2nd and 3rd readings of BP was calculated as mean blood pressure and used to categorize the blood pressure level of the participants. Based on the report of JNC 7, individuals with systolic blood pressure 120-139 mm Hg or/and diastolic blood pressure 80-90 mm Hg were referred to as prehypertensive. Similarly, the height and weight of the participants were measured and Body Mass Index (BMI) was calculated based on the WHO STEP Surveillance manual (World Health Organization, 2017). All the obtained data were checked thoroughly for its completeness following after each data collection.

3.7 Data management and analysis

The data were coded, compiled, entered, cleaned, and analyzed in the SPSS software program. Both descriptive statistics and analytical statistics were used to analyze the data. Descriptive statistics described the characteristics of the participants, i.e., mean with standard deviation for continuous data and number with percentage for categorical data. Univariate analysis and multivariate analysis in a binary logistic regression model were done to detect the associated factors of prehypertension with odds ratio at 95% confidence interval and p-value 0.05. After adjusting factors through multivariate analysis, significant independent associated factors of prehypertension were identified with Adjusted Odds Ratio (AOR) at 95% Confidence Interval (CI) and p-value 0.05.

3.8 Ethical Consideration

This study was approved by the ethical review board of Mae Fah Luang University, Thailand and Nepal Health Research Council, Nepal, based on the Declaration of Helsinki 2002. Similarly, permission from the study settings was obtained. The informed written consent from participants was taken prior to data collection.

4. Results and Discussion

4.1 Results

A total of 273 eligible participants were enrolled with a 100% response rate in the study. The mean age of participants was 36.50±5.77 years, 63.37% were female, 78.39% were married, 37.73% had a graduate educational level, 41.39% had 51000-80000 NRs of monthly family income, and 43.59% were the nursing staff. The prevalence of prehypertension among health workers in the study was 67.40 % (95% CI: 61.50-72.90). The information about socio-demographic characteristics, clinical characteristics, behavioral characteristics, occupational characteristics, and perceived stress of the non-Prehypertensive and Prehypertensive participants are shown in Table 1, Table 2, and Table 3. The proportion of Prehypertension was higher among participants who were 30-39 years of age, had graduate level of education, married, 51000-8000 NRS of monthly family income, nursing staff, had permanent employment, had no family history of hypertension, had no diabetes, had normal BMI, consume low fruits and vegetables, intake 5-10 grams of salt per day, less physically active, works on rotating shift basis, 1-9 years of work duration, habit of normal sleep duration, and had moderate level of perceived stress (53.48%).

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Table 1 Socio-demographic characteristics with normal BP and prehypertension among participants

Variables	Total (n=273) N (%)	Normal Blood Pressure (n=89) N (%)	Prehypertension (n=184) N (%)
Age (years)			
30-39	208 (76.19)	74 (83.15)	134 (72.82)
40-49	56 (20.51)	11 (12.36)	45 (24.46)
50-59	9 (3.30)	4 (4.49)	5 (2.72)
36.50 ± 5.77[a]			
Sex			
Male	100 (36.63)	23 (25.84)	77 (41.85)
Female	173 (63.37)	66 (74.16)	107 (58.15)
Level of education			
TSLC	27 (9.89)	8 (8.99)	19 (10.33)
PCL	72 (26.37)	26 (29.21)	46 (25.00)
Graduate	103 (37.73)	33 (37.08)	70 (38.04)
Post-graduate or higher	71 (26.01)	22 (24.72)	49 (26.63)
Marital status			
Unmarried	48 (17.58)	18 (20.23)	30 (16.30)
Married	214 (78.39)	68 (76.40)	146 (79.35)
Separated/ Divorced and Widowed	11 (4.03)	3 (3.37)	8 (4.35)
Monthly family income (NRs)			
20000-50000	74 (27.11)	26 (29.21)	48 (26.09)
51000-80000	113 (41.39)	41 (46.07)	72 (39.13)
81000-110000	51 (18.68)	13 (14.61)	38 (20.65)
>110000	35 (12.82)	9 (10.11)	26 (14.13)
Type of health worker			
Doctors	71 (26.01)	23 (25.84)	48 (26.09)
Nursing staff	119 (43.59)	42 (47.19)	77 (41.85)
Paramedic staff	41 (15.02)	13 (14.61)	28 (15.21)
Other health staff[b]	42 (15.38	11 (12.36)	31 (16.85)
Type of employment			
Permanent	192 (70.33)	68 (24.91)	124 (67.39)
Contract	56 (20.51)	14 (5.13)	42 (22.83)
Temporary	25 (9.16)	7 (2.56)	18 (9.78)

Note. [a] indicates mean ± SD, TSLC stands for Technical School Leaving Certificate, PCL stands for Proficiency Certificate Level, and Other health staff[b] includes pharmacy staff, laboratory staff, radiological staff, anesthesia staff, dietetics staff, ophthalmic staff, & dental staff

Table 2 Clinical characteristics and behavioral characteristics with normal BP and prehypertension among participants

Variables	Total (n=273) N (%)	Normal Blood Pressure (n=89) N (%)	Prehypertension (n=184) N (%)
1. Clinical characteristics			
Family history of hypertension			
Yes	117 (42.86)	42 (47.19)	75 (40.76)
Unknown	13 (4.76)	4 (4.49)	9 (4.89)
No	143 (52.38)	43 (48.32)	100 (54.35)
History of diabetes			
Yes	20 (7.33)	4 (4.49)	16 (8.70)
No	253 (92.67)	85 (95.51)	168 (91.30)
Body Mass Index (kg/m^2)			
Normal (18.50-24.99)	154 (56.41)	62 (69.66)	92 (50.00)
Overweight (25.00-29.99)	114 (41.76)	25 (28.09)	89 (48.37)
Obesity (≥30)	5 (1.83)	2 (2.25)	3 (1.63)
2. Behavioral characteristics			
Fruit and vegetable consumption (servings/day)			
<5	153 (56.04)	44 (49.44)	109 (59.24)
≥ 5	120 (43.96)	45 (50.56)	75 (40.76)
Amount of salt intake (grams/day)			
<5	108 (39.56)	40 (44.95)	68 (36.96)
5-10	140 (51.28)	45 (50.56)	95 (51.63)
>10	25 (9.16)	4 (4.49)	21 (11.41)
Level of physical activity (MET-minute/week)			
<600	142 (52.01)	43 (48.31)	99 (53.80)
≥600	131 (47.99)	46 (51.69)	85 (46.20)

Table 3 Occupational characteristics and perceived stress with normal BP and prehypertension among participants

Variables	Total (n=273) N (%)	Normal Blood Pressure (n=89) N (%)	Prehypertension (n=184) N (%)
1. Occupational characteristics			
Shift work			
Day (non-shift)	90 (32.97)	28 (31.46)	62 (33.70)
Morning shift	22 (8.06)	9 (10.11)	13 (7.06)
Rotating shift	161 (58.97)	52 (58.43)	109 (59.24)
Work duration (years)			
1-9	188 (68.87)	63 (70.79)	125 (67.94)
10-19	61 (22.34)	17 (19.10)	44 (23.91)
≥ 20	24 (8.79)	9 (10.11)	15 (8.15)
Sleep duration (hours)			
<6	14 (5.13)	3 (3.37)	11 (5.98)
≥6	259 (94.87)	86 (96.63)	173 (94.02)
2. Level of perceived stress (score)			
Low (0-13)	124 (45.42)	53 (59.55)	71 (38.59)
Moderate (14-26)	146 (53.48)	35 (39.33)	111 (60.32)
High (27-40)	3 (1.10)	1 (1.12)	2 (1.09)

All the independent variables were tested for its association with prehypertension through Univariate analysis in a binary logistic regression model with a crude odds ratio at 95% confidence interval and p-value 0.2. In Univariate analysis, only seven variables, i.e., age, sex, employment type, body mass index, amount of salt intake, level of fruit and vegetable consumption, and level of perceived stress, were found to be significantly associated with prehypertension. Then, those significant variables were adjusted further in the multiple binary logistic regression model at p-value 0.05 in which 40-50 years age (AOR:2.40, 95% CI:1.07-5.39), male sex (AOR:2.18, 95% CI:1.18-4.03), contract type of employment

(AOR:2.73, 95% CI:1.28-5.83), overweight (AOR:1.86, 95% CI:1.02-3.39), and moderate level of perceived stress (AOR:2.48, 95% CI:1.39-4.42) were revealed as significant independent predictors of the prehypertension among health workers as illustrated in Table 4.

Table 4 Multiple logistic regression model showing associated factors of prehypertension

Factors	Adjusted OR (95% CI)	p-value
Age (in years)		
30-39	Reference	
40-49	2.40 (1.07-5.39)	0.034*
50-59	0.99 (0.24-4.07)	0.989
Sex		
Male	2.18 (1.18-4.03)	0.013*
Female	Reference	
Type of employment		
Permanent	Reference	
Contract	2.73 (1.28-5.83)	0.009*
Temporary	2.40 (0.87-6.64)	0.092
Body Mass Index (kg/m^2)		
Normal (18.50-24.99)	Reference	
Overweight (25.00-29.99)	1.86 (1.02-3.39)	0.043*
Obesity (≥30)	1.65 (0.24-11.20)	0.606
Level of perceived stress (score)		
Low (0-13)	Reference	
Moderate (14-26)	2.48 (1.39-4.42)	0.002*
High (27-40)	2.14 (0.17-26.85)	0.556

Note. * means significant at p-value 0.05

4.2 Discussion

This study is the first study that estimated the prevalence of prehypertension and its associated factors among health workers of Nepal. Age, sex, employment type, BMI, and perceived stress were found to be associated with prehypertension among health workers in this study.

Even if the criteria for the classification of blood pressure is evolving as in JNC 8 report followed by ACC/AHA guideline 2017 (Williams et al, 2018) and ESC/ESH guideline 2018 (Whelton et al, 2018), this study adopted the prehypertension definition as systolic BP 120-139 mmHg and/or diastolic BP of 80-89 mmHg; and hypertension definition as systolic BP ≥140 mmHg and/or diastolic blood pressure of ≥90 mmHg according to the JNC 7th report, because the latest criteria in JNC 8th report are not widely accepted and apply worldwide yet (Williams et al, 2018; Huang et al, 2019). More importantly, all of the previous studies, including Nepal step survey, observed blood pressure based on the report of JNC 7th report. In addition, JNC 7 considered as a comprehensive document that includes both clear definition of prehypertension as well as hypertension and hypertension treatment measures, whereas JNC 8th report is narrowly focused in the treatment thresholds (Joseph et al, 2016). Few authors of ACC/AHA hypertension guideline 2017 argued that prehypertension is not scientific to achieve target BP of the individual, where, this claim was disproved because the rates of BP control after JNC 7 inclined from 37% to 57% based on National Health and Nutrition Survey data (Bakris, 2019). Therefore, the JNC 7th report is still used as a reference and essential tool to classify the blood pressure of an individual.

The prevalence of prehypertension among health workers in this study was found to be 67.40%, which is higher than 37% prevalence rate reported in health care workers of Iran (Sahebi et al, 2010). The inclusion of health workers <30 years of age in the study of Sahebi et al. (2010) could be a significant reason for less prevalence of prehypertension. Because people of this age group tended to have normal elasticity of blood vessels possessing less risk for prehypertension as well as hypertension. Osei-Yeboah et al. (2018) conducted a similar study and found 52.68% of prehypertension rate among health workers of Ghana. Furthermore, Ghana has the annual health screening program for the health workers, due to which

they have known their blood pressure level each year and might practice preventive measures for hypertension. However, no health screening program has been endorsed, focusing on Nepalese health workers. This reason might be accountable for the high prevalence of prehypertension in the current study than the study of Osei-Yeboah et al. (2018). A previous study conducted among health workers of Angola demonstrated the prevalence of prehypertension at 54.03% (Paquissi et al, 2016). The study setting of the study by Paquissi et al. (2016) was a private hospital which has differ working environment such as less workload, adequate availability of health workers, availability of healthy foods, strict rules and regulation related to health than government hospitals (current study settings). In addition, health workers aged <30 years have participated in their study. The difference in working environment and age factor could be the probable reason for a low prehypertension rate as compared to the current study.

The prevalence of prehypertension among health workers in this study (67.41%) was found higher in comparison to 35.40% among the Nepalese adult population (Huang et al, 2019). A previous study of Bhavani et al. (2018) shown the low prevalence of prehypertension among the Indian adult population at 15.9 % as compared to current study findings. Based on the findings of this study and study of Aryal et al. (2014), health workers were found less physically active, consume less fruit and vegetable, had more habit of alcohol use, and had more stressful life as compared to the general adult population of Nepal. In addition, dual responsibility towards work and family among health workers, force them to practice unhealthy behaviors, and a sedentary lifestyle ultimately leads to having high blood pressure. This figure indicates that Nepalese health workers are facing the escalating hidden burden of prehypertension and susceptible to hypertension that should be addressed and controlled urgently.

In this study, older age (40-49 years) was found to be a significant predictor of prehypertension among health workers. A similar result was revealed in the study of Xu et al. (2016), where Age 40-49 years (AOR:1.61, 95% CI:1.456-1.77) was associated with prehypertension among Chinese adults. This result was also consistent with the finding of National Demographic and Health Survey 2016, which reported the significant association between the older age and prehypertension among the adult population of Nepal (Kibria et al., 2018). Bhavani et al. (2018) found a similar result of an association between older age and prehypertension among the adult population of India. Barnes et al. (2014) mentioned that older age involves vascular remodeling and arterial stiffness, which can cause the increment of blood pressure and leads to prehypertension as well as hypertension.

The association between male sex and prehypertension among health workers was revealed in this study. The male health workers had 2.18 times higher risk of getting prehypertension as compared to female health workers. This result was similar to findings of the study of Kibria et al. (2018), who mentioned that the Nepalese male adults were at greater risk of prehypertension than Nepalese female adults. The study of sahebi et al. (2010) among Iranian health workers found the consistent result that male sex (OR:3.5, 95% CI:2.24-5.56) was significantly associated with pre-hypertension. Glibert et al. (2006) and Ojeda et al. (2008) stated that the intrinsic sex differences in cardiovascular function and protective effects of estrogen puts men at high risk of increased blood pressure than women of similar age.

This study found the association of contract type of employment with prehypertension among health workers. Similar to the current result, Seon et al. (2017) mentioned that the workers whose employment is on a contract basis are more likely to have high blood pressure compared to permanent workers. Schnall et al. (2018) also stated that contract type of employment has detrimental health effects on the individual, such as increment of blood pressure. Similarly, high blood pressure was found higher among hospital workers who worried about becoming unemployed, contract health workers (Kaur et al, 2014). The current study also revealed the high prevalence of perceived stress (known independent predictor of prehypertension in this study) among health workers who had contract type of employment, which might boost the effect of contract employment on pre-hypertension.

From the findings of this study, the association of overweight with prehypertension among health workers was revealed. It was found that overweight health workers had 1.86 times more chance to have hypertension than health workers with normal BMI. Sahebi et al. (2010) showed similar findings that

increased BMI was associated prehypertension among health workers; overweight health workers had 2.46 times the risk of being pre-hypertensive compared to health workers with normal BMI. In line with the current result, a previous study of Wang et al. (2008) illustrated that overweight is the significant risk factor of prehypertension among China adult population. In India, Bhavani et al. (2018) found a significant association between high BMI and prehypertension during multivariate analysis as the current finding. Similar to the current result, Al kibria et al. (2019) found that Overweight was associated with prehypertension among both male and female Bangladeshi adults population. Likewise, Kibria et al. (2018) found that overweight (AOR:3.5, 95% CI:2.9-4.1) was significantly associated with prehypertension among the Nepalese adult population. The study setting of current study was in Kathmandu valley; urban areas of Nepal where sedentary and busy lifestyle, preferences to eating junk foods; fast foods in instead of fruits and vegetables, inadequate physical activity are growing rapidly among local people leading to overweight and possesses risk for increased blood pressure (Muzzini & Aparicio, 2014). This unhealthy lifestyle and behaviors lead to an accumulation of bad fats in the body and cause overweight. Owen et al. (2019) stated that being overweight involves excessive non-esterified fatty acids into the bloodstream, altered renal mechanism, and abnormal activation of the sympathetic nervous system & hormones leads to an increment of blood pressure.

This study identified moderate perceived stress as the significantly associated factor of prehypertension among health workers. Several studies have supported the current finding. Hussian, Noor & Nabi (2018) found a significant association of increased perceived stress with prehypertension among patients in Pakistan. The stress was also revealed as a significant factor of increased blood pressure among African Americans (Ford et al, 2016). Abeetha et al. (2018) shown the association between increased perceived stress and prehypertension among university students in India. Furthermore, Mucci et al. (2016) found the consistent findings that stress was found to be associated with the development of hypertension in adults. Similar to the current finding, Egerter et al. (2008) stated the physiological evidence that the stressful events in an individual can trigger the normal homeostasis causing damage to immune systems and essential organs, i.e., heart, brain, and kidney which leads to a progression of chronic conditions including increased blood pressure. The health workers in this study have dual responsibility towards the job as well as family, and correspondingly they are facing shift work, job insecurities, less spare time for entertainment, and increased burden of work, which creating their life complex and stressful. Furthermore, stressed individuals tended to practice unhealthy behaviors such as intake of junk foods leading to be overweight, a risk factor of pre-hypertension.

The current study has some limitation. Firstly, limitation was in study design, i.e. cross-sectional design is not adequate to prove the real causal relationship of the disease. However, it is appropriate to estimate disease prevalence. Secondly, the over-estimation of prehypertension might result due to the use of single visit blood pressure measurement. Lastly, the study setting of this study was in urban areas; Kathmandu and Lalitpur district of Nepal; therefore, study findings might not generalize to the health workers who are working in the rural areas of Nepal. Despite these limitations, this study has numerous strengths. This study was the first scientific study that reported the burden of prehypertension among Nepalese health workers which provides the platform for further researchers and interventions makers to control hypertension among this neglected group, Nepalese health workers.

5. Conclusion

A high prevalence of prehypertension was reported among health workers of central hospitals in Nepal. The modifiable factors (overweight, & perceived stress) and non-modifiable factors (increasing age employment type, & male sex) of prehypertension among health workers were identified from this study. The effective interventions that include periodic blood pressure screening, weight reduction strategies, and stress management strategies, should be implemented immediately, particularly focusing on the health workers who are older and have a contract type of employment, to prevent foreseeable CVD complications among Nepalese health workers. Despite having health knowledge, Nepalese health workers are facing the concealed burden of prehypertension as a submerged portion of iceberg. Thus, knowledge, attitude, and

behaviors regarding prehypertension among Nepalese health workers can be assessed by future scholars to uncover the real scenario.

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7. References

Abeetha, S., Sureka, V., Brinda, S., & Ganesh, M. (2018). Prevalence of prehypertension and its association with levels of stress and anxiety among students of various disciplines in Chennai-A cross-sectional study. *National Journal of Physiology, Pharmacy and Pharmacology*, *8*(12), 1599-1604. doi:10.5455/njppp.2018.8.0928210092018

Agho, K. E., Osuagwu, U. L., Ezeh, O. K., Ghimire, P. R., . . . Ogbo, F. A. (2018). Gender differences in factors associated with prehypertension and hypertension in Nepal: A nationwide survey. *PloS one, 13*(9), e0203278. doi:10.1371/journal.pone.0203278

Ahmed, M. T., Jadhav, J., & Sobagaiah, R. T. (2018). Assessment of risk factors of non- communicable diseases among healthcare workers in Nelamangala : a cross sectional study. *International Journal of Community Medicine and Public Health*, *5*(2), 745–748. doi:10.18203/2394-6040.ijcmph201802615.

Al Kibria, G. M., Burrowes, V., Choudhury, A., Sharmeen, A., & Swasey, K. (2019). Sex differences in prevalence and associated factors of prehypertension and hypertension among Bangladeshi adults. *International Journal of Cardiology Hypertension*, *1*, 100006. doi:10.1016/j.ijchy.2019.100006

Arima, H., Murakami, Y., Lam, T. H., Kim, H. C., . . . Woodward, M. (2012). Effects of prehypertension and hypertension subtype on cardiovascular disease in the Asia-Pacific Region. *Hypertension*, *59*(6), 1118-1123. doi:10.1161/HYPERTENSIONAHA.111.187252

Assadi F. (2014). Prehypertension: a warning sign of future cardiovascular risk. *International Journal of Preventive Medicine, 5*(1), S4–S9. Retrieved December 20, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3990920/?report=reader

Bakris, G. (2019). Similarities and differences between the ACC/AHA and ESH/ESC guidelines for the prevention, detection, evaluation, and management of high blood pressure in adults: a perspective. *Circulation research*, *124*(7), 969-971. doi:10.1161/CIRCRESAHA.118.314664

Barnes, J. N., Hart, E.C., Curry, T. B., Nicholson, W. T., . . . Joyner, M. J. (2014). Aging enhances autonomic support of blood pressure in women. *Hypertension*, *63*(2), 303-308. doi:10.1161/HYPERTENSIONAHA.113.02393

Bhavani, P. L., Gupta, S., Thanikonda, S., Epari, V. (2018). A cross-sectional study on prehypertension & its association with anthropometric indices among undergraduate medical students in Andhra Pradesh, India. *Indian Journal of Medical Research. 148*(6):752–755. doi:10.4103/ijmr.IJMR_678_17

Central hospitals of Nepal. (2019). *Number of health workers in central hospitals of Nepal*. Central Hospitals. Retrieved from https://dohs.gov.np/about-us/department-of-health-services/

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., . . . Roccella, E. J. (2003). The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *Jama*, *289*(19), 2560-2571. doi:10.1001/jama.289.19.2560

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396. doi:10.2307/2136404

Egbi, O., Rotifa, S., & Jumbo, J. (2015). Prevalence of hypertension and its correlates among employees of a tertiary hospital in Yenagoa, Nigeria. *Annals of African Medicine, 14*(1), 8. doi:10.4103/1596-3519.148709

Egerter, S., Dekker, M., An, J., Grossman-Kahn, R., & Braveman, P. (2008). *Issue brief 4: Work matters for health*. Princeton NJ: Robert Wood Johnson Foundation. Retrieved June 18, 2019, from http://www.commissiononhealth.org/PDF/0e8ca13d-6fb8-451d-bac8-7d15343aacff/Issue%20Brief%204%20Dec%2008%20-%20Work%20and%20Health.pdf

Ford, C. D., Sims, M., Higginbotham, J. C., Crowther, M. R., . . . Parton, J. M. (2016). Psychosocial factors are associated with blood pressure progression among African Americans in the Jackson Heart Study. *American Journal of Hypertension, 29*(8), 913-924. doi:10.1093/ajh/hpw013

Fukuhara, M., Arima, H., Ninomiya, T., Hata, J., . . . Kiyohara, Y. (2012). Impact of lower range of prehypertension on cardiovascular events in a general population: the Hisayama Study. *Journal of Hypertension, 30*(5), 893-900. doi:10.1097/HJH.0b013e328351d380

Gupta, A. K., McGlone, M., Greenway, F. L., & Johnson, W. D. (2010). Prehypertension in disease-free adults: a marker for an adverse cardiometabolic risk profile. *Hypertension Research, 33*(9), 905-910. doi:10.1038/hr.2010.91

Gilbert, J. S., Cox, L. A., Mitchell, G., & Nijland, M. J. (2006). Nutrient-restricted fetus and the cardio–renal connection in hypertensive offspring. *Expert Review of Cardiovascular Therapy, 4*(2), 227-238. doi:10.1586/14779072.4.2.227

Government of Nepal, Ministry of Health and Population. (2013). *Human resource for health Nepal country profile*. Retrieved June 1, 2019, from https://www.herd.org.np/uploads/frontend/Publications/PublicationsAttachments1/1483613482-HRH.pdf

Government of Nepal, Ministry of Health and Population, EDCD. (2018). *Package of essential non communicable diseases (PEN) intervention at primary service setting; PEN training trainer's guide*. Retrieved June 8, 2019, from http://www.edcd.gov.np/index.php/resources/download/pen-training-trainers-guide-2075

Hu, L., Huang, X., You, C., Li, J., . . . Cheng, X. (2017). Prevalence and risk factors of prehypertension and gypertension in Southern China. *PloS one, 12*(1), e0170238. doi:10.1371/journal.pone.0170238

Huang, Y., Guo, P., Karmacharya, B. M., Seeruttun, S. R., . . . Hao, Y. (2019). Prevalence of hypertension and prehypertension in Nepal: a systematic review and meta-analysis. *Global Health Research and Policy, 4*(1), 11. doi:10.1186/s41256-019-0102-6

Huang, Y., Su, L., Cai, X., Mai, W., . . . Xu, D. (2014). Association of all-cause and cardiovascular mortality with prehypertension: a meta-analysis. *American Heart Journal, 167*(2), 160-168. doi:10.1016/j.ahj.2013.10.023

Hussain, A., Noor, H. T., & Nabi, U. (2018). Evaluation of role of increased perceived stress score and body mass index in causing secondary systemic hypertension in patients of hepatitis C. *Journal of Cardiovascular Disease & Diagnosis, 6*(6), 343. doi:10.4172/2329-9517.1000343

Joseph, A. C., Karthik, M. S., Sivasakthi, R., . . . Udaya Chander, S. J. (2016). JNC 8 versus JNC 7 – Understanding the evidences. *International Journal of Pharmaceutical Sciences Review and Research, 36*(1), 38-43. Retrieved March 12, 2019, http://globalresearchonline.net/journalcontents/v36-1/06.pdf

Julius, S., Nesbitt, S. D., Egan, B. M., Weber, M. A., . . . Schork, M. A. (2006). Feasibility of treating prehypertension with an angiotensin-receptor blocker. *New England Journal of Medicine, 354*(16), 1685-1697. doi:10.1056/NEJMoa060838

Kakunje, A. (2011). Stress among health care professionals: The need for resiliency. *Online Journal of Health and Allied Sciences, 10*(1), 6-8. Retrieved June 2, 2019, from http://cogprints.org/7952/8/2011-1-1.pdf

Kaur, H., Luckhaupt, S. E., Li, J., Alterman, T., & Calvert, G. M. (2014). Workplace psychosocial factors associated with hypertension in the US workforce: A cross-sectional study based on the 2010 National Health Interview Survey. *American Journal of Industrial Medicine, 57*(9), 1011-1021. doi:10.1002/ajim.22345

Kibria, G. M. A., Sakib, M. N., Swasey, K., Sharmeen, A., & Burrowes, V. (2018). Prevalence and associated factors of pre-hypertension and hypertension in Nepal : Analysis of the Nepal demographic and health survey 2016. *Health Science Reports, 1*(10), e83. doi:10.1002/hsr2.83

Monakali, S., Goon, D. Ter., Seekoe, E., & Owolabi, E. O. (2018). Prevalence, awareness, control, and determinants of hypertension among primary health care professional nurses in Eastern Cap, South Africa. *African Journal of Primary Health Care & Family Medicine, 10*(1), a1758. doi:10.4102/phcfm.v10i1.1758

Mucci, N., Giorgi, G., De Pasquale Ceratti, S., Fiz-Pérez, J., . . . Arcangeli, G. (2016). Anxiety, Stress-Related Factors, and Blood Pressure in Young Adults. *Frontiers in psychology, 7*, 1682. doi:10.3389/fpsyg.2016.01682

Muzzi, M., Pawlina, C., & Schnorr, G. P. (2018). Prevalence of stress in health workers in the context hospital. *Psychology and Behavioral Medicine Open Access Journal*, 15–21. Retrieved March 1, 2019, from http://ologyjournals.com/pbmoaj/pbmoaj_00003.pdf

Muzzini, E & Aparicio, G. (2014). *Urban growth and transition in Nepal: An initial assessment.* The World Bank. doi:10.1596/978-0-8213-9659-9

Neupane, D., McLachlan, C. S., Sharma, R., Gyawali, B., . . . Kallestrup, P. (2014). Prevalence of hypertension in member countries of South Asian Association for Regional Cooperation (SAARC): Systematic review and meta-analysis. *Medicine, 93*(13), 1–10. doi:10.1097/MD.0000000000000074

Nugraha, M., Pratama, P., & Turmudzi, D. (2017). Prevalence and characteristics of hypertension patients among the employee of malalengka public hospital in 2016. *Journal of Hypertension, 35*(3), e4. doi:10.1097/01.hjh.0000527411.19729.36

Ojeda, N. B., Grigore, D., & Alexander, B. T. (2008). Intrauterine growth restriction: fetal programming of hypertension and kidney disease. *Advances in Chronic Kidney Disease, 15*(2), 101-106. doi:10.1053/j.ackd.2008.01.001

Osei-yeboah, J., Kye-amoah, K. K., Owiredu, W. K. B. A., Lokpo, S. Y., . . . Aduko, R. A. (2018). Cardiometabolic risk factors among healthcare workers : A cross-sectional study at the sefwi-wiawso municipal hospital, Ghana. *BioMed Research International*, 2018: 8904548. doi:10.1155/2018/8904548

Paquissi, F. C., Manuel, V., Manuel, A., Mateus, G. L., . . . Castela, A. (2016). Prevalence of cardiovascular risk factors among workers at a private tertiary center in Angola. *Vascular Health and Risk Management*, *12*, 497. doi:10.2147/VHRM.S120735

Phiri, L. P., Draper, C. E., Lambert, E. V, & Kolbe-alexander, T. L. (2014). Nurses' lifestyle behaviours, health priorities and barriers to living a healthy lifestyle : a qualitative descriptive study. *BMC Nursing, 13*(1), 38. doi:10.1186/s12912-014-0038-6

Sahebi, L., Vahidi, R. G., & Mousavi, S. H. (2010). Prevalence of hypertension and associated variables in hospital staff in Iran. *Acta Medica Saliniana, 39*(1), 6–13. doi:10.5457/ams.138.10

Schnall, P. L., Dobson, M., Rosskam, E., & Elling, R. H. (2018). *Unhealthy work: Causes, consequences, cures.* Routledge. Retrieved 10 June, 2019, from https://www.taylorfrancis.com/books/9781351840859

Seon, J. J., Lim, Y. J., Lee, H. W., Yoon, J. M., . . . Park, S. M. (2017). Cardiovascular health status between standard and nonstandard workers in Korea. *PloS one, 12*(6), e0178395. doi:10.1371/journal.pone.0178395

Sumaila, F. G., Shittu, A., Idris, A. S., & Abba, M. A. (2016). Prevalence of undiagnosed hypertension and its risk factors among health care workers of some selected hospitals in Dutse, Jigawa State, North western Nigeria. *Advances of Science for Medicine, 1*(2), 19-23. doi:10.5281/zenodo.1308458.svg

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., . . . MacLaughlin, E. J. (2018). 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice

Guidelines. *Journal of the American College of Cardiology*, *71*(19), e127-e248. doi:10.1016/j.jacc.2017.11.005

Williams, B., Mancia, G., Spiering, W., Agabiti Rosei, E., . . . Kahan, T. (2018). 2018 ESC/ESH Guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH). *European heart journal*, *39*(33), 3021-3104. doi:10.1093/eurheartj/ehy339

World Health Organization. (2017). *WHO STEPS surveillance manual*. Geneva: World Health Organization. Retrieved March 7, 2019, from https://www.who.int/ncds/surveillance/steps/manual/en/

World Health Organization. (2018a). *Non communicable disease country profiles 2018*. Geneva: World Health Organization. Retrieved March 22, 2019, from http://www.who.int/iris/handle/10665/274512

World Health Organization. (2018b). *WHO methods and data sources for global burden of disease estimates 2000-2016*. Geneva: World Health Organization. Retrieved March 18, 2019, from http://www.who.int/gho/mortality_burden_disease/en/index.html

Xu, T., Liu, J., Zhu, G., Liu, J., & Han, S. (2016). Prevalence of prehypertension and associated risk factors among Chinese adults from a large-scale multi-ethnic population survey. *BMC Public Health*, 16(1), 775. doi:10.1186/s12889-016-3411-4

Zhou, B., Bentham, J., Di Cesare, M., Bixby, H., . . . Taddei, C. (2017). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19·1 million participants. *The Lancet, 389*(10064), 37-55. doi:10.1016/S0140-6736(16)31919-5