24 hr-Ambulatory Blood Pressure Profile and Clinical Features of Hypertensive and Prehypertensive Health Care Workers in a Tertiary Covid Center

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ABSTRACT

Objectives: To determine the blood pressure profile and phenotypes of hypertensive and prehypertensive health care workers and its association to BP control dipping status.

Methodology: This was a prospective cross-sectional study of health care workers who underwent 24 hour ambulatory blood pressure monitoring (ABPM). Clinical profile was taken, and ABPM data were also evaluated

Results:181 patients were included with majority from 50-59 years old age group (33.3%), female (70.17%), non-shift workers (61.88%) with the most common comorbidity of obesity (60.22%) and suspected obstructive sleep apnea (60.22%). All the known hypertensives (100%) had uncontrolled blood pressure despite being on antihypertensive medication. The following hypertension phenotypes were identified: Sustained hypertension (64.7%), masked hypertension (13.26%), white coat hypertension (7.18%), and non-dippers (66%).

Conclusion: Among health care workers, mean 24-hour, daytime, and nighttime blood pressure were elevated more in females 50-59years old age group, known hypertensives on antihypertensive therapy, with association on working hours>8hrs, without association to shift work, and job classification. This study highlights the importance of 24-hour ABPM to detect 24-hr BP pattern and identify participants with ABPM parameters at high risk for cardiovascular outcomes and also to determine blood pressure control among known hypertensive patients on maintenance medications. The findings of this study can serve as a “red- flag” signs to physicians and the patients more primarily for physicians to improve on screening, diagnosis and management strategies for hypertension, and check adherence to therapy of our patient.

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Keywords: ambulatory blood pressure, health care workers, non-dipper, blood pressure control

I. INTRODUCTION

Epidemiology / burden of disease

Hypertension is a leading cause of cardiovascular morbidity and mortality accounting for 49 % of ischemic heart disease, 69 % of cerebrovascular disease, and 7.1 million deaths per year worldwide. The prevalence of hypertension is increasing most rapidly in developing countries where poor hypertension treatment and control contribute to the growing epidemic of cardiovascular disease (CVD)[4].In the National Nutrition and Health Survey (NNHes) of the Food and Nutrition Research Institute (FNRI) prevalence of elevated blood pressure among Filipino Adults 20 years old and above were at 22.3% in 2013, and at 23.9% in 2015, which was based on a single visit blood pressure measurement of systolic blood pressure >140mmHg or higher, and or a diastolic blood pressure of 90mmHg or higher. Presyon 3, reflecting the nationwide survey on the prevalence of hypertension in the Philippines in 2015, showed the increasing trend of elevated blood pressure in our country. From 21 percent in 2007 to 28 percent in 2013, the rise in numbers establishes hypertension as a prevalent risk factor for the development of cardiovascular disease in our nation. Of those diagnosed, only 56% were taking antihypertensive medications, with only 20% of diagnosed hypertensives to have blood pressure controlled[15]

In terms of 24 hour blood pressure profile, the prevalence of masked (uncontrolled) hypertension, excessive morning BP surge and morning hypertension, and nocturnal hypertension is higher in Asians than in Europeans.[27] In addition, data from the international Ambulatory Blood Pressure Registry: Telemonitoring of Hypertension and Cardiovascular Risk Project (ARTEMIS) showed that masked hypertension and masked uncontrolled hypertension were diagnosed more often in Asia than in any other region.[28.] It is important to identify these

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individuals as disrupted diurnal blood pressure variation or those with non- dipping patterns, nocturnal hypertension, reverse dipping patterns, and morning surges is associated with particularly poor prognosis with occurrence to stroke and cardiac events.[27]

Review of Related Literature:

Evaluation of Hypertension

There are four ways to evaluate blood pressure: conventional office blood pressure measurement, out of office or home blood pressure measurement, unattended office blood pressure measurement and ambulatory blood pressure (ABPM) monitoring. Conventional office blood pressure measurement is done by medical personnel and should be measured at least twice. Home blood pressure monitoring is done twice in the morning and twice at night for at least 3 consecutive days (preferably 7 days) [4.]; first day readings are discarded then an average of all the rest of the readings is computed. An average home blood pressure of 135/85mmHg or higher is classified as hypertension. Unattended office blood pressure measurement or automated BP measurement is taken by an oscillometric monitor set to take 3 readings at 1,minute intervals after the patient has been seated in a quiet room for 5minutes. ABPM provides the average of BP readings over a defined period, and the device is typically programmed to record BP at 15 - 30 min intervals. Average BP values are usually provided for daytime, night-time, and the entire 24 hours while the patient provides a diary of daily activities. It has been shown to be a better predictor for hypertension mediated organ damage (HMOD) and is recommended by international guidelines like ESC 2018 guidelines to aid in diagnosis of hypertension. [21]

Ambulatory Blood Pressure Monitoring and Its Clinical Use

Ambulatory blood pressure monitoring has been in existence for more than 20 years. The first meetings to examine the potential of ABPM was held in Ghent in 1978 during European Society of Hypertension (ESH) working group on blood pressure monitoring. However, its potential for clinical use has been increasingly recognized and incorporated into guidelines for the diagnosis

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of hypertension. ABPM provides the average blood pressure readings over a defined period, usually 24hrs with 15-20min intervals of BP determination[3]. Ambulatory blood pressure monitoring diagnostic threshold for hypertension is ≥ 130/80mmHg over 24hrs, ≥135/85mmHg for daytime average and ≥120/70mmHg for nighttime average based on 2018 ESC/EHS Hypertension Guidelines.

The most widely accepted indication for ABPM is to diagnose hypertension in untreated patients with high office blood pressure readings. It allows classification into sustained normotension, white coat hypertension, masked hypertension and sustained hypertension. Sustained normotension is seen in patients with normal clinic and ABPM values. White coat hypertension is seen in individuals with BP elevations in clinic with normal ABPM values. Masked hypertension is defined as normal clinic readings with elevated ABPM averages. Sustained hypertension is seen in patients with recorded bp elevations both in the clinic and by ABPM.[7]. ABPM is known to be a better predictor for hypertension mediated organ damage (HMOD). Expert panel consensus recommendations for ABPM in Asia, the HOPE Asia network identified several ABPM parameters like morning surge, non-dipping pattern, riser pattern, nocturnal hypertension, and extreme dipping pattern, and short term blood pressure variation to be associated with target organ damage. Furthermore, 24-hour ambulatory blood pressure monitoring parameters like higher nighttime blood pressure and non-dipping patterns may pose prognostic importance among hypertensive patients and may also guide in treatment of uncontrolled hypertension.

Ambulatory Blood Pressure Profile: Local Data

In a report on the current status of ambulatory blood pressure monitor in Asian Countries published September 2019 which included 11 Asian countries, there was still a problem with availability of ABPM. In referral centers, ABPM was readily available but seldom in primary care clinics. Aside from availability, patient reluctance or poor acceptance owing to discomfort by

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repeated cuff inflations were also reported to be major barrier to its use despite it being the gold standard method for diagnosis, and guidance of hypertension treatment

Since the 1990s there have been few local studies done on 24-hour ambulatory blood pressure mostly in private institutions. One study by Soria, et.al in 1997 described morning and nocturnal blood pressure patterns in hypertensive and normotensive patients. Majority of the 121 patients included in the study followed the circadian pattern of nocturnal fall of BP during nighttime period; dippers among normotensives were 65.4% (34 out of 42), among Stage I hypertensives 68% (17 out of 25) and among Stage II hypertensives 40% (2 out of 5). The study also showed that 3 hours before waking up, both hypertensive and normotensive patients have generally higher mean BP with more significant increases among moderate hypertensive patients. This was attributed to the early morning increase in sympathetic nervous activity correlating with the rise in cardiovascular events like AMI, stroke, sudden cardiac death during this time of day. [6]

Another retrospective study done in a private tertiary hospital in 2018 featured blood pressure morning surge among Filipinos as a risk factor for cardiovascular events and found a prevalence of 36.6% among Filipino hypertensives included in the study.

Sudden Cardiac Death, and risk of Cardiovascular diseases among Shift Workers

While rare, sudden death on the job for healthcare workers is not unheard of. Most succumb to cardiovascular disease (CVD). In addition to traditional risk factors documented for sudden cardiac death, other identified occupational contributory factors, include shift work and working long hours. Shift work is defined by Kawachi et.al, in 1995, as work patterns that extend for more than the 8- hour daytime work schedule which can potentially disrupt workers' normal biological or social diurnal rhythm or both. Shift work is common in industrial work, customs and immigration, hospitals, and healthcare, protection services like police, fire, and transportation services like trucking, automobile and airlines. In a metaanalysis by Torquati, et.al, in 2018

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which included 21 studies with a total of 173,010 participants, the risk of any cardiovascular (CV) event was 17% higher among shift workers than day workers. Sub-group analysis showed an almost 20% higher risk of CVD and CHD mortality among shift workers than those who did not work shifts.

Implication and Importance:

ABPM is an important diagnostic tool among hypertensive patients especially in resistant hypertensive patients to define true and white-coat hypertension. Evaluation of circadian blood pressure profile is important to determine presence or absence of nocturnal fall (NF). Lack of normal NF is associated with an increased incidence of cardiovascular disease. Elevated ABPM values in patients are associated with a higher prevalence of target organ damage and increased incidence of future cardiovascular event. Determination of clinical risk factors affecting circadian blood pressure profile would allow identification of those health care workers in whom blood pressure surge and absence of nocturnal night fall would place them at greater risk for cardiovascular events, especially sudden cardiac death. Furthermore, ABPM would be particularly helpful in monitoring and guide in treatment control and modification.

II. MATERIALS AND METHODS

This was a prospective cross-sectional study of all hypertensive and pre-hypertensive PGH employees referred for 24-hour ambulatory blood pressure monitoring for the following indications: those on maintenance for hypertension, those who were advised to take anti-hypertensives in the past but were poorly compliant, those with high normal blood pressure (130-1139/85-89), those with blood pressure measurements >140/90 taken on 3 separate occasions, those with blood pressure measurement ≧180/110mmHg on single measurement, those with other comorbidities suspicious for nocturnal hypertension like diabetes, CKD,

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Obesity, and those with high normal blood pressures (SBP 130-139mmHg and DBP 85-89mmHg) taken and referred by UP Health Service. Participants who completed 24 hrs monitoring with >70% of all measurements validated from August 2020 to April 2021 were included in the study.

Patients less than 19 years old, those who did not complete 24 hour monitoring of blood pressure or those who did not achieve at least 70% successful blood pressure measurements for the past 24 hours, those with known atrial fibrillation and other arrhythmias, pregnant women, those with wounds on upper extremity that will prevent application of the blood pressure cuff were excluded from the study.

The principal investigator administered the ABPM data forms (please see appendix), obtained participants' height, weight (anthropometrics), and clinical history which includes co-morbidities and STOP questionnaire to asses for risk for obstructive sleep apnea. Patients were then scheduled for 24hour ambulatory bp monitoring General informed consent of the hospital was accomplished prior to administration of 24hr ambulatory blood pressure monitor. The administration of the 24hr ABPM monitor to the patient was which thoroughly explained upon asking for consent. Data were recorded using a standardized data collection form.

24-h ABPM determination was performed in each patient, using the BTL-08 ABPM monitor which is a property of the Division Hypertension. BP was measured by oscillometric method using standard adult washable ABPM cuffs (size 12x25cm bladder dimension with arm circumference range 25-34cm). Sleep and wake periods were reported by patients during the monitoring in the diary provided. Once the ABPM device is fitted, the patients were advised to return to their usual daily and professional activities. ABPM was carried out for 24 hrs. BP measurements were performed every 30 min during a predetermined wake period (6am- 10PM)

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and every 60 min during the sleep period (10:01PM-5:59AM). Recordings with > 30% of measurement errors were excluded from the analysis. Blood pressure levels will be determined dusing 24-hr average, daytime, and nighttime measurements. The following is a definition of terms used in the study.

a. Shift work- Shiftwork involves working outside the normal daylight hours. (outside the hours of around 7 a.m. to 4 p.m
b. Longer work hours- Those working> 8hrs/day for at least 5 days or those working> 40hrs per week.
c. Ancillary Health Care workers- those working as supplemental services other than room, board, and medical/nursing services provided to hospital patients in the course of care.
d. Pre- Hypertensive- Those with high- normal office blood pressure defined as SBP 130-139mmHg and or DBP 85-89 as defined by ESC 2018 Guidelines on Hypertension
e. Hypertensive - A health care worker who is either one of the following: Patient on maintenance medications for hypertension, A patient who was advised to take antihypertensive medications but were poorly compliant or patients with blood pressure >140/90 taken randomly on three separate instances
f. *Sustained hypertension*- participants with an office SBP values ≥140 mmHg and/or diastolic BP (DBP) values ≥90 mmHg, Daytime mean SBP≥135 and or DBP≥85, Nighttime mean SBP≥120 and or DBP≥70, 24hr mean SBP≥130, and or DBP≥80mmhg, Home BP mean SBP≥135, and or DBP≥85 (ESC Hypertension Guidelines 2018)
g. *Sustained normotension*- participants with an office SBP values<140 mmHg and/or diastolic BP (DBP) values <90 mmHg, Daytime mean SBP<135 and or DBP<85, Nighttime mean SBP<120 and or DBP<70, 24hr mean SBP<130, and or DBP<80mmhg, Home BP mean SBP<135, and or DBP<85 (ESC Hypertension Guidelines 2018)

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h. *White Coat Hypertension*- Those with elevated office BP despite normal ambulatory blood pressure measurements.

i. *Masked Hypertension*- participants with non-elevated office BP (<140/90 mm Hg) but elevated on out-of-office BP measurements using ABPM (Daytime mean SBP≥135 and or DBP≥85, Nighttime mean SBP≥120 and or DBP≥70, 24hr mean SBP≥130, and or DBP≥80mmhg, Home BP mean SBP≥135, and or DBP≥85

j. *Nocturnal Dipper*- Nocturnal Blood Pressure fall>10% of daytime values

k. *Non Dipper*- Nocturnal blood pressure fall <10% of daytime values.

Patients were also instructed to record for symptoms and their timing in the activity sheet provided. Patients were given the contact number the principal investigator for trouble shooting and for any concerns at the time of the 24 hour ambulatory blood pressure determination. Data was collated and analyzed by the principal investigator using the BTL -08 ABPM software program.

Descriptive statistics was used to summarize the demographic and clinical characteristics of the Healthcare workers. Frequency and proportion was used for categorical variables, median and inter quartile range for non-normally distributed continuous variables, and mean and SD for normally distributed continuous variables. Odds ratio and corresponding 95% confidence intervals from binary logistic regression was computed to determine significant predictors of Non-dippers and elevated 24 hour blood pressure. Shapiro-Wilk was used to test the normality of the continuous variables. Missing values was neither replaced nor estimated. Null hypotheses were rejected at 0.05α-level of significance. STATA 13.1 was used for data analysis.

III. RESULTS

A total of 181 patients were included in this study, consisting of 127 women and 54 men with mean age 46.3 ± 10. 18 years. Almost half of the population consisted of those in the ancillary

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services of the hospital while the other half came from medical and nursing services. Majority of them were non- night shift workers with work hours less than 9 hours. Majority of the participants were non-smokers, or already quitted for >20years, non-diabetic. About half of the population were obese, and those at risk for obstructive sleep apnea as evaluated using the STOP Questionnaire. Most identified indication for requesting the ambulatory blood pressure monitor was to evaluate BP control among known hypertensives (59.67%), followed by suspicion of masked hypertension (21.55%), Median duration of hypertension for the known hypertensives was between 0-5years

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Table 1. Characteristics of study population (n=181)

	Total (n=181)	Known hypertension (n=108, 60%)	Unknown hypertension (n=73, 40%)	P-value
	Frequency (%); Mean ± SD; Median (IQR)			
Age (in years)	46.30 ± 10.18	46.88 ± 9.68	45.45 ± 10.88	0.356
20-29 (%)	11 (6.08)	7 (6.48)	4 (5.48)	0.310
30-39 (%)	41 (22.65)	19 (17.59)	22 (30.14)	
40-49 (%)	51 (28.18)	35 (32.41)	16 (21.92)	
50-59 (%)	61 (33.7)	37 (34.26)	24 (32.88)	
≥ 60 (%)	17 (9.39)	10 (9.26)	7 (9.59)	
Gender (%)				0.869
Female	127 (70.17)	75 (69.44)	52 (71.23)	
Male	54 (29.83)	33 (30.56)	21 (28.77)	
Job Classification (%)				0.288
Medical and Nursing Services	97 (53.59)	54 (50)	43 (58.90)	
Ancillary Services	84 (46.41)	54 (50)	30 (41.10)	
Shift work (%)				0.214
With shifting	69 (38.12)	37 (34.26)	32 (43.84)	
Office hours	112 (61.88)	71 (65.74)	41 (56.16)	
Work hours (%)				**0.021**
Up to 9 hours	127 (70.17)	25 (23.15)	29 (39.73)	
> 9 hours	54 (29.83)	83 (76.85)	44 (60.27)	
Height (cm)	159.15 ± 9.11	159.65 ± 9.44	158.41 ± 8.61	0.370
Weight (kg)	70.02 ± 15.81	70.37 ± 15.80	69.51 ± 14.32	0.720
BMI	27.40 ± 5.85	27.5 ± 5.57	27.26 ± 6.28	0.788
Smoking status (%)				0.784
Non Smoker	167 (92.27)	9 (8.33)	5 (6.85)	
Smoker	14 (7.73)	99 (91.67)	68 (93.15)	
Duration of hypertension, years (IQR)	1 (0 to 5)	2.5 (0 to 6)	0 (0 to 2)	**<0.001**
Co-morbidities (%)				
Obese	109 (60.22)	64 (59.26)	45 (61.64)	0.760
Obstructive Sleep Apnea Symptoms	109 (60.22)	65 (60.19)	44 (60.27)	1.000
Dyslipidemia	34 (18.78)	24 (22.22)	10 (13.70)	0.177
Cerebrovascular Disease	8 (4.42)	6 (5.56)	2 (2.74)	0.477
Type 2 Diabetes	6 (3.31)	3 (2.78)	3 (4.11)	0.686
CKD St V on HD	0	0	0	-

The mean 24hr systolic blood pressure (SBP) 132.43 ±+ 15.24 and mean 24hr diastolic blood pressure (DBP) was 80.36 ±10.89, mean daytime systolic blood pressure (SBP) was 136.08 ± 15.37 and diastolic office daytime blood pressure was 82.69 ± 10.81and median systolic and diastolic nocturnal night fall index of 9 (5 to 12), and 10 (5 to 15) respectively.

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Out of 181 employees included in the study, following hypertension phenotypes were identified: 67.421/22% are with sustained hypertension, 13% masked hypertension, 12% are sustained normotensives while 7% are those with white coat hypertension. Furthermore, the study was able to identify 66% non-dippers compared to 35% dippers, and 87% are with elevated 24 hour blood pressure level. Among the known hypertensives, 100% are still with uncontrolled 24-hour blood pressure levels despite being on antihypertensive maintenance medications.

The most frequent anti-hypertensive drug was an angiotensin receptor blocker (ARB, most cited was Losartan), comprising 62% among those on antihypertensive medication followed by calcium channel blockers (CCB- 23%), with the remaining on either betablocker therapy (7.18%), diuretic therapy and combination therapy (ARB+CCB, ARB+hydrocholorthiazide in single pill or in free form). Majority were on monotherapy (73%), with some on free form combination 23%), and only a few on fixed dose combination (4%). This study deviates with the Philippine Heart Association-Council on Hypertension Report on Survey of Hypertension (PRESYON3) released in 2014 where they reported that the most frequent antihypertensive drugs used in the Philippines then were betablockers followed by calcium channel blockers, then angiotensin receptor blockers, and only a few were on ACEi. Perhaps another reason for the popularity of ARBs and calcium channel blockers specifically Losartan among the study population is because these medications in single pill formulations are in the Department of Health Medicines Access Program, a nationwide distribution of essential medicines including medications for hypertension and diabetes specifically Metoprolol, Amlodipine, Losartan and Metformin. During the past decade, monotherapy has been the mode of treatment, which could also explain why BP control rates have been low. [32]

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Table 3. Distribution of Patients According to Nocturnal Dipping Pattern in relation to clinical and demographic variables.

Characteristic	Dippers (n=63, 35%)	Non Dippers (n=118, 66%)	Odds Ratio (95% CI)	P-value
Age (in years)	45.06 ± 9.50	46.97 ± 10.50	1.02 (0.99–1.05)	0.231
20-29(%)	2 (3.17)	9 (7.63)	(reference)	-
30-39(%)	19 (30.16)	22 (18.64)	0.26 (0.05–1.34)	0.107
40-49(%)	22 (34.92)	29 (24.58)	0.29 (0.06–1.49)	0.140
50-59(%)	16 (25.4)	45 (38.14)	0.63 (0.12–3.21)	0.573
≥ 60 (%)	4 (6.35)	13 (11.02)	0.72 (0.11–4.82)	0.737
Gender (%)				
Female	43 (68.25)	84 (71.19)	1.15 (0.59–2.23)	0.681
Male	20 (31.75)	34 (28.81)	(reference)	
Job Classification(%)				
Medical and Nursing Services	36 (57.14)	61 (51.69)	0.80 (0.43–1.49)	0.484
Ancillary Services	27 (42.86)	57 (48.31)	(reference)	-
Shift work(%)				
With shifting	19 (30.16)	50 (42.37)	1.70 (0.89–3.26)	0.109
Office hours	44 (69.84)	68 (57.63)	(reference)	-
Work hours(%)				
Up to 9 hours	50 (79.37)	77 (65.25)	(reference)	-
> 9 hours	13 (20.63)	41 (34.75)	2.05 (1.02–4.20)	**0.041**
*Height (cm)	159.53 ± 8.09	158.94 ± 9.64	0.99 (0.96–1.03)	0.681
*Weight (kg)	69.67 ± 15.57	70.21 ± 16	1.01 (0.98–1.02)	0.826
*BMI	26.76 ± 6.10	27.74 ± 5.71	1.03 (0.98–1.09)	0.283
Smoking status (%)				
Non-Smoker	57 (90.48)	110 (93.22)	(reference)	-
Smoker	6 (9.52)	8 (6.78)	0.69 (0.23–2.09)	0.512
Duration of hypertension, years (IQR)	0.08 (0 to 5)	2 (0 to 5)	1.03 (0.97–1.09)	0.281
Co-morbidities (%)				
Obese	37 (58.73)	72 (61.02)	1.10 (0.59–2.05)	0.765
Obstructive Sleep Apnea Symptoms	35 (55.56)	74 (62.71)	1.34 (0.72–2.50)	0.349
Dyslipidemia	7 (11.11)	27 (22.88)	2.37 (0.97–5.81)	0.058
Cerebrovascular Disease	1 (1.59)	7 (5.93)	3.91 (0.49–32.5)	0.207
Type 2 Diabetes	2 (3.17)	4 (3.39)	1.07 (0.19–6.01)	0.939
CKD St V on HD	0	0	-	-
Indication for Requesting ABPM(%)				
Suspicious of white coat hypertension	33 (52.38)	75 (64.56)	(reference)	-
Suspicious of masked hypertension	13 (20.63)	19 (16.1)	0.64 (0.28–1.45)	0.289
Evaluation of BP control	16 (25.4)	23 (19.49)	0.63 (0.30–1.35)	0.236
Evaluation of symptoms consistent with hypotension during treatment	1 (1.59)	1 (0.85)	0.44 (0.03–7.25)	0.566

Outcome of interest: Non Dipper **Mean + SD*

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Table 4. Distribution of Patients who are not known hypertensives according to average 24 hour blood pressure level in relation to clinical and demographic variables.

Characteristic	Normal 24 hour BP (n=23, 32%)	Elevated 24 hour BP (n=50, 68%)	Odds Ratio (95% CI)	P-value
	Frequency (%); Mean ± SD; Median (IQR)			
Age (in years)	43.52 ± 10.93	46.34 ± 10.93	1.02 (0.98–1.07)	0.303
20-29	2 (8.70)	2 (4)	(reference)	-
30-39	8 (34.78)	14 (28)	1.75 (0.21–14.9)	0.609
40-49	5 (21.74)	11 (22)	2.2 (0.24–20.40)	0.488
50-59	7 (30.43)	17 (34)	2.43 (0.28–20.8)	0.418
≥ 60	1 (4.35)	6 (12)	6 (0.34–107.42)	0.224
Gender				
Female	18 (78.26)	34 (68)	0.59 (0.19–1.87)	0.371
Male	5 (21.74)	16 (32)	(reference)	-
Job Classification				
Medical and Nursing Services	11 (47.83)	32 (64)	1.94 (0.71–5.28)	0.195
Ancillary Services	12 (52.17)	18 (36)	(reference)	-
Shift work				
With shifting	9 (39.13)	23 (46)	1.33 (0.48–3.62)	0.583
Office hours	14 (60.87)	27 (54)	(reference)	-
Work hours				
Up to 9 hours	15 (65.22)	29 (58)	1.36 (0.49–3.79)	0.559
> 9 hours	8 (34.78)	21 (42)	(reference)	-
Height (cm)	158.82 ± 9.52	158.22 ± 8.25	0.99 (0.94–1.05)	0.779
Weight (kg)	68.48 ± 16.24	69.98 ± 13.50	1.01 (0.97–1.04)	0.677
BMI	27.17 ± 6.40	27.3 ± 6.28	1.01 (0.93–1.09)	0.936
Smoking status				
Non Smoker	22 (95.65)	46 (92)	(reference)	-
Smoker	1 (4.35)	4 (8)	1.91 (0.20–18.1)	0.572
Duration of hypertension, years	0 (0 to 2)	0 (0 to 4)	0.95 (0.87–1.04)	0.301
Co-morbidities				
Obese	12 (52.17)	33 (66)	1.78 (0.65–4.86)	0.261
Obstructive Sleep Apnea Symptoms	16 (69.57)	28 (56)	0.56 (0.20–1.59)	0.274
Dyslipidemia	2 (8.70)	8 (16)	2 (0.39–10.26)	0.406
Cerebrovascular Disease	0	2 (4)	-	-
Type 2 Diabetes	1 (4.35)	2 (4)	0.92 (0.08–10.7)	0.945
CKD St V on HD	0	0	-	-

*Outcome of interest: Elevated 24 hour BP*Mean + SD*

Healthcare workers who work > 9 hours were 2.05 times more likely to be non-dippers compared to healthcare workers who works up to 9 hours. Other variables were insignificant predictor of nocturnal non dipping pattern (Table 3).

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IV. DISCUSSION

ABPM provides greater number of readings in 24 hours even while doing his or her own daily activities, including sleep, thereby giving a better picture of the average blood pressure of an individual. Since the advent of ABPM, number of studies have shown that 24-hour ambulatory blood pressure highlights the chronobiology of cardiovascular system, specifically influencing nocturnal and early morning blood pressure, and is a better predictor of hypertension mediated organ damage (HMOD) in comparison to other blood pressure examinations. Furthermore, it has consistently been shown to have a closer relationship with morbid or fatal events. For these reasons, 24hr ABPM is considered the gold standard in the diagnosis of hypertension and has been included in several guideline recommendations for arterial hypertension. The American Heart Association identified as cutoffs for diagnosis of hypertension using ABPM average daytime blood pressure of at least 130/80mm Hg, while ESC diagnostic threshold for hypertension using ABPM are the following: >=130/80 over 24 hrs, >=135/85mmHg for daytime average, and >=120/70mmHg for nighttime average. In the study population prevalence of sustained hypertension was identified to be at 67% of the study population of Filipino health care workers, 70% of which are females.

Studies in other specific occupational groups demonstrated variable arterial hypertension prevalence levels.[30] Health care occupations have long been known to be highly stressful and associated with higher rates of psychological distress than many other occupations. Furthermore, such stressors can lead to physical (headache, blood pressure changes), behavioral (absenteeism, sleep problems), and psychological symptoms(depression) [29]. In a study done in a population of health care workers in Brazil, prevalence of arterial hypertension was found to be at 33.1%, which is not far from the 30% prevalence of hypertension among the general population in Brazil. Intense exposure to physical and mental

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stress, the type of activities of health care professionals and circadian rhythm changes like shifting were important determinants of increased blood pressures in this study population. This study showed that the mean 24hr blood pressure of the population is 132.43 + 15.24 / DBP 80.36 + 10.89, mean daytime 136.08 + 15.37/ DBP 82.69 + 10.81 and mean nighttime 125.31 + 17.31/ DBP 75.07 + 11.77, reflecting a generally elevated blood pressure level for this study population. Across all premorbid conditions, and clinical risk factors, including job classification (Ancillary vs medical/nursing services), whether they work in the night shift or daytime office hours, all factors except for long work hours (>8hrs/day) was significantly associated and are 2.05 times more likely to have a nocturnal non dipping pattern.

The two components of the circadian rhythm of blood pressure that have attracted the greatest attention in recent years are the nocturnal dip, which occurs when an individual goes to sleep, and the early morning rise in blood pressure[9]. Patients are identified as dippers if their nocturnal BP falls by >10% and extreme dippers, if their nocturnal BP falls by >20% while non dippers if only with a modest decrease (<10%) of the daytime average BP values[3].The usual higher BP during daytime is likely due to increased sympathetic tone in the morning where there are high levels of plasma norepinephrine, epinephrine, and urinary catecholamine concentrations and more active renin-angiotensin-aldosterone system (RAAS). The withdrawal of sympathetic dominance and reduced levels of catecholamines, and peak nitric oxide levels are responsible for the relatively lower BP at night. In this study, night time average blood pressure of the study population is elevated at SBP 125.7 + 17.7/DBP 86 + 11.3mmHg which is deemed elevated by both ACC/AHA and ESC guidelines for arterial hypertension. Majority of the study population were identified as non-dippers (66%).

Based on literature, risk factors identified to non-dipping and nocturnal hypertension include diabetes mellitus, renal failure, obesity, obstructive sleep apnea, and autonomic nervous system dysfunction. Moreover, other patient factors like smoking status, age, physical activity, and work-related factors like job strain, shiftwork, job demands, can affect diurnal variations in

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blood pressure. In this study, longer work hours (>8hrs/day) was significantly associated with nocturnal non dipping pattern, but its association with blood pressure control was insignificant. This can be due to several factors. For one, those with longer work hours, may also be the one with shorter sleep duration or those with poorer quality of sleep, more night time awakenings. Sherwood *et al* [34] reported that poor sleep quality was associated with non-dipping blood pressure and the potential mechanism might be heightened sympathetic activity.

Although sleep apnea is clearly related to nocturnal non dipping BP pattern, it was not an independent explaining factor for non- dipping in our population.

Hypertension Phenotype and Blood Pressure Levels

Half of the population (59.67%) are known hypertensives on maintenance medications. Furthermore, the prevalence of true hypertensives in the study population is 67.4% wherein 14 of which are newly diagnosed and are previously not on any antihypertensive maintenance medication. Prevalence of the other hypertension phenotypes identified are as follows: white coat Hypertensives 7.18%, Masked Hypertension 13.26%, and true normotensives 12.5%. Among known hypertensives, 100% belong to the uncontrolled group despite being on antihypertensive medications.

V. CONCLUSION:

There was high prevalence of sustained hypertension among healthcare workers included in this study. All those known hypertensives tested had uncontrolled blood pressure despite being on one or more antihypertensive therapy, while there were also newly diagnosed with masked hypertension. The overall prevalence of non-dippers and those with elevated mean 24- hour blood pressure levels was high, and there is significant association of working longer hours and nocturnal dipping pattern. However, there was no significant difference on nocturnal dipping status and blood pressure elevation among those with those with shift work, compared to usual

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office work hours. This study is one of the few local data on 24hr ambulatory blood pressure measurement of Filipino hypertensive and prehypertensive patients, however we may be limited by sample population and is not representative of general population of hypertensives and prehypertensives in the country. Since the study is a cross sectional study, no followup was done for these patients to be able to establish prognostic implication of having a particular hypertensive phenotype. Followup study on cardiovascular outcomes and manifestations of hypertension mediated end organ damage for each phenotype and hypertension profile is recommended. The findings of this study can serve as a “red- flag” signs to physicians and and the patients. For us physicians to improve on screening, diagnosis with the aid of 24 hour ambulatory blood pressure, and management strategies for hypertension, and check adherence to therapy of our patients.

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VI. APPENDIX:

Data Collection Form

CODE:_____		
AGE:_____	**SEX:** ( )Male ( ) Female	Ht_____Wt_____BMI_____
(To be filled up by rotator) :		
Indication for ABPM: o Evaluation of resistant hypertension o Evaluation of Secondary Hypertension	o Suspicious of white coat hypertension o Suspicious of masked hypertension o Evaluation of BP control especially in treated higher-risk patients with poor BP control (%)	o Evaluation of symptoms consistent with hypotension during treatment o Others: _____ _____
Deparment:	Shift Schedule: to	Shift worker Y_____N_____ Number of work hours:
Smoking Status:	• Smoker • None Smoker	• Previous Smoker stopped _____ years ago
Co-Morbidities:		
( ) Heart Failure	( ) Cerebrovascular Disease	( ) Dyslipidemia
( ) DM (Those taking OHA and or insulin requiring)	OSA Symptoms STOP: **S**nore loudly?___ **T**iredness/Excessive daytime Sleepiness? ,	**O**bserved apnea?____, known or are being treated for hy**P**ertension?____) *at least 2 out of 3= at risk for OSA

Hypertension Profile

years Hypertensive: _____

Usual Office/Clinic Blood Pressure: _____

Medications for Hypertension :

_____

_____

_____

_____

(*To be filled up using Ambulatory blood pressure monitor data)*

Mean Daytime SBP_____Mean Daytime DBP_____

Mean Nighttime SBP_____. Mean Nighttime DBP_____

Mean 24hr SBP_____. Mean 24hr DBP_____

Nocturnal Fall Index:

Circadian Profile

( ) Dipper ( ) Non Dipper

Blood Pressure Phenotype

( )Sustained Hypertension

( )True Normotension ( )White coat Hypertension ( )Masked Hypertension

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