

## Original Article

# Role of Home Blood Pressure Monitoring in Treatment Follow-up by Hypertensive Patients Cohort

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### Abstract

**Background:** The main benefit of home-based blood pressure monitoring (HBPM) is the potential approach to reduce the risk of white-coat hypertension (HTN) and to encourage patients to take ownership of their condition. This study was conducted to assess the role of HBPM in treatment follow-up in a cohort of hypertensive patients.

**Materials and methods:** This was a prospective observational study conducted from December 2017 to May 2018. A total of 100 patients fulfilling the inclusion and exclusion criteria were selected by purposive sampling from Medicine Outdoor of Dhaka Medical College Hospital (DMCH). In total, 100 hypertensive patients were enrolled, and informed consent was obtained. Subsequently, the study subjects received information and training on BP self-management and performed 2 resting measurements per day for 4 days per week for 3 months. All measurements were performed using validated BP monitors. The study endpoints included patient awareness, attainment of BP goals, adherence to antihypertensive treatment, lifestyle modification, assessment of discrepancy between office and HBPM, and white coat HTN or masked HTN at 3 months. SPSS version 22.0 was used for data analysis and reporting.

**Results:** Overall, the mean age was  $57.76 \pm 12.60$  years with a range of 34 – 80 years. Males were more prevalent than females, and the ratio was 1.17:1. The majority of cases (76.0%) had established HTN with a history of taking medication, whereas others were non-compliant with medications. Among them 47% had obesity, and 24% had diabetes mellitus. Of the patients, 91% adherence to HBP monitoring, 84.0% adherence to medication, and 75.0% achieved their target BP. The achievement of target blood pressure was significantly higher among the study subjects who adhered to HBP monitoring, and the *p*-value was  $< 0.04$  (Fisher's Exact test).

**Conclusion:** In a cohort of patients with arterial hypertension, information, and training on BP self-measurement and direct involvement of patients using HBPM led to improvement in BP control and could be an effective method by incorporating it into the usual care of hypertensive patients in the hypertension management center of the community.

**Key Points:** Systolic blood pressure, Diastolic Blood Pressure, Home blood pressure monitoring, Hypertension, Masked Hypertension, Office BP measurement, White coat hypertension.

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## Background

Hypertension is the leading preventable risk factor for premature death and disability worldwide.<sup>1</sup> Different methods of blood pressure monitoring have been evaluated for their usefulness in the routine management of hypertension. Conventional office (clinic/hospital-based) measurement of blood pressure, Home blood pressure monitoring (HBPM), and 24-hour Ambulatory Blood Pressure Monitoring (ABPM) are useful but have great variability.<sup>2,3</sup>

HBPM is a useful adjuvant to office blood pressure measurement in many conditions such as diagnosis of possible hypertension, white coat effect, masked Hypertension, and in monitoring blood pressure.<sup>4</sup> HBPM is a tool that evaluates the efficacy of antihypertensive treatment and rationalizes dose adjustment, especially in hypertensive patients with white coat effect, and supports antihypertensive medication dose adjustment in previously misdiagnosed or over-treated patients.<sup>4</sup> Control of blood pressure in patients discharged from the hospital in whom the treatment is either newly initiated or modified is essential. For them, treatment adherence and lifestyle changes as well as awareness about hypertension are mostly improved by this measure. HBPM is the ability to take multiple readings of blood pressure during the day and for several days to months. It may provide a better prediction of hypertension-induced end organ damage or other complications compared with the office settings though this has not been unequivocally proved.<sup>5</sup> The possibility of long-term monitoring, the ease and wide availability of equipment to monitor blood pressure, convenience, and perhaps financial advantages for the patient are benefits of HBPM over 24-hour continuous ABPM.<sup>5</sup>

When a person is at a workstation (office) or while sleeping, it is challenging to check their HBPM boundaries.<sup>2</sup> In most subjects, a home blood pressure reading of less than 130/80 mmHg is regarded as normal, whereas one of more than 135/85 mmHg is regarded as excessive.<sup>5,6</sup> There are numerous types of blood pressure monitoring devices. However, the auscultatory apparatus is more cost-effective than the others for a low-income nation like Bangladesh.<sup>2</sup>

## Rationale of the Study

Like many low- and middle-income nations, Bangladesh is going through an epidemiological transition where diseases are changing from communicable to noncommunicable diseases (NCDs). Cardiovascular disease (17%) is one of the main NCDs, accounting for 41% of all deaths. 18% of the population had hypertension, an intermediate risk factor for cardiovascular illnesses and heart attacks. Sustainable development goal (SDG) 3, "Ensure healthy lives and promote well-being for all at all ages", provides a high degree of importance to NCD control and targets to reduce premature NCD deaths by one-third by

2030.<sup>7</sup> The high prevalence of hypertension is a tremendous public health burden. Being the main cause of heart disease and stroke, which are the number 1 and third most common causes of mortality globally, respectively.<sup>8,7</sup> Even when office BP is adequately controlled, uncontrolled masked morning hypertension with residual cardiovascular risk should still be a target for the management of hypertension since HBPM-guided antihypertensive therapy has been successful in preventing these.<sup>9,10</sup> Each 20 mm Hg increase in SBP between the ages of 40 and 69 is linked to more than a doubling of the baseline level of organ damage.<sup>11</sup> The use of HBPM allows for quicker diagnosis and treatment, reduces the need for consultations, and may also aid in better control of hypertension. However, despite these facts, few clinical studies have been devoted to the issue of HBPM and its validity in Bangladesh.

## Materials and Methods

It was a hospital-based prospective observational study conducted in the Outpatient Department of Medicine at Dhaka Medical College & Hospital from November 2020 to April 2021. All the data were recorded in a structured data collection sheet. The sample size of this study was 100. Patients who visited the hypertensive clinic of DMCH fulfilling inclusion and exclusion criteria were selected by purposive sampling. Patients aged > 18 years, with newly diagnosed hypertension, established HTN with a history of taking antihypertensive medication, and using their own upper arm-type HBPM machine to measure BP at home were enrolled in this study. Hypertension was defined as a constant, repeated systolic blood pressure (SBP) in the office of  $\geq 140$  mmHg and or diastolic BP (DBP)  $\geq 90$  mmHg.<sup>12</sup> For home BP monitoring, an average value of  $\geq 135/85$  mm Hg was defined.<sup>12</sup> White-coat hypertension (WCH) is defined as a condition characterized by an elevation of office blood pressure (BP) with normal ambulatory or home values.<sup>13</sup> According to the National Institute for Clinical Excellence (NICE) guidelines for HBPM, BP was recorded.<sup>14</sup> Participants with a home blood pressure monitor were taught how to use it, validated, and adjusted by the researchers. Then, feedback demonstration from the patient on how to use monitor and record in HBPM log sheet was taken. They were also explained treatment goals, medications, diet, and exercise. They were asked to see the investigator monthly for three months. The patient was examined clinically, and OBPM was done on the day of 1<sup>st</sup> visit. A HBPM log sheet and a questionnaire regarding the awareness of BP, BP goal, frequency of BP measurement outside the clinic, frequency of drug skipping, and perception of the importance of BP and HBPM were carried out. Each patient was interviewed thrice, just before and 1<sup>st</sup> and 3<sup>rd</sup> months after HBPM. Home BP was recommended to be measured twice a day, in the morning, 5-10 minutes after waking up and just before going to sleep. The frequency of HBPM at home was 4 days in a week. Mean systolic BP (SBP) and diastolic BP (DBP) were determined from two readings, with at least a 2 minute interval between each reading. The

primary outcome was BP change and attainment of the target BP, 140/90 mm Hg in patients with no complications and 130/80 mm Hg in patients with complications, as determined by the office BP readings after HBPM. Drug adherence, drug skipping or lessening, attitude, and knowledge of BP and HBPM were evaluated by patients using a survey after the 3 month period of HBPM with this questionnaire. Informed written consent was obtained from each patient and/or their legal guardians where necessary. All data are presented as percentages or as mean ± standard deviation. For data analysis, SPSS 22.0 version was used. Statistical analyzes of the comparison of BP, target attainment, drug adherence, and awareness of patients before and after HBPM were performed by the paired *t-test*. The McNemar test was used for values in percentages. A comparison of the above parameters before and after HBPM was made by the *t-test* or Chi square test and Fisher’s Exact test. *P* values < .05 were considered statistically significant.

**Results**

100 patients with Hypertension were enrolled in this study. Data were collected from 8<sup>th</sup> November 2020 to 8<sup>th</sup> April 2021 to observe the role of HBPM in the management of hypertension. Table 1 showed that most of the patients were >50 years old (68%) followed by 41-50 years (20.0%) in age group 71-80 years and d’ 40 years (12%). Mean age of the study subjects was 57.76 ± 12.60 years. Males (54.0%) were more predominant than females (46.0%) and male to female ratio was 1.17:1. Among them 74.0% of patients were from urban.

**Table 1:** Demographic profile of the study subjects (N=100)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
<40	12	12
41 - 50	20	20
51 - 60	24	24
61 - 70	24	24
71 - 80	20	20
Mean ± SD	57.76 ± 12.60	
Gender		
Male	54	54
Female	46	46
Residence		
Urban	74	74
Rural	36	36

Table 2 showed that mean BMI (kg/m<sup>2</sup>) was 27 ± 5.30. Before HBPM, the mean Office BP was 167.1/95.9, and the mean Home BP was 160.3/93.2 mmHg, respectively. After HBPM, the mean Office BP was 135.9/81.7 and the mean Home BP was 132.3/81.9 mmHg, respectively.

**Table 2:** Baseline Clinical profile of the study subjects (N=100)

Parameters (Baseline)	[Mean ±SD]
BMI (kg/m <sup>2</sup> )	27 ± 5.30
Before HBPM	
Office SBP(mm of Hg)	167.1±16.6
Office DBP(mm of Hg)	95.9±11.1
Home SBP(mm of Hg)	160.3±18.0
Home DBP(mm of Hg)	93.2±12.0
After HBPM	
Office DBP(mm of Hg)	135.9±10.2
Office SBP(mm of Hg)	81.7±7.7
Home SBP(mm of Hg)	132.3±11.5
Home DBP(mm of Hg)	81.9±8.7

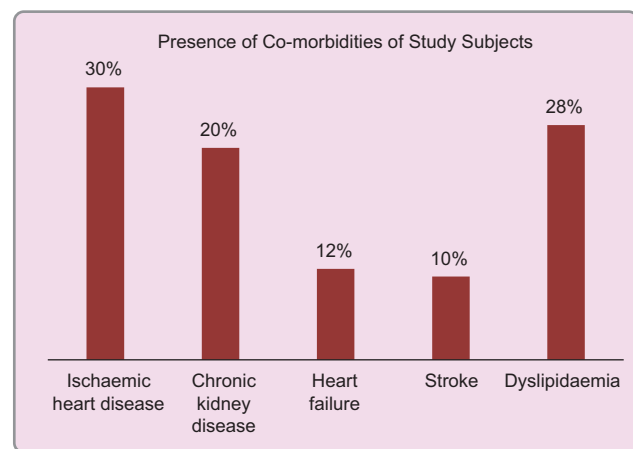
Table 3 showed the distribution of the study subjects based on their hypertension diagnosis where the majority of cases (76.0%) had established HTN with medication, followed by established HTN without medication (12.0%) and newly diagnosed HTN (12.0%).

**Table 3:** Distribution of the study subjects according to diagnosis of HTN (N=100)

Diagnosis of hypertension	Frequency (n)	Percentage (%)
Newly diagnosed HTN	12	12.0
Established HTN without medication	12	12.0
Established HTN with medication	76	76.0

Figure 1 showed that among the study subjects, 30% had ischemic heart disease, 28% had dyslipidemia, 20% had chronic kidney disease, 12% had heart failure and 10% had stroke.

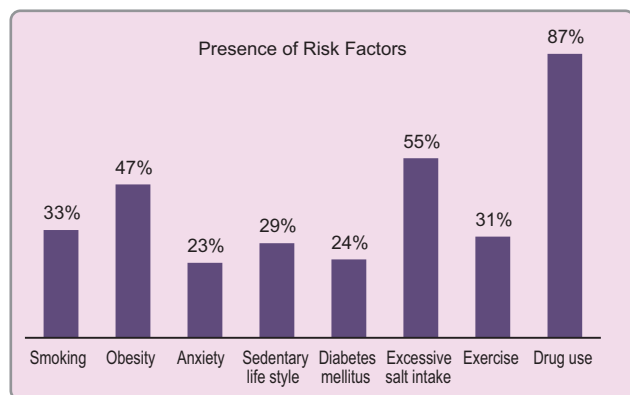
Figure 2 showed the distribution of the study subjects based on risk factors. Among the study subjects, 47% had obesity, 24% had diabetes mellitus, 23% had anxiety, 33% had



**Figure 1:** Bar diagram showing the presence of comorbidities (n=100)

smoking habits, 29% had a sedentary lifestyle, 55% consumed excessive salt, and 87% used drugs.

Table 4 showed the difference in blood pressure between the office and the home and it revealed 16.0% of the study participants had a difference between their office and home blood pressures.



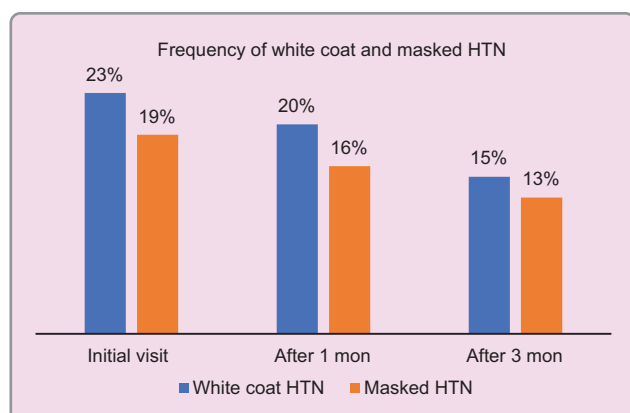
**Figure 2:** Bar diagram showing the presence of risk factors (n=100)

**Table 4:** Discrepancy between office BP and home BP (N=100)

Discrepancy between office BP and home BP	Frequency (n)	Percentage (%)
Yes	16	16.0
No	84	84.0

Figure 3 showed the frequency of white coat before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up were 23%, 20%, and 15% respectively, and the frequency of masked HTN before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up were 19%, 16%, and 13% respectively.

McNemar was done to analyze the data. p-value for White coat HTN is 0.008 (McNemar test). p-value for Masked HTN is 0.031 (McNemar test).



**Figure 3:** Bar diagram showing the frequency of white coat and masked HTN before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up

Table 5 showed patient adherence to medication and HBP monitoring. Among patients, 84% had adherence to medication and 91% had adherence to HBP monitoring. Moreover, Table 6 showed drug non adherence in the pattern of skipping drugs per week decreased significantly after HBPM from 58% to 16% and lessening medication before HBPM adaptation 65% to 13% days per week. p-value was <0.001 (Paired t-test was done).

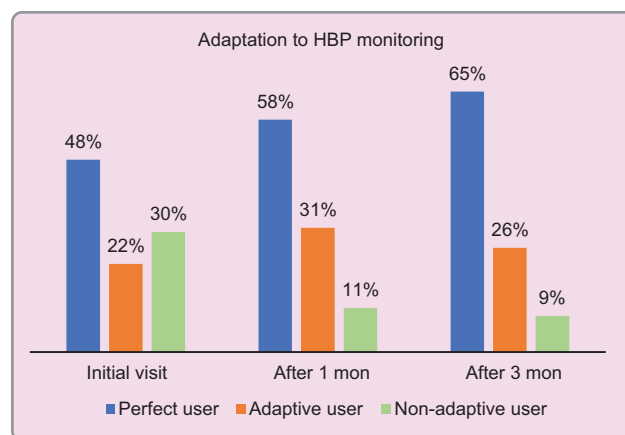
**Table 5:** Adherence of patients to medication and HBP monitoring (N=100)

	Frequency (n)	Percentage (%)
Adherence of medication	84	84
Adherence of HBP monitoring	91	91

**Table 6:** Change in drug adherence after HBPM

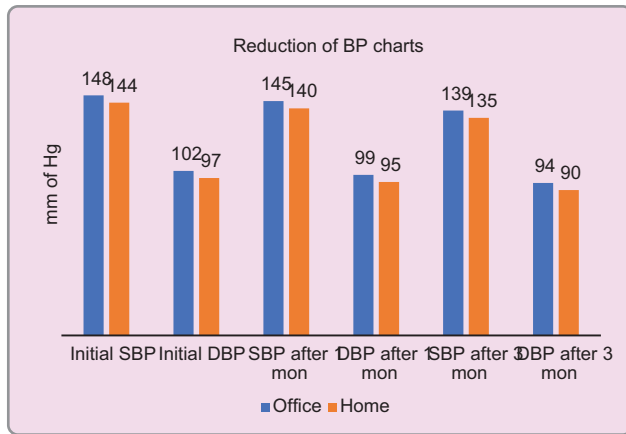
	Before HBPM (%)	After HBPM (%)
Skipping medication	58	16
Lessening medication	65	13

Figure 4 showed adaptation of patients to HBP monitoring showed that the frequency of perfect users before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up were 48%, 58%, and 65% respectively and the frequency of adaptive users before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up were 22%, 31% and 26% respectively and frequency of non-adaptive users before HBPM and during 1<sup>st</sup> and 3<sup>rd</sup>-month follow-up were 30%, 11%, and 9%, respectively. p-value = <0.001 (McNemar test).



**Figure 4:** Adaptation of patients to HBP monitoring (N=100)

Figure 5 shows the office BP reading significantly decreased from 148/102 to 128/73 mm Hg (P < .001) after the 3 month program of HBPM. p-value = <0.001 (Paired t-test was done).



**Figure 5:** Bar diagram showing Reduction of BP and attaining target BP after HBPM

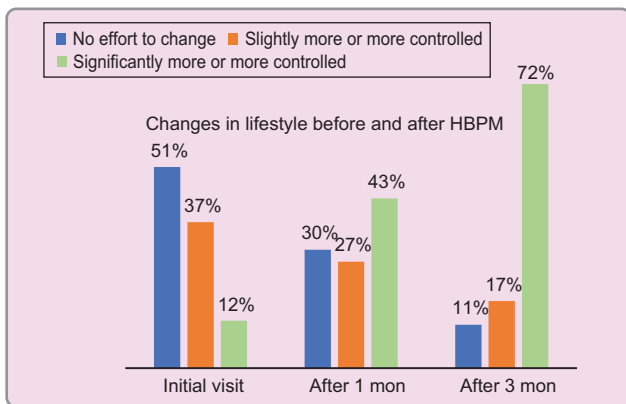
Table 7 showed the achievement of target blood pressure based on HBP monitoring adherence. The achievement of target blood pressure was significantly higher (78%) among study subjects who adhered to HBP monitoring. p-value < 0.04 (Fisher’s Exact test)

**Table 7.** Achievement of target BP according to adherence to HBP monitoring (N=100)

Achievement of target BP	Adherence to HBP monitoring		p-value
	Yes	No	
Achieved	71 (78.0)	4 (44.4)	.041*
Not achieved	20 (22.0)	5 (55.6)	

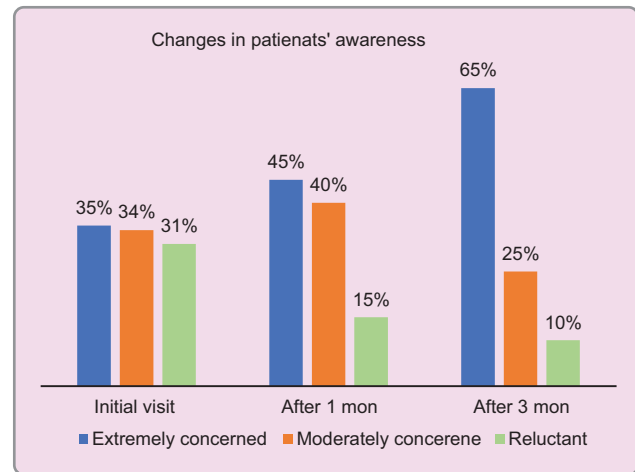
p-value < 0.05 or p-value < 0.001 (Significant value)

Figure 6 showed changes in lifestyle before HBPM and after HBPM at 1<sup>st</sup> and 3<sup>rd</sup> month follow-up and it revealed significant improvement in lifestyle after adapting HBPM. Among participants risk factors are significantly more and more controlled from 12% to 72%, slightly controlled from 13% to 27% and no effort to change lifestyle are reduced from 51% to 11%. Mc-Nemar was done to analyze the data and p-value < 0.001.



**Figure 6:** Changes in lifestyle before HBPM and after HBPM at 1<sup>st</sup> and 3<sup>rd</sup> month follow-up.

In the view to show changes in patients’ awareness on BP goal after the 3 month HBPM revealed in Figure 7 that the proportion of patients who were aware of BP goal increased from 35% to 65% (P < .001) among extremely concerned responders. The proportion of patients who were reluctant about achieving of target BP as 120/80 mm Hg decreased from 31% to 10% at the visit after the 3 month HBPM.



**Figure 7:** Changes in patients’ awareness on BP goal after the 3 month HBPM

**Discussions**

The mean age distribution of the study participants was 57.76 ± 12.60 years, with a range of 34 – 80 years. There was a male predominance, 54% patients were male and 46% were female and Male to female ratio was 1.17:1. Ruixin, M et al, also showed among patients with HBPM, there was no significant difference in gender (female 59% vs. male 63%; p=0.10).<sup>15</sup>

The majority of participants (76.0%) had established HTN with medication, followed by established HTN without medication (12.0%) and newly diagnosed HTN (12.0%). In contrast, According to another survey, just half of the persons who had previously received a diagnosis of hypertension from a healthcare professional reported using medication to manage their symptoms. 12% of the population had this condition.<sup>16</sup>

Among the study subjects, 36.0% had ischaemic heart disease, 31.0% had dyslipidemia, 28.0% had chronic kidney disease, 12.0% had heart failure and 11.0% had stroke. At 12-month follow-up, self-monitoring of blood pressure was linked to a lower risk of having uncontrolled clinic BP (OR [odds ratio] 0.68, 95% CI 0.52, 0.87), and this was also true for patients with more co-morbidities (P for interaction = 0.607). Identical results were seen at the 6-month follow-up.<sup>17</sup>

Among the study subjects, 47.0% were obese, 24.0% had diabetes mellitus, 23.0% had anxiety, 33.0% had smoking habit, 29.0% had a sedentary lifestyle, 55.0% consumed excessive salt, 87.0% used drugs.

16.0% of the study participants exhibited a difference in their blood pressure at work and at home, according to this study, which looked at this issue. Office blood pressure measurement (OBPM) and home blood pressure measurement (HBPM) differences between systolic (left) and diastolic (right) pressures decreased considerably. Similar results from another study indicated that disparities for SBP tended to increase only with higher pressures.<sup>18</sup>

Among patients, 84.0% had adherence of medication and 91.0% had adherence of HBP monitoring. Previous studies have shown that the two most important factors contributing to poor adherence are the asymptomatic and chronic nature of the disease. Other factors associated with adherence include, demographic factors such as age, the patient's understanding and perception of hypertension, the healthcare provider's model of delivering treatment, and the relationship between patients and healthcare professionals.<sup>16</sup> Another study by Rahman A.R.A in Hong Kong showed his study, 82% of patients were highly adherent to their medications, and 68% of patients reported that they always refilled their prescription before the previous one ran out.<sup>16</sup> A randomized study including 441 patients with uncontrolled BP that assessed SBPM effectiveness revealed a significant reduction of systolic BP by 4.3 mm Hg after 6 months. Interestingly, the SBPM group did not show any differences in drug adherence but did have better weight loss.<sup>19</sup> A meta analysis by Fletcher and colleagues showed improved office DBP reduction by SBPM, irrespective of improvement in adherence. That is, the drug non adherent group also had BP reduction.<sup>20</sup>

Among the study subjects, 15.0% had masked HTN and 13.0% had white coat HTN. Peacock, J. et al<sup>21</sup> observed Masked HTN is considered that the prevalence of MH varies between 15% and 30%. Fagard RH, et al. showed that White coat phenomenon accounts for up to 25%–30% of subjects attending outpatient hypertension centers.<sup>22</sup> The prevalence is higher in female sex, obese, and it seems to increase according to the age.<sup>23</sup> This is also consistent with the present study.

Among the study subjects, 75.0% achieved their target BP. Clinic BP showed a significantly greater decrease in the home BP monitoring group than in the group without home BP monitoring.

Changes in patients' awareness on BP goal after the 3 month HBPM showed in this study that the proportion of patients

who were aware of BP goals (as their own perceived BP goals) increased from 35% to 65% ( $P < .001$ ) among extremely concerned responders. The proportion of patients who were reluctant about achieving of target BP of 120/80 mm Hg decreased from 31% to 10% at the visit after the 3 month HBPM. Similarly, acceptance of hypertension observed in a study in Finland found that 66% of 1,561 patients had difficulties accepting hypertension, and 33% of patients had a careless attitude towards hypertension.<sup>16</sup>

#### Limitations of the study

The study had the following limitations. These should be kept in mind while deciding on the implications of the findings from the study.

- Small sample size
- Descriptive study
- Single tertiary care hospital site

#### Conclusions

In this study, HBPM was shown to be associated with an improvement in patients' awareness of BP, drug adherence, reduction of BP, and better BP control in hypertensive patients receiving antihypertensive medications. It represented a promising tool to improve the diagnosis of BP accurately including hidden phenotype (white coat and masked) and treatment of hypertension by lowering BP over time. So it is important to consider strategies to facilitate the effective implementation of HMBP

#### Ethical measures

The study was conducted after ethical clearance from the Ethical Review Committee of Dhaka Medical College. Informed written consent was obtained from each patient and/or their legal guardians where necessary. Moreover, the confidentiality of collected data was maintained with utmost priority.

#### Recommendations

All patients with established HTN with or without medication should buy devices that have been validated and should be monitored with close attention and regular follow-up.

Proper instructions should be provided about seeking medical advice during the period of hypertensive emergency and urgency.

Multi-centered tertiary care hospital-based analytical study with a larger sample size is required to establish that HBPM can be included in daily practice for the prevention of cardiovascular complications.

#### Conflicting interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## References

1. Le Jeune S, Pointeau O, Hube C, Lopez-Sublet M, Giroux-Leprieur B, Dhote R, et al. Usefulness of different techniques of blood pressure measurements in 2016. *Rev Med Interne*. 2016;S0248-8663(16)30558-6.
2. Yarows SA, Julius S, Pickering TG. Home blood pressure monitoring. *Arch Intern Med*. 2000;160:1251-57.
3. Tzourio C, Hanon O, Godin O, Soumare A, Dufouil C. Impact of home blood pressure monitoring on blood pressure control in older individuals: a French Randomized study. *J Hypertens*. 2017;35(2):612-20.
4. British Hypertension Society. Home blood Pressure Monitoring Protocol. Available at <http://www.bhsoc.org/files/4414/1088/8031/Protocol.pdf> [accessed on 14th May 2017].
5. Parati G, Stergiou GS, Asmar R, Bilò G, de Leeuw P, Imai Y, et al. European Society of Hypertension practice guidelines for home blood pressure monitoring. *J Hum Hypertens*. 2010;24:779-85.
6. Milkami Y, Takai Y, Era S, Ono Y, Saitoh M, Baba K, et al. Provisional criteria for the diagnosis of hypertension in pregnancy using home blood pressure measurements. *Hypertens*.
7. Multi - sectoral action plan for prevention and control of non-communicable diseases 2018-2025. (2018). Dhaka: Non-communicable Disease Control Programme, Directorate General of Health Services. *Res*. 2017;40(7):679-84.
8. BP Monitors available at <http://bhsoc.org/bp-monitors/bp-monitors/for-homeuse/> accessed on 16th February 2016.
9. Matsui Y, Ishikawa J, Eguchi K, Shibasaki S, Shimada K, Kario K. Maximum value of home blood pressure: a novel indicator of target organ damage in hypertension. *Hypertension*. 2011;57:1087-1093.
10. Kario K. *Essential Manual of 24 Hour Blood Pressure Management from Morning to Nocturnal Hypertension*. London, UK: Wiley Blackwell; 2015:1-138.
11. Kollias A, Ntineri A, Stergiou GS. Association of night-time home blood pressure with night-time ambulatory blood pressure and target-organ damage: a systematic review and meta-analysis. *J Hypertens*. 2017;35(3):442-52.
12. Williams B, Mancia G, Spiering W, Rosei EA, Azizi M, Burnier M, et al. ESC Scientific Document Group, 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*. 2018; 39(33): P.3021–3104.
13. Mancia, Giuseppe. Clinical significance of white-coat hypertension. *Journal of Hypertension*: April, 2016; 34(7):623-626.
14. NIHS. Blood Pressure Monitoring Protocol National Institute for Health Research. Nov 1, 2017: p.1-8.
15. Ma, Ruixin; Zhao, Yang; Yu, Xiaorong; Li, Ningyin; Yu, Heng; Liang, Wei; Zhao, Xu; Zhang, Xiaowei; Yu, Jing. A0775 Sex difference in home-office blood pressure difference. *Journal of Hypertension*: October 2018 - Volume 36 - Issue - p e108
16. Rahman, A.R.A., Wang, JG., Kwong, G.M.Y. et al. Perception of hypertension management by patients and doctors in Asia: potential to improve blood pressure control. *Asia Pac Fam Med* 14, 2 (2015)
17. Bello, Nicole S., "Implementing a Home-Based Blood Pressure Monitoring Program to Improvement Hypertension Management" (2017). Doctor of Nursing Practice (DNP) Translational and Clinical Research Projects.
18. Willem J. Verberk, Abraham A. Kroon, Alfons G.H. Kessels and Peter W. de Leeuw. Home Blood Pressure Measurement: A Systematic Review. *J Am Coll Cardiol*. 2005 Sep, 46 (5) 743–751
19. McManus RJ, Mant J, Roalfo A, et al. Targets and self - monitoring in hypertension: randomised controlled trial and cost effectiveness analysis. *BMJ*. 2005; 331: 493.
20. Fletcher BR, Hartmann Boyce J, Hinton L, McManus RJ. The effect of self monitoring of blood pressure on medication adherence and lifestyle factors: a systematic review and meta analysis. *Am J Hypertens*. 2015; 28: 1209-1221.
21. Peacock J, Diaz KM, Viera AJ, Schwartz JE, Shimbo D. Unmasking masked hypertension: prevalence, clinical implications, diagnosis, correlates and future directions. *J Hum Hypertens*. 2014;28(9):521–528.
22. Fagard RH, Cornelissen A. Incidence of cardiovascular events in whitecoat, masked and sustained hypertension versus true normotension: a meta-analysis. *J Hypertens*. 2007;25(11):2193–2198.
23. Cuspidi C, Sala C, Grassi G, Mancia G. White coat hypertension: to treat or not to treat? *Curr Hypertens Rep*. 2016;18(11):80