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Effect of Home Blood Pressure Telemonitoring Plus Additional Support on Blood Pressure Control: A Randomized Clinical Trial

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Abstract

Objective: The current clinical evidence for effects of Home Blood Pressure Telemonitoring (HBPT) on improving blood pressure control comes entirely from developed countries. Thus, we performed this randomized controlled trial to evaluate whether HBPT plus support (patient education and clinician remote hypertension management), better improves blood pressure control than Usual Care (UC) in Chinese population.

Methods: We recruited 190 patients randomized to HBPT plus support or UC groups for 12 weeks. The primary end points were blood pressure reduction and proportion of patients achieving the target blood pressure.

Results: Totally, 172 patients completed the study. Patients in plus support group attained greater reduction of mean ambulatory blood pressure than those in UC group. The plus support group had a significantly higher proportion of patients who achieved the target blood pressure and maintained the dipper blood pressure pattern at the 12th week of follow-up. Additionally, the patients in plus support group showed lower blood pressure variability and higher drug adherence than those in UC group.

Conclusion: HBPT plus additional support results in greater blood pressure reductions, better blood pressure control, and higher proportion of dipper blood pressure pattern, lower blood pressure variability, and higher drug adherence than UC.

Keywords: Hypertension; Telemonitoring; Blood pressure control; Additional support

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Introduction

Cardiovascular Disease (CVD) is currently the most serious disease for human health worldwide. According to the Global Burden of Disease Study, approximately 17.6 million people died of CVD [1]. By 2030, the number of people dying of CVD each year is expected to reach 23.6 million [2]. Hypertension is one of the major risk factors for CVD, and about half of CVD events are caused by hypertension [3]. Therefore, effective prevention and treatment of hypertension is essential to the reduction of the health risks caused by CVD.

In the treatment of hypertension, achieving the target Blood Pressure (BP) is a key to treatment. Patients with poor BP control suffer significantly higher risk of Myocardial Infarction (MI), stroke, renal failure, heart failure, and death than those who keep their BP under control [4]. Epidemiological data in the United States shows that the BP control rate of adult hypertensive patients was 40.2% in 2013-2014 [5]. However, the BP control rate of adult hypertensive patients in China was only 13.8% in 2012, much lower than that in the developed countries [6].

Many factors can influence the BP control in hypertensive patients. Studies have shown that Home Blood Pressure Telemonitoring (HBPT) can better help hypertensive patients control BP than Usual Care (UC) and make it easier for them to achieve the target BP [7,8]. Meta-analysis based on randomized controlled clinical trials has demonstrated that HBPT can lead to greater Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) drop than UC [9-11], enabling more patients to achieve the target BP. The ACC/AHA Hypertension Management Guideline 2017 recommends using telemedicine interventions (HBPT alone or HBPT plus additional support) to help improve BP control in hypertensive patients [12].

Almost all the current clinical evidence for HBPT improvement of BP control comes from the developed countries such as the United States, the United Kingdom, and South Korea. The countries with relatively lower medical levels, including China, have not conducted such clinical research. There are few such clinical studies in countries with relatively lower medical levels, including China. Therefore, we conducted the randomized controlled trial to explore whether HBPT plus additional support can improve BP control in Chinese hypertensive patients.

Patients and Methods

Research design and informed consent

This was a single center randomized controlled study conducted in the Chinese PLA General Hospital. All enrolled patients were informed that they would receive one of two hypertension treatment regimens and would be followed up. All respondents gave informed consent (Clinical research registration no. ChiCTR2200058922).

Participants

The patients were hypertensive patients treated clinically in our hospital over the recruitment period (from August 2016 to March 2017), from 11 different provinces in China, with 12 weeks follow-up. Patients were included if they met the following criteria: (1) age ≥ 18 years; (2) previously diagnosed with hypertension or newly diagnosed with hypertension; (3) poor BP control (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg; for patients with diabetes, SBP ≥ 130 mmHg and/or DBP ≥ 80 mmHg); (4) in possession of a Smartphone. Patients would not be included in the study if they met one or more of the following criteria: (1) SBP ≥ 180 mmHg and/or DBP ≥ 110 mmHg at the time of consultation; (2) secondary hypertension; (3) patients with white coat hypertension, white coat hypertension was defined as conventional hypertension in the presence of a normal daytime ABPM. (4) patients with chronic kidney disease, with serum creatinine ≥ 2.5 mg/dl (221 μmol/L); (5) patients with chronic liver disease, with aspartate aminotransferase/alanine aminotransferase four times greater than the upper limit; (6) patients undergoing hospitalization due to Acute Myocardial Infarction (AMI), stroke, and congestive heart failure during the past 6 months; (7) patients with dementia; (8) patients who were unable to communicate due to severely impaired hearing or speech function; (9) patients with malignant tumors.

Interventions

Home blood pressure remote monitoring plus additional support is a closed-loop feedback system formed with a software application, a cloud platform, a blood pressure monitoring apparatus, and a management team.

Interventions received by HBPT plus group (95 patients) including: (1) remote HBPT (The patients were offered an automated sphygmomanometer, which uploaded blood pressure readings onto the BP monitoring APP, which can be seen by both patients and staff); (2) patient education (Health education knowledge are regularly sent *via* the BP monitoring APP); (3) remote hypertension treatment management guided by a clinician or pharmacist (by phone or BP monitoring APP). Based on the BP measurement data uploaded by the patient, the system calculated a BP average and sent it to the patient and staff *via* the BP monitoring APP every week. In the first two weeks of the study, the patients were asked to measure their BP every morning and evening. Two weeks later, if the patient's BP remained stable; they could measure the BP 1 to 2 times every 1 to 2 days [13,14]. If the patient failed to take BP measurements for 5 consecutive days, the staff would remind and supervise him by phone. If the patients' BP failed to reach the standard for two consecutive weeks (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg; for patients with diabetes, SBP ≥ 130 mmHg and/or DBP ≥ 80 mmHg), the nurse would follow up the patient's medication within these two weeks by phone, and a pharmacist or clinician would adjust the dose, usage or type according to the patients' BP level in accordance with the latest medication guidelines, and deliver individualized lifestyle guidance. Patients in HBPT plus group were regularly followed up for drug adherence (every two weeks).

The patients in UC group (95 patients) were treated according to the treatment regimens given by the first visit physician based on the latest guidelines. The patients were recommended to undergo home BP monitoring with a normal family sphygmomanometer and outpatient return visit every 4 weeks (no mandatory requirements). If the patients visit physician, the treatment regimens would be adjusted based on the results of home BP monitoring and outpatient BP monitoring. Consistent with HBPT plus group, patients were also regularly followed up for drug compliance (every two weeks).

All patients underwent ambulatory BP monitoring within 3 days after enrollment and within 3 days after the end of the trial (12 weeks). BP was automatically measured every 30 min during the day (06:00-20:00) and every 1 h at night (20:00-06:00) [15]. The number of effective BP readings within 24 h >85% of the number of monitoring readings was considered valid.

Outcomes

Primary study end points: The primary end points of the study included (1) changes in BP from enrollment to the end of the 12-week follow-up and (2) proportion of patients achieving the target BP.

Secondary study end points: Secondary end points included (1) BP rhythm; (2) Blood Pressure Variability (BPV); (3) drug adherence.

Definition of study end point: The 24-h mean BP was defined as the mean of all-day BP measurements, daytime mean BP was the mean of BP measurements from 06:00 to 20:00, and the nighttime mean BP was the mean of BP measurements from 20:00 to 06:00. Achieving target BP was defined as 24-h mean SBP<130 mmHg and DBP<80 mmHg. BPV was the degree of fluctuation in BP during 24-h ambulatory BP monitoring, as measured by the standard deviation of the mean BP in our study. Drug adherence was calculated with the formula:

(Numbers of days take the medication as required/total days needed to take the medication) × 100%

Sample size: Our preliminary study showed that HBPT could help about 65% of hypertensive patients achieve the target BP, with

a conservative estimate of 60%. The rate of achieving the target in the previous outpatient BP hypertensive patients in our hospital was about 37%, and the conservative estimate was 35%. In this study α=0.05, β=0.10, the sample size was estimated (by PASS software) and 79 patients were needed in each group. Taking into account of the 10% follow-up loss, we enrolled 95 patients in each group eventually.

Randomization: As for randomization, SPSS 20.0 software was used to generate random serial numbers, and 190 patients were equally randomized into HBPT plus group and UC group, with 95 cases in each group. Allocation concealment was adopted by placing the random serial numbers in an opaque Kraft envelope and leaving it in the hands of a specially assigned person. The statistical analysis upon the completion of the trial was carried out by a special statistician.

Statistical analysis: All statistical analyses were conducted based on per-protocol analysis, and the mean, Standard Deviation (SD), and percentage were used to describe the baseline clinical characteristics of patients. Inter-group comparisons of continuous variables were performed using the *t*-test. Inter-group comparisons of categorical variables were performed by Pearson χ^2 test and exact Fisher test. Statistical analysis was done using SPSS 20.0 software. P<0.05 was considered statistically significant.

Results

A total of 511 hypertensive patients were screened. After 321 patients who did not meet the inclusion criteria for the study were excluded, 190 hypertensive patients were randomized to HBPT plus group and UC group. By the end of the 3-month study follow-up, 7 patients in HBPT plus group and 2 patients in UC group withdrew from the study. In addition, 9 patients with white coat hypertension were identified during the study. Therefore, a total of 172 patients were included in the final analysis of the study (84 in HBPT plus group and 88 in UC group) (Figure 1).

According to the latest guidelines, the treatment plan varies for different individual conditions, with different number, classes and dosage of antihypertensive medications. Antihypertensive drugs given to the patients were diuretics, Calcium Channel Blockers (CCBs), Beta-blockers, Angiotensin-Converting Enzyme Inhibitors (ACEIs) or Angiotensin II Receptor Blockers (ARBs). The mean number of antihypertensive medication classes was 1.7 ± 0.6 in HBPT plus group and 1.6 ± 0.5 in usual care group at baseline.

There were no differences in terms of age, gender, body mass index, family history of hypertension, waist-to-hip ratio, hypertension grade, the mean number of antihypertensive medication classes, history of coronary heart disease, history of diabetes mellitus, and proportion of newly or previously diagnosed hypertension between the two groups (Table 1). There was no difference in baseline office BP level (Table 1), baseline 24-h mean BP, daytime mean BP, and nighttime mean BP (Table 2) between the two groups. The 24-h mean SBP and DBP were approximately 10 mmHg and 4 mmHg lower than office SBP and DBP, respectively. The proportion of white coat hypertension in HBPT plus group and UC group was 4.8% and 5.7%, respectively (Table 1).

The mean number of antihypertensive medication classes increased from 1.7 ± 0.6 at baseline to 2.2 ± 0.7 at 12 weeks in the HBPT plus group, and from 1.6 ± 0.5 at baseline to 1.9 ± 0.6 at 12 weeks in the UC group.

Primary study end points

At the 12th week of follow-up, the BP levels (including 24-h mean BP, daytime mean BP, and nighttime mean BP) in both HBPT plus group and UC group were significantly lower than baseline levels

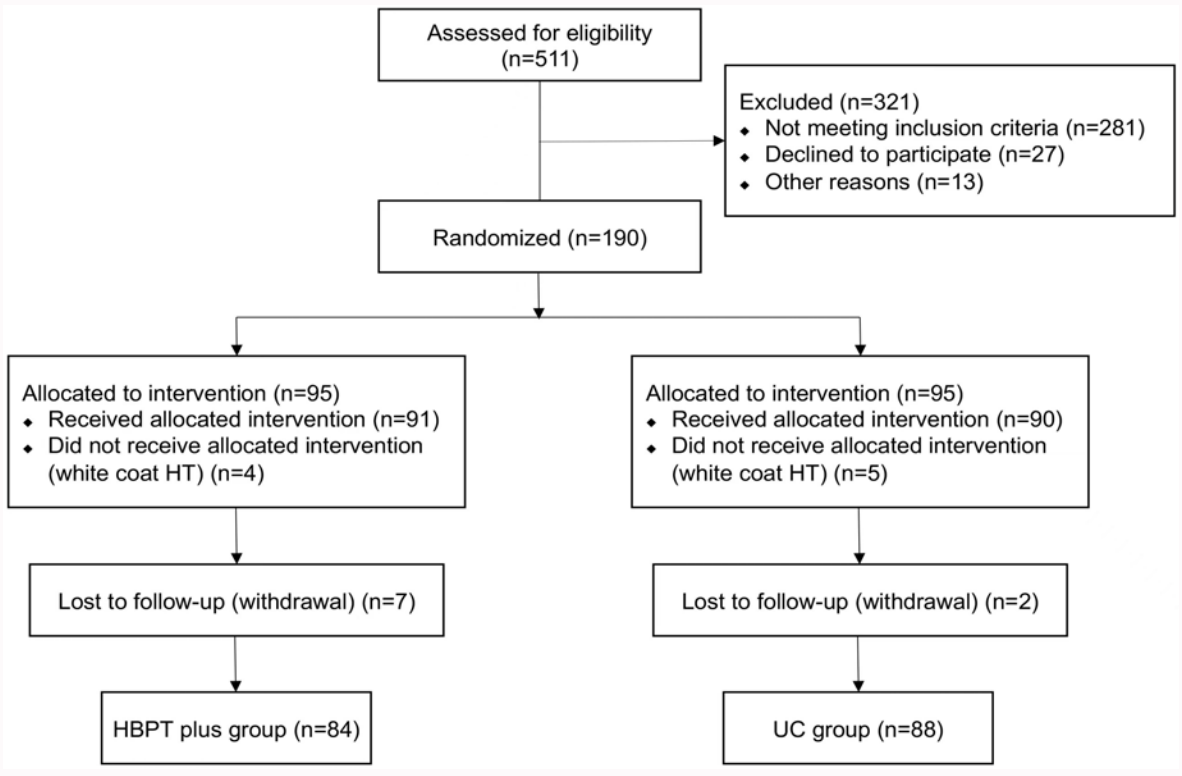

Figure 1: Study recruitment flowchart.

Table 1: Baseline characteristics of patients.

Characteristics	HBPT plus group (n=84)	UC group (n=88)	P-value
Age (years)	50.96 ± 10.50	51.45 ± 12.22	0.778
Males	50 (59.5%)	51 (58.0%)	0.834
BMI	27.33 ± 3.11	26.85 ± 3.71	0.365
WHR	0.932 ± 0.68	0.92 ± 0.52	0.302
Blood pressure (mmHg)			
Systolic	151.92 ± 10.74	151.18 ± 9.30	0.632
Diastolic	91.01 ± 9.98	90.60 ± 12.90	0.817
History of HTN	36 (42.9%)	26 (30.0%)	0.052
HTN Grade			
Class I	57 (67.9%)	64 (72.7%)	0.485
Class II	27 (32.1%)	24 (27.3%)	
HTN Categories			
New diagnosed	30 (35.7%)	22 (25.0%)	0.152
Previous diagnosed	54 (64.3%)	64 (72.7%)	
DM	21 (25.0%)	18 (20.5%)	0.450
CAD	33 (39.3%)	37 (42.0%)	0.713
White coat HTN[a]	4 (4.8%)	5 (5.7%)	0.460
No. of hypertension medication classes	1.7 ± 0.6	1.6 ± 0.5	0.236

BMI: Body Mass Index; CAD: Coronary Artery Disease; DM: Diabetes Mellitus; HBPT: Home Blood Pressure Telemonitoring; HTN: Hypertension; UC: Usual Care; WHR: Waist-to-Hip Ratio

[a] Patients number of the two groups did not include the white coat HTN, the proportions were calculated based on new diagnosed HTN patient number

Data are presented as mean ± SD or number and percentage. P<0.05 was considered statistically significant

Table 2: Primary outcomes of BP change at 12 weeks.

	HBPT plus group (n=84)	UC group (n=88)	P-value
24 h mean Systolic ABPM			
baseline	139.76 ± 9.48	139.97 ± 9.45	0.888
Week 12	127.52 ± 7.12	132.81 ± 5.74	<0.001
Change	12.01 ± 4.82	7.16 ± 8.57	
P-value (within group)	<0.001	<0.001	
24 h mean Diastolic ABPM			
baseline	86.95 ± 9.12	86.48 ± 8.03	0.475
Week 12	78.65 ± 6.13	82.38 ± 6.66	<0.001
Change	8.11 ± 9.84	4.10 ± 8.41	
P-value (within group)	<0.001	<0.001	
Daytime mean Systolic ABPM			
baseline	142.90 ± 9.88	143.51 ± 9.83	0.687
Week 12	130.73 ± 7.01	136.27 ± 6.09	<0.001
Change	11.92 ± 6.19	7.24 ± 9.05	
P-value (within group)	<0.001	<0.001	
Daytime mean Diastolic ABPM			
baseline	89.64 ± 9.73	89.22 ± 8.12	0.755
Week 12	81.12 ± 7.01	85.02 ± 6.83	<0.001
Change	8.24 ± 10.81	4.19 ± 9.11	
P-value (within group)	<0.001	<0.001	
Nighttime mean Systolic ABPM			
baseline	133.42 ± 11.74	132.88 ± 11.20	0.542
Week 12	121.05 ± 8.67	125.76 ± 6.63	<0.001
Change	12.20 ± 7.96	7.11 ± 10.49	

P-value (within group)	<0.001	<0.001	
Nighttime mean Diastolic ABPM			
baseline	81.67 ± 9.53	80.89 ± 9.48	0.780
Week 12	73.75 ± 6.85	77.06 ± 7.91	<0.001
Change	7.92 ± 10.27	3.83 ± 8.93	
P-value (within group)	<0.001	0.004	

ABPM: Ambulatory Blood Pressure Monitoring; HBPT: Home Blood Pressure Telemonitoring; UC: Usual Care
Data are presented as mean ± SD or number and percentage. P<0.05 was considered statistically significant

Table 3: Primary and secondary outcomes at baseline and 12 weeks.

	HBPT plus group (n=84)	UC group (n=88)	P-value
24 h mean ABPM (130/80 mmHg)			
baseline	5 (6.0%)	6 (6.8%)	0.817
12 weeks	60 (71.4%)	22 (25%)	<0.001
Daytime mean ABPM (135/85 mmHg)			
baseline	9 (10.7%)	11 (12.5%)	0.672
12 weeks	69 (82.1%)	31 (35.2%)	<0.001
Nighttime mean ABPM (120/70 mmHg)			
baseline	5 (6.0%)	3 (3.4%)	0.936
12 weeks	50 (59.5%)	18 (20.5%)	<0.001
Dipper blood pressure pattern			
baseline	35 (41.7%)	38 (43.2%)	0.878
12 weeks	56 (66.7%)	42 (47.7%)	0.014

ABPM: Ambulatory Blood Pressure Monitoring; BP: Blood Pressure; HBPT: Home Blood Pressure Telemonitoring; UC: Usual Care
Data are presented as mean ± SD or number and percentage. P<0.05 was considered statistically significant

(P<0.01). The reduction of the BP (including 24-h mean BP, daytime mean BP, and nighttime mean BP) in HBPT plus group was greater than that in UC group (P<0.01) (difference in changes between group: 24-h ABPM mean SBP and DBP were 4.85 mmHg and 4.01 mmHg, respectively) (Table 2).

At the beginning of the study, there was no significant difference in proportion of achieving target BP (including 24-h BP, daytime BP, and nighttime BP) between HBPT plus group and UC group (P<0.01). At the end of the study, the proportion of achieving target BP of both HBPT plus group and UC group was significantly higher than that at the beginning, with the proportion in HBPT plus group significantly higher than that in UC group (P<0.01). The proportion of achieving target BP of 24 h mean ABPM of HBPT plus group was 71.4%, whereas that of UC group was only 25.0% [Relative Risk (RR) = 2.6, 95% Confidence Interval (CI) = 1.8-3.8]. The RR was significantly higher than that of the previous meta-analysis (HBPT *vs.* UC, RR=1.32, 95% CI 1.15-1.51) (Table 3).

Secondary study end points

At the beginning of the study, 35 patients (41.7%) in HBPT plus group and 38 patients (45.2%) in UC group had dipper blood pressure pattern (Nocturnal blood pressure fall >10% of daytime values or night/day blood pressure ratio <0.9 and >0.8 is defined as "dipper". A diminished nocturnal fall in BP is associated with poor cardiovascular outcome) [15]. At the end of the study, the number of patients with dipper blood pressure pattern increased to 56 (66.7%) in HBPT plus group, and 42 (47.7%) in UC group, without significant change in UC group. The proportion of dipper blood pressure pattern in HBPT plus group was significantly higher than that in UC group (P<0.05) (Table 3).

At the beginning of the study, there was no significant difference in BPV between HBPT plus group and UC group. At the end of the study, the BPV of the two groups was significantly lower than that at the beginning. The BPV in HBPT plus group was significantly lower than that in UC group (P<0.01) (Table 4).

At the 12th week of follow-up, drug adherence in HBPT plus group was significantly higher than that in UC group (P<0.01) (Table 4).

Discussion

The results of this randomized controlled trial showed that compared with UC, HBPT plus additional support (patient education and remote pharmacist or physician BP management) could lead to more significant BP reduction, and enabled more hypertensive patients to achieve target BP, maintain dipper blood pressure pattern, and have lower BPV. We also found that patients in HBPT plus group had significant higher drug adherence.

Patients in HBPT plus group had a greater BP reduction than those in UC group, possibly because of higher drug adherence in HBPT plus group. Timely adjustment of medication by clinicians and pharmacists may be another possible reason. A previous meta-analysis has shown that HBPT achieved an additional BP reduction (24 h ABPM) of 2.71/1.08 mmHg compared with UC [16]. In our study, HBPT plus group achieved an even greater BP reduction, which was possibly ascribable to the additional support to HBPT. Previous studies have also shown that HBPT plus additional support can result in greater BP reduction than HBPT alone (3.44/1.40 mmHg) [16], indicating that additional support may help to better control BP.

The proportion of achieving target BP of HBPT plus group in our study was higher than that of the intervention group in the other studies, whereas the proportion of achieving target BP of UC group was significantly lower than that of UC group in the other studies [17-

Table 4: Secondary outcomes of BPV and drug adherence.

	HBPT plus group (n=84)	UC group (n=88)	P-value
BPV of 24 h mean Systolic ABPM			
baseline	18.91 ± 4.46	19.47 ± 5.56	0.463
Week 12	13.33 ± 2.90	15.82 ± 3.82	<0.001
Change	5.46 ± 4.73	3.65 ± 6.66	
P-value (within group)	<0.001	<0.001	
BPV of 24 h mean Diastolic ABPM			
baseline	15.73 ± 4.96	16.18 ± 5.16	0.558
Week 12	11.01 ± 3.27	13.81 ± 3.52	<0.001
Change	4.87 ± 5.76	2.37 ± 6.31	
P-value (within group)	<0.001	<0.001	
BPV of Daytime mean Systolic ABPM			
baseline	18.06 ± 4.90	17.39 ± 3.78	0.280
Week 12	12.39 ± 3.36	15.51 ± 4.60	<0.001
Change	5.67 ± 5.97	1.83 ± 5.69	
P-value (within group)	<0.001	0.004	
BPV of Daytime mean Diastolic ABPM			
baseline	15.75 ± 6.48	15.41 ± 5.19	0.375
Week 12	10.35 ± 3.50	13.30 ± 3.70	<0.001
Change	5.15 ± 6.93	2.11 ± 6.67	
P-value (within group)	<0.001	0.002	
BPV of Nighttime mean Systolic ABPM			
baseline	15.46 ± 4.30	16.33 ± 5.19	0.234
Week 12	12.14 ± 3.29	14.13 ± 3.64	<0.001
Change	3.37 ± 4.71	2.26 ± 5.66	
P-value (within group)	<0.001	0.001	
BPV of Nighttime mean Diastolic ABPM			
baseline	12.61 ± 3.13	13.22 ± 3.39	0.223
Week 12	9.78 ± 3.31	12.28 ± 3.48	<0.001
Change	3.25 ± 4.41	0.93 ± 4.76	
P-value (within group)	<0.001	0.073	
Drug adherence (week 12)	93.6 ± 7.9	78.1 ± 12.2	<0.001

ABPM: Ambulatory Blood Pressure Monitoring; BPV: Blood Pressure Variability; HBPT: Home Blood Pressure Telemonitoring; UC: Usual Care
Data are presented as mean ± SD or number and percentage. P<0.05 was considered statistically significant

20]. The high proportion of achieving target BP of HBPT plus group was achieved because in our study we required patients to measure and upload BP data more frequently. In addition, our pharmacists and physicians had higher management intensity for the patients who did not meet the standard. If the patient's BP was not up to standard for two weeks, we would follow up by phone and adjust the treatment regimen. Furthermore, our study lasted for 12 weeks. In such a short period of time, the proportion of achieving target BP would likely be high, but may decrease to some extent as time went by. The low proportion of achieving target BP in UC group may be attributed to the low drug adherence and low awareness of hypertension. According to the data 2012, the overall awareness rate in Chinese hypertensive patients was only 46.5% [6].

We also studied the effects of HBPT plus on BP rhythm and BPV. At the end of the study, the proportion of dipper blood pressure pattern in HBPT plus group was significantly higher than that in UC group, and BPV was significantly lower than that in UC group. BP rhythm and BPV are known to have an impact on poor prognosis in hypertensive patients. This study thus suggests that HBPT plus may reduce adverse events in hypertensive patients by helping them restore normal BP rhythm and reduce BPV. However, the confirmation of the conclusion requires further follow-up studies.

In the treatment of chronic diseases, drug adherence determines the therapeutic effect. Previous studies have found that drug adherence in HBPT group was 92%, compared with 74% in the control group [21]. Kim et al. [17] also found in their randomized controlled trial that HBPT plus remote physician care improved the patients' drug adherence compared with HBPT group alone. Our findings are consistent with the above results.

The more significant BP reduction in the intervention group may be attributed to the following points: First is the improvement of patient compliance: Changing patients' wrong health concepts and treatment inertia, strengthening their subjective initiative to actively cooperate with medical staff; Second, reasonable and accurate drug

plan: Based on layer evaluation and blood pressure monitoring at home, choose the best drug plan to lower blood pressure while control hypertension in the morning; Thirdly, improvement of patient's lifestyle: Stabilize the effect of lowering blood pressure, help blood pressure to reach the standard smoothly for a long term.

There are several limitations in our study. First, our study was a single-center study conducted in a large hospital in a developed city in China, so the results may not be applicable to lower-level hospitals with lower levels of healthcare. According to the inclusion criteria of this study, patients need to have a smart phone and be proficient in using it, which is unlikely for the hypertensive patients in remote and impoverished areas of China. Second, the follow-up time of this study was 3 months, which was relatively short. It is therefore impossible to determine the benefit level of HBPT plus hypertension management in long-term BP management. Third, this study included only the patients with Grade I and Grade II hypertension. The patients with chronic kidney disease were excluded, and no patients who were eventually enrolled were over 75 years of age. Thus, it is difficult to ascertain whether the findings of this study can be applied to the patients with grade III hypertension, the patients with chronic kidney disease who's BP is more difficult to control than those with normal hypertension, and elderly hypertensive patients.

In China, there are a large number of hypertension patients with low blood pressure control rate and limited medical resources. With the rapid development of mobile medical care and remote monitoring technology, HBPT plus would overcome the limits of traditional blood pressure management, and provide new insight into hypertension control, which would be a strategy worth further exploring. In the follow-up research and application of HBPT plus in China, full consideration should be given to equipment certification, staff qualifications and payment methods, etc. Furthermore, it is necessary to establish big-data-based assessment systems, early warning models and auxiliary decision-making systems upon hypertension. It is also important to perfect the service structures, legal system, insurance strategy and business model, etc.

Conclusion

Home blood pressure telemonitoring plus additional support was effective for improving BP control compared to usual care over 3 months. Therefore, how to apply this better BP management method to hypertensive patients is the direction of our future effort. Geo location information: Beijing, China.

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