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Effectiveness of Self-Monitoring of Blood Pressure during Multimorbidity; A Review Article

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ABSTRACT

Hypertension is a key determinant for multi-morbidity specifically cardiovascular disease and chronic renal disease, which contributes to an increasing healthcare burden. This review aimed to discuss the hypertension in patients with multiple medical conditions and its impact on the effectiveness of self-monitoring of blood pressure (SMBP) during various morbidity such as cardiovascular, kidney disease, Stroke and diabetes mellitus. This review is helpful for researchers who conducted a study on self-monitoring of blood pressure during different morbidities. Google Scholar was employed as a secondary search tool, while electronic databases such as MEDLINE, Scopus, PMC, PubMed database, and Web of Science were utilized. These key words were used for self-monitoring of blood pressure, hypertension, cardiovascular diseases, diabetes mellitus, out-of-office BP measurement, In –office BP measurement, home based blood pressure monitoring, digital monitoring and white coat affect. The results of various literatures showed that Self-measured blood pressure (SMBP) alone led to modest reductions in clinic systolic and diastolic blood pressure (SBP/DBP) at 6 months (SBP/DBP -3.1/-2.0 mmHg) and 12 months (SBP/DBP -1.2/-0.8 mmHg), with a significant reduction at 6 months, in contrast to standard care in the administration of hypertension. Home blood pressure monitoring (HBPM) has been linked to lower blood pressure and increased prescription use. While self-measured blood pressure (SMBP) with tele-monitoring shows potential for long-term benefits, its effects beyond the 12-month mark are unknown. The literature review concluded that self-monitoring blood pressure is helpful in reducing blood pressure significantly in patients with various morbidities, including diabetes mellitus, kidney disease, and cardiovascular disease. This can be achieved through lifestyle modifications and antihypertensive medication.

Introduction

Among people with multiple morbidities, hypertension is the most prevalent individual ailment. To be multi-morbid means having two or more concurrent illnesses and affects between 10% to 50% of patients, based on the demographic under investigation [1]. Increasing multi-morbidity is correlated with diminished quality of life. Few studies have looked at therapies explicitly intended to enhance

outcomes in patients with multi-morbidity since it can be difficult to investigate people who have many diseases [1]. Multiple risk factors have been linked to incident cardiovascular events by population-based research, with hypertension being one of the most significant.[2] Furthermore to being a determinant for chronic kidney disease, hypertension additionally contributes to the rising cost of treating chronic illnesses.[3]

The expression "silent killer" is also used for hypertension because, typically, it does not cause any symptoms for a number of years or decades.[4] The majority of hypertension patients do not have symptoms at all. As therefore, the only way to identify the condition is to take frequent blood pressure (BP) readings. By performing this, we can benefit from the early warning signal.[5] Hypertension has identified risk factors like age[6], body mass index (BMI)[7], low physical fitness[8], and waist-hip ratio (WHR)[9]. Whereas; age, BMI, low physical fitness, and WHR, and ethnicity[10] were factors that have a substantial correlation with isolated systolic hypertension (ISH). Additional research revealed that obesity was a risk factor for ISH, and that age, BMI, and WHR were risk factors for hypertension. However, ethnicity was found to be strongly related to ISH. Obesity can lead to fatal health consequences and impose significant financial burdens due to the associated illnesses. This burden is expected to rise, according to evidence.[11] Both waist circumference and SBP or DBP in males and females, as well as BMI and SBP or DBP in women, were found to be positively correlated[5]

Faced with this challenge, Home-based blood pressure monitoring (HBPM) is not only used to control hypertension but also foretells about cardiovascular outcomes[12] No doubt office BP measurement is the main tool used to manage hypertension, HBPM is one step better approach in detecting white-coat hypertension and masked hypertension.[13] In this way, HBPM is far better than office BP measurements in determining coming cardiovascular event.[14] Use of validated home BP devices in Asia was limited due to its cost but with advances in technology these devices are becoming cheaper and accessible. With the usage of these devices patient self-care behavior is cornerstone in diagnosing and treating hypertension.[15] Information and communication technology (ICT) based HBPM system has been revealed and is used to obtain BP transmissions from patients at home in medical centers for appropriate recommendations [16]. This system is best suited for those areas where large remote or rural population is present such as Asia. Other countries like Chinese, Japanese, Korean, and European also support the usage of HBPM tools. Smartphone-based applications are also associated with HBPM and nearly 14% of android apps are being used for measuring BP.[17] Morning hypertension and other cardiovascular disturbances can be easily assessed and monitored using home BP measurements rather than ambulatory BP measurement devices. [18] Electronic devices for self-monitoring of BP enables people to detect their blood pressure everywhere and anytime, during daily activities, throughout the day and night, during exercise. Benefits of self-monitoring of BP involves improvement in health consciousness, provides follow-up to hypertensive patients and helps in controlling relevant risk factors like physical activity and obesity.[19,20]

The majority of patients (68.5%) engaged in moderate to low levels of self-care. This conclusion is significant as hypertension can be treated by improved self-care behavior. [21] The viability of treating hypertension across the population remains insufficient. The primary factor contributing to a poor reaction to medication is inadequate drug adhesion. Hypertension can be managed and controlled with a combination of medication and demanding changes in habits.[22] The purpose of this research aimed to look at the impact of health education on self-monitoring, patient knowledge, and medication adherence for blood pressure control.[23]

Overall, our research showed that patients were not given as much instruction and advice from doctors regarding changing their lifestyles and aiming for a target blood pressure as physicians thought.[24] Furthermore, we identified physician-provided assessment and feedback concerning specific lifestyle alterations, as well as patient motivation to maintain their objective of lowering blood pressure, as critical factors of the lack of major lifestyle modifications[25]

These outcomes persisted and increased throughout the 12months of the trial. Derived from comprehensive evaluations of clinical outcome trials, the blood pressure variation observed in self-managing persons is expected to be associated with a roughly 30% reduction

in the risk of stroke, assuming the effect is maintained.[26]

Self-monitoring of their BP and titration of their own antihypertensive medication has succeeded in controlling BP and turned the most economical choice as compared to routine or clinic care.[27] Patient self-monitoring along with tele-monitoring helps in reducing BP faster than self-monitoring alone and also reduces cardiovascular mortality and morbidity[28] There is increasing evidence that SMBP improves blood pressure control when combined with guided support outside of standard primary care. We expected that doctors would be more inclined to advise patients at higher risk to undergo HBPM for instance; those who were elder or had multi-morbidity), and the usage of HBPM would be linked with reduced blood pressure and increased medication adhesion, especially among individuals who disclosed a doctor's advice for HBPM.[29]

SMBP is most useful when managing high blood pressure if non-office blood pressure is regularly 130/80 mm Hg, even with higher in-office readings, and for people without harm to the intended organs who want to disregard pharmaceutical treatment, as well as smoking individuals.[5] Improving adherence therefore becomes a primary goal of behavioral therapies. Another goal is to improve a person's lifestyle, since it's been calculated that losing weight with a diet can be at the minimum as successful at lowering blood pressure as single-drug therapy.[30] According to a 2006 comprehensive review, 6 of 11 comprised trials found an increase in antihypertensive medication adherence that is statistically significant from SMBP.[31] Qualitative research offers scant evidence that SMBP can affect adherence to exercise and diet plans. This review's main goals were to compile the research and ascertain how SMBP affected hypertension patients' lifestyle choices, medication adherence, and determination.[30] Table 1 showed the effectiveness of SMBP during multi-morbidity.

Table: 1 Effectiveness of self-monitoring of blood pressure during different co-morbidities

References	Number of Participants	Study arms included a review	Follow-up	SMBP Protocol	Morbidity	Effectiveness/ Results
[32]	7021	SMBP Medication Lifestyle Modification	For 12 Months	Daily	Hypertension	Significant decrease
[5]	400	SMBP	For 1 Month	Daily	Hypertension	Educate the people about HTNC
[33]	90	SMBP Self-management	For 4 Year	Daily	Type 2 Diabetes	12-15 mmHg decrease
[26]	552	SMBP Medication	For 12 Months	Daily	Cardiovascular Disease, DM, CKD, Stroke	9.2-3.4 mmHg decrease
[23]	90	SMBP Medication adherence	12 weeks	Daily	Hypertension	Significant decrease
[34]	153	SMBP	3 days	Morning and Evening	Hypertension	Decrease DBP:2.4mmHg SBP:2.5mmHg
[35]	2590	SMBP Medication	1-5 years	Daily	Hypertension	Decrease DBP:9.8mmHg SBP:14.2mmHg

Effect of SMBP in Cardiovascular Diseases: A 12-months randomized controlled trial was conducted in HBPM in community hospital. Each patient provides the blood pressure monitor for home blood pressure measurement. At month 12 the result revealed the decrease the blood pressure 2.5mmHg. The patients greater the >60 showed to decrease the 8.9mmHg. This showed that effectiveness of SMBP was good in patients whose perform better primary care.[36, 37] Study showed that the discrepancy amid office measured blood pressure and self-measured blood pressure meta-analysis of prospective studies conducted for 3.2-10.9 year. The result exhibits the significant control of hypertension in office measured blood pressure low threat of cardiovascular events but in SMBP sick individuals show significant changes in blood pressure.[38] Hospital based descriptive cross-sectional study was conducted consecutively 6 weeks for monitoring of blood pressure and educate the patients for SMBP. The results indicate the reduction of systolic blood pressure and also the reduction of diastolic blood pressure.[39, 40]

Effect of SMBP in Diabetes mellitus: To prevent the complication of diabetes mellitus the patients developed the skills along with SMBP during diabetes mellitus.[41] The mobile based application was developed for the SMBP during diabetes mellitus. This can improve the blood pressure with diabetes mellitus.[41] The SMBP during diabetes mellitus which effectively reduced the blood pressure 3.71 mmHg.[1] SPRINT (systolic blood pressure interventional trail) Randomized trials was conducted for monitoring of blood pressure with diabetic patient. The results showed that significant decrease the blood pressure and reduce cardiovascular outcome.[42]

Effect of SMBP in Kidney Diseases: Maintaining the blood pressure target can lower the chance of developing chronic renal disorders. A randomized clinical trial was conducted by the pharmacist intervention of telemonitoring blood pressure in individuals with chronic renal disease improve blood pressure in chronic renal disease.[43] A study was conducted for the monitoring of blood pressure in diabetic and individuals. with kidney disease that persists over time. 6-12 month of follow up with dietary plan sodium intake and excretion of albumin in urine was also monitored. The result indicates the reduction of blood pressure and albumin level in urine.[44] A systematic review was published in 2021 which result indicates the telemonitoring of blood pressure reduced the blood pressure in non-dialysis people who have chronic kidney disease.[45]

Digital Monitor for self-monitoring of blood pressure: Digital monitoring and telemonitoring plays a paramount role in SMBP.[46] It starts with the collection and transmission of BP values to a remote monitoring unit for management of BP and its associated risk factors. To achieve target blood pressure patients are provided with suitable and relevant recommendations for controlling their BP and also educate them on improving their health through lifestyle changes. The progress in telemedicine enables smartphones and mobile apps to obtain and analyses cyclic voltammetry (CV) signals and is inexpensive and attainable. Moreover, these new electronic devices are painless, easy to carry or wear and time-saving.[47] Mobile devices serve as medium and tells important information regarding electrocardiographic data, pulse, blood pressure, and oxygen levels. Accelerometer is used to note any slight movement, movement modifications and cardiac monitoring. Fitness bands, strips or sensors are used to collect data and ballisto cardiogram-based approaches are used to detect cardiac variables. BP changes at night or during exercise can be monitored through these wearable devices and digital apps.[48] Wristwatches uses the method of photoplethysmography and electrocardiography to allow the inference of BP values. Analyzing pulse, heart rate variability, arrhythmias, sleep phases, cardiac output, systolic volume, Corrected-QT interval QTc interval analysis, oxygen saturation, and changes in electrolyte abnormalities are some of the advantages of these devices. Here are some of the common wearable devices and smartphone applications having Food and Drug Administration (FDA) approval are available in the market. These are smartwatches from Apple (Apple Watch)[49], Biobeat (BB-613WP)[50], Omron (Heart Guide)[51], and Fitbit (Flex, One, Charge)[20].

Wearable Sensor by Shuzo: One of the most effective systems for those who want to measure their blood pressure during exercise was developed by Shuzo.[52] These are wearable sensors that are compatible with portable electronics, such as MP3 players or

smartphones. The electronic circuit board, data processor, and iPod Touch R are some of the system's key parts. This system has the capacity to measure continuously for two hours at a frequency of one kilohertz, or for twenty-eight hours if measurements are taken intermittently every thirty minutes.[53] It is very easy for the user to measure his/her blood pressure even when user is listening music or simply looking at websites and very comfortably carry this system without much effort and attention. Furthermore, appropriate recommendations according to the need of user is also provided by this system like graphical exercise menu.

Heart Guide by Omron Corp: Another device used for blood pressure monitoring is Heart Guide by Omron Corp (Kyoto, Japan) based on "Project Zero monitor 2.0". With one push of a button, this wrist monitors measures blood pressure accurately and is sync with Omron corp. app for the transmission of blood pressure data. Physical activity and sleep cycle are also measured by this device.[52] The extra band of watch exactly works like blood pressure cuff as inflating for taking oscillometric measurement. It also has the quality to measure blood pressure at night time during sleep to detect hypertension at night time and risk of stroke and notify the user through phone notifications.[54] According to Scott, this watch will work efficiently for 10-14 days with single charge and takes only 1 minute to guage the blood pressure. This watch is beneficial and easy to use especially for elderly patients.[55]

Sensor system mounted on the steering wheel for Cuffless Blood Pressure Monitoring by Denso Corp: The technology has evolved from the past few years and advancement have been seen in controlling hypertension through these electronic devices. A sensor is used in steering wheel to measure blood pressure while driving. Denso Corp has developed Sensor system mounted on the steering wheel with an optical and EEG sensor embedded in the steering wheel for this reason.[56] In order to detect driver's blood pressure during driving photoplethysmography is used instead of sphygmomanometer. Using digital processing, photoplethysmography is a non-invasive blood pressure monitoring technology utilized in steering wheels.[52]

BB-613WP/Biobeat: It involves a wearable; wireless wristwatch monitor that uses smartphone-based app for remote patient monitoring specially to determine cardiovascular changes during labor and delivery. It is very easy to use and less time consuming like it measures BP every 5 seconds. First measurements were taken and added into the device app. Later photoplethysmography (PPG)-based devices used to monitor BP at every 5 second.[57, 19] According to the US Health Styles survey conducted in 2005 and 2008, the proportion of persons with hypertension who routinely use HBPM climbed from 40.1% to 45.8%.[58] Those with access to blood pressure monitors were older persons (87.7%), those with higher education (93.8%), "white collar" workers (92.3%), residents of small cities (90.5%), those who did not drink alcohol (89.6%), those who were physically active (90%) and those who had a normal weight (90.2%). The HBPM performance is correlated with age, gender, alcohol intake, smoking status, exercise, cardiovascular disease risk score, length of counteracting hypertension medication, and multimorbidity. Females, elder population, people with diabetes, people engaged in physical activity, those at increased CV exposure, people with CAD, and people with lower incomes and less education used blood pressure monitors more frequently than people with lower incomes and fewer education levels. According to statistics, HBPM was most frequently performed by older people (80%), retirees, female (79.1%), non-drinkers (77.2), people engaged in physical activity (75.9%), individuals who have received hypertension treatment for less than a year (87.1%) or more than five years (74.3%) and diabetic individuals (79.0%). Young, uneducated men with hypertension are the ones who do not use these blood pressure monitors, hence it is important to urge others to use them.[58]

The white coat effect and white coat hypertension: White coat response is actually an increase in blood pressure when measured in clinic or doctor's office but vanishes soon when comes out the office.[59] The reason behind this effect is anxiety, an overly vigilant reaction, or a learned behaviour to the physician's presence and medical environment.[60] To limit this effect ambulatory or self-monitoring of BP are emphasized to use in which readings are to be taken outside the physician's office. White coat hypertension includes those patients who are hypertensive when measured in clinic while normotensive at other times.[61] The basic difference between white coat response and white coat hypertension is that the first one is

the measure of blood pressure change while the second one is a method of measuring blood pressure.[62]

Different Blood Pressure Measuring Procedures

Clinic blood pressure measurement through automated devices or conventional sphygmomanometer is the principal method of clinical evaluation. But when the clinic measurement is not enough to start the treatment, it is necessary to use self-monitoring or ambulatory monitoring methods as these two methods involve multiple readings taken throughout the 24 hours.[63] Ambulatory monitoring in the best method as it measured the blood pressure experienced during everyday life. In this perspective, latest electronic monitors are introduced that are smaller in size, easy to use and can take up to 100 readings of BP over 24 hours[62] showed in figure 1.

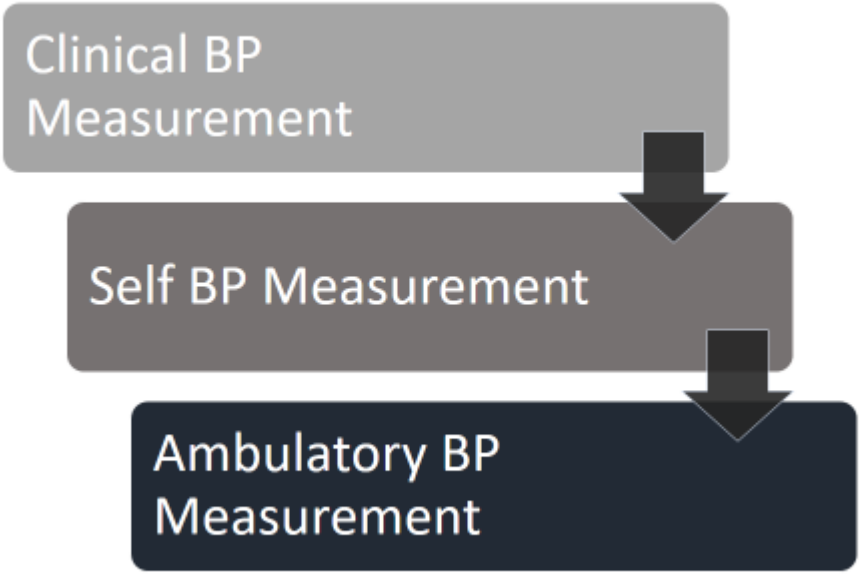

Figure 1: Different methods of blood pressure measurements

Advantages of self-monitoring of blood pressure: SMBP by alone or through customary treatment resulted in a little drop in the clinic's diastolic and systolic blood pressures (SBP and DBP) at six and twelve months, respectively (SBP/DBP -3.1/-2.0 mmHg and -1.2/-0.8 mmHg). Analyses of meta-data revealed there was a statistically significant net decrease in SBP and DBP at 6 months, but not at 12 months.[64] HBPM usage was related with decreased systolic and diastolic blood pressure and a greater likelihood of self-stated usage of counteracting hypertension drug in the group who had been advised for HBPM. Among individuals who reported a doctor's suggestion, HBPM was linked with reduced systolic (3.1 mm Hg; 95% CI: 5.7, 0.5) and diastolic (4.5 mm Hg; 6.2, 2.8) blood pressure.[29] Healthcare practitioners should encourage greater adoption of SMBP best practices as part of initiatives to enhance hypertension control, and insurance can standardize and support SMBP.[65] Nowadays, self-measured blood pressure monitoring and other out-of-office blood pressure monitoring are used to enhance blood pressure control in people with hypertension and to confirm the diagnosis of hypertension.[3] Incorporating community and public health groups into the healthcare delivery process can be beneficial for patients enrolled in SMBP.[66] The association between SMBP (by the level of intervention) and the clinical care processes for hypertension (physician visits, non-physician visits, and intensifications of antihypertensive regimens) as well as the BP outcomes (diastolic blood pressure [DBP] changes from baseline) at 12 months was the main result of the Phase 1 analysis.[35]

Patient involvement is necessary for SMBP in order to evaluate and enhance BP control. Since hypertension is a chronic illness that requires long-term monitoring since blood pressure changes with age, acute illness, and comorbidities, obtaining optimal management is necessary.[67] Considering an improvement in clinical cardiovascular outcomes is one of the benefits of long-term blood pressure control, proving the long-term benefits of SMBP is crucial to demonstrating SMBP's rationale.[68] Net decreases in systolic blood pressure (weighted mean difference [WMD] –2.5 mmHg, 95%CI = –3.7 to –1.3 mmHg) and diastolic blood pressure (WMD –1.8 mmHg, 95%CI = –2.4 to –1.2 mmHg) were linked to self-monitoring.[69]

Some of the advantages of SMBP involves the elimination of white coat effect, indicator of intended organ harm, cardiovascular events and mortality.[70] Multiple readings can be taken throughout the 24 hours. Diagnosis of hypertension at early age and disease prevention in older age is also made possible through self-monitoring. ABPM manages hypertension in far better way than clinic BP measurement.[62] Arterial blood pressure (ABP) monitoring through self-monitoring devices is useful to detect and manage hypertension and cardiovascular disease (CVD).[71] American Stroke Association stated that while having stroke for the first time, 77% of patients have BP ≥140/90 mmHg.[72] Stroke management is also related with proper monitoring of BP especially Morning Blood Pressure Surge monitoring system is helpful in reducing stroke probability[73] showed in figure 2.

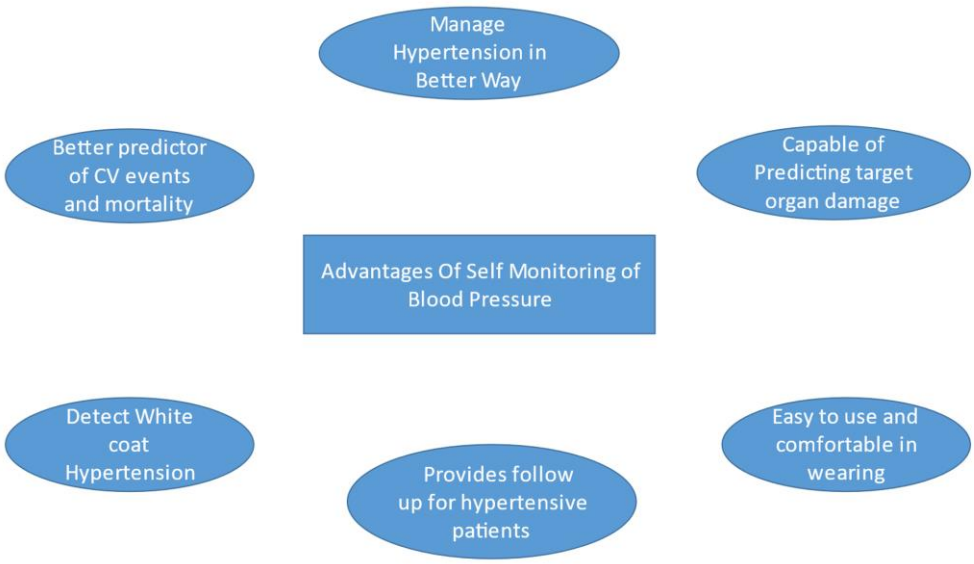

Fig: 2 Advantages of Self-monitoring Of Blood Pressure

Out Office and In Office Blood Pressure Measurement:

Out-of-office BP monitoring is helpful in the control of high blood pressure especially of elderly people as in old age BP varies greatly from time to time.[74] In order to differentiate between standard hypertension, white-coat phenomena, concealed unregulated blood pressure, and persistent elevated blood pressure, home blood pressure monitoring is a crucial technique. The people themselves measured their own blood pressure at their residence using their own blood pressure monitors. They took their blood pressure in the morning for three to five days straight at their respective residences.[75] Hence these measurements are helpful to detect the variations in SBP between home and onsite blood pressure. SBP on-site less residence SBP values more than 10 mmHg marks the presence of white-coat phenomenon. On-site SBP less residence When SBP is less than zero, veiled

phenomena are present. Normal tension is indicated by the difference between the on-site and home SBPs of 0 to 10 mmHg. Monitoring blood pressure (HBP) is also used to prevent complications from hypertension, such as cardiovascular and cerebrovascular illnesses.[76] Cognitive impairments, lifestyle-related diseases, and weakness also be preventable through HBP measurement. Maintenance of fine mental functions and ADL in the elderly.[76] SBPM at home is characterized with many benefits such as BP control and management, reduce unnecessary visits to clinics, cheaper hypertension care.[77] SBPM provides record of medications' effect and other lifestyle changes which helps in better treatment by altering certain unhealthy lifestyle activities. Improvement in treatment motivates the individuals to continue the treatment.[78] Furthermore, it is also beneficial to change medication or therapy sooner if the current does not give good results and also prevent the individual from taking too much medicines due to clinic measurements.[79]

SMBP is simple and easily be done with the use of cheap but validated BP monitor producing same results as tele-monitoring and also is not associated with anxiety problems.[80] Some of the advantages of self-monitoring include its improved correlation with cardiovascular outcomes, treatment improvement including the treatment of concealed uncontrolled elevated blood pressure and not treating white coat hypertension which is the main cause of clinic monitoring.[81] Tele-monitoring along with self-monitoring helps the individuals to contact with their GP for any recommendations and guidelines relevant to the accurate usage and sufficient monitoring.[82] To control extreme readings health-care providers were given mean blood pressure value and graphical illustration showing upward trend in blood pressure.[83] Furthermore, text-based and feedback tele-monitoring systems in smartphones enables working age group to access the facility of physician's advice while on their workplace. The use of blood pressure self-monitoring in primary care to adjust the dosage of antihypertensive medication results in decreasing systolic blood pressure with the benefit of having no extra burden on GP.[81]

Blood pressure both within and outside the workplace measurements both have strong and weak points and are used to collect and evaluate individuals BP values. Out-of office BP is used for the detection and treatment of high blood pressure. In comparison between ambulatory blood pressure and blood pressure at home, blood pressure at home is given priority as it is cheaper and anxiety free.[3] Whereas a blood pressure monitor that is ambulatory is expensive and related with mental/physical stresses. Hence Blood pressure monitoring at home is cost-effective treatment of hypertension for years. Out-of-office blood pressure measurement is not suited for low resource settings.[84]

Self-monitoring home SMHBP first day readings are higher and not stable and should not be considered as it produces a mild white coat effect. This is because the first day of SMHBP is seen as training with the device.[85] Therefore, patients should be trained in heath facility by nurses that how-to take-home readings. Hence it is helpful in Short 3-day SMHBP scheduling and have more advantages like clinical decisions be made earlier and less number of days enhance their compliance with the requirements of test and also to decrease CV morbidity and mortality and also there is no need of excluding first-day readings[85]

Using mobile devices like smartphones and tablets for health purposes is known as mobile health (mHealth). It is a useful technology which provide health services outside the health centers and manages different chronic diseases including diabetes, asthma and cardiovascular diseases[86] Meanwhile it also improves hypertension outcomes. But there is great variation among population groups who actually utilize the mHealth and take advantage from it. Such as those who are older, less educated and Black populations are less likely to use mHealth tools. It is because of the digital illiteracy and inability to use current digital health tools.[87] Whereas, some studies reported that these groups use mHealth in developed countries like US where 85 percent of non-white, 80 percent adults with modest incomes and two-thirds of adults over 65 uses mHealth. mHealth is best for these population groups as they cannot afford in-person office visits due to financial instability in case of low-income group and also due to mobility issues and time limitations. In US Black adults have lower improvement in hypertension than white adults. According to the data one-third of persons over 60 who do not take anti-hypertensive drugs have high blood pressure.,11% grown-ups with less education than a high school diploma and

8% college-educated adults have hypertension.[88] Mobile health (mHealth) solutions could play a crucial part in solving these disparities and differences and is a great solution for addressing hypertension through remote management. Tele-monitoring, interactive voice responses, feedback mechanisms, short messaging service and apps are best for overcoming hypertension in populations especially those who are facing obstacles accessing care such as lower educational adult, minority and old people.[89] Hypertension is also affected by lifestyle factors and work-related factors such as long working hours, job strain, constant demand for attention, shift work, high work intensity and psychosocial factors.[90] Therefore, blood pressure monitoring at rest is not only sufficient but is also accompanied by ambulatory monitoring under working conditions to detect hypertension and its associated risk factors at earlier stage.[91] It is shown that those employees who has more physical workload has more chances of hypertension than those who has mixed workload. BP values fluctuates throughout day depending on the condition of the individual. During working conditions normal range is of 137/83mmHg. Only 3 to 6mmHg BP value drops during leisure time maintaining high level activity in this period. It was stated that employer has increased BP values in working days as compared to work-free days but carry-over effect is still seen after the work has finished which means increased blood pressure.[92] Occupational screening Programme is therefore important to monitor hypertension during real working conditions. As it is very difficult to diagnose and treat hypertension in young people as they generally do not visit health centers for checkups and remain untreated. Therefore, monitoring of blood pressure at worksites enhance the chance of diagnosing and treating hypertension at earlier age[92] showed in figure 3.

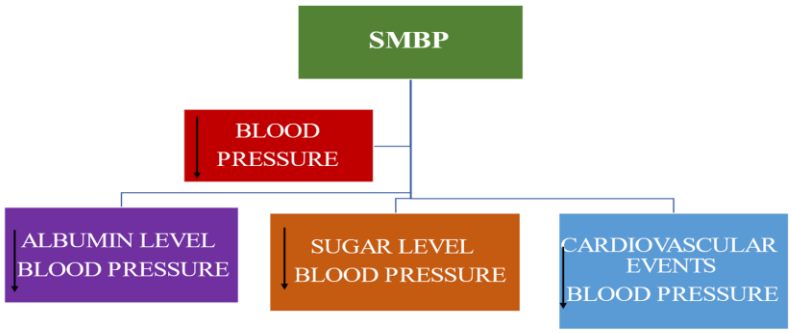

Figure 3 Effectiveness SMBP (self-monitoring of blood pressure) in different morbidity

Conclusion: In conclusion, this literature review emphasizes the significance of self-monitoring of blood pressure (SMBP) in managing, elevated blood pressure a pivotal risk factor for various morbidities such as cardiovascular disease, chronic renal ailment, stroke, and diabetes mellitus. The findings highlight that SMBP, particularly when coupled with telemonitoring, results in modest but significant reductions in diastolic and systolic blood pressure in a clinic. Home blood pressure monitoring (HBPM) is associated with lower blood pressure and increased prescription use, contributing to the efficient treatment of hypertension. The review underscores the significance of continuous blood pressure monitoring, especially in diabetic patients and arterial hypertension, recommending maintenance of blood pressure levels between 120 and 130/80 mmHg through lifestyle modifications and antihypertensive medication. Overall, the comprehensive insights provided in this review serve as valuable guidance for researchers investigating the efficacy of SMBP in diverse medical conditions, offering a foundation for improving healthcare strategies and mitigating the burden of hypertension-related multi-morbidities.

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