

Telehealth Blood Pressure Monitoring Models In Hypertensive Patients: A Scoping Review

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Abstract

The main global cause of death in the world is non-communicable diseases (NCDs). One of NCD is hypertension. Increased hypertension during the Covid-19 pandemic is associated with risk factors for lifestyle changes, social restrictions, lack of physical activity, and stress. Therefore, a remote blood pressure control system is needed to monitor the patient's health status. The purpose of writing this literature review is to provide an overview of health care practices with remote monitoring of blood pressure of hypertension patients based on online management with telemonitoring. the method used is scoping review with the inclusion criteria of articles were published from 2017 – 2021, used the research designs of Randomized Control Trial and Study Experimental, and were published in English and Indonesian. Articles selections were using PRISMA Flow Diagram 2009 and selection for eligibility were using. The Joanna Briggs Institute Critical Appraisal. Four articles were included in the study and 1037 articles were excluded from the study. It was found that telehealth blood pressure monitoring carried out in hypertensive patients was home and online blood pressure management, TASMINH (Telemonitoring and Self-Management in the Control of Hypertension), and scale-up blood pressure. Telemonitoring was found to be significant in reducing and monitoring patients with home care-based hypertension Self-Monitoring Blood Pressure (SMBP) at home using a digital sphygmomanometer accompanied by direct monitoring of doctors and nurses via the internet can be a solution for monitoring blood pressure during a pandemic.

Keywords: Blood pressure monitor, covid-19, hypertension, telemedicine, telenursing.

Introduction

Non-communicable diseases (NCDs) are a disease condition that is not transmitted from one person to another (Kim & Oh, 2013). The World Health Organization (WHO) in 2021 reported that NCDs are the leading global cause of death in the world (World Health Organization, 2021). One of the NCDs is hypertension. It is known that there are 1.13 billion people in the world who suffer from hypertension (World Health Organization, 2021). The prevalence of hypertension in Indonesia increased in 2018, from 25.8% in 2013 to 34.1% (Risesdas, 2018).

Hypertension or high blood pressure is defined as a condition in which systolic blood pressure reaches 140 mmHg and/or diastolic blood pressure reaches 90 mmHg (Risesdas, 2018). Hypertension risk factors are divided into controllable risk factors such as smoking habits, exercise or physical activity, and body mass index while uncontrollable risk factors such as age and family history (Sartik et al., 2017). Also, one of the risk factors for hypertension is physical inactivity. Pandemic Covid-19 caused social restriction and overall physical activity to decrease from 4.4 hours to 2.9 hours per day, and bedtime of about 25 to 30 minutes per night (Giuntella et al., 2021). Studies conducted by Dr. Fosco at the Favaloro Foundation University Hospital, Argentina in 2020, found that the frequency of blood pressure in patients aged 21 years and over experienced increased after the introduction of social restrictions compared to before the implementation of this policy in the same month (ESC Press Office, 2020).

In addition to decreasing physical activity, stress is also a risk factor for increasing blood pressure. Stressful situations can trigger the body to produce hormone adrenaline, which prompts the heart's response to beat faster and louder. This makes the blood vessels narrower, which can lead to high blood pressure. Symptoms of stress during WFH (work from home) throughout Covid-19 pandemic show the average stress value in the medium and high categories (Perdana, 2020). This shows that Stressful workloads are related to the incidence of increased blood pressure during the Covid-19 pandemic (Widiharti et al., 2020).

Hypertension is a disease that can be controlled. Uncontrolled hypertension is more at risk of developing heart disease (Zhou et al., 2018). Based on research conducted by Oparil, et al. (2019). Hypertension is the most common risk factor found for chronic kidney disease (CKD), and cognitive impairment, and cardiovascular disease (CVD), such as coronary heart disease, heart failure, stroke, myocardial infarction, fibrillation, and peripheral arterial disease (Oparil et al., 2019). One of the efforts to control hypertension is monitoring blood pressure regularly.

Periodic blood pressure checks at health care providers need to be carried out to monitor the patient's blood pressure so that if there is an increase it can be detected early (CDC., 2020). Pandemic conditions limit patient visits to hospitals to prevent disease transmission. However, this has the risk of causing the patient's blood pressure to be uncontrolled. In order to facilitate this monitoring, several primary health care services during the COVID-19 pandemic, in monitoring NCDs risk factors such as blood pressure measurements are still carried out by health workers through home visits, appointments, or special scheduling for these services (Kemenkes RI, 2020). However, it cannot be done optimally, because people have to reduce activities outside the home and visits to other places to prevent transmission of the virus. This is certainly a challenge, both for hypertensive patients and health workers maintaining and monitoring health, one of which is by checking blood pressure regularly during the pandemic.

To prevent and reduce the transmission of Covid-19 and facilitate optimal health services, telehealth services can be an option for health workers and patients, one of which is in monitoring blood pressure (Turana et al., 2020). Telehealth is the use of telecommunications and electronic information technology for health workers to provide care to patients remotely. Telemonitoring Blood Pressure (BPT) is a telehealth application with a focus on hypertension that allows the transmission of blood pressure and various clinical information from the patient's home or from the community to the hospital. BPT is one of m-health's wireless solutions, which is

equipped with drug tracking and medication reminders and educational support, and remote consultation (Omboni., 2019).

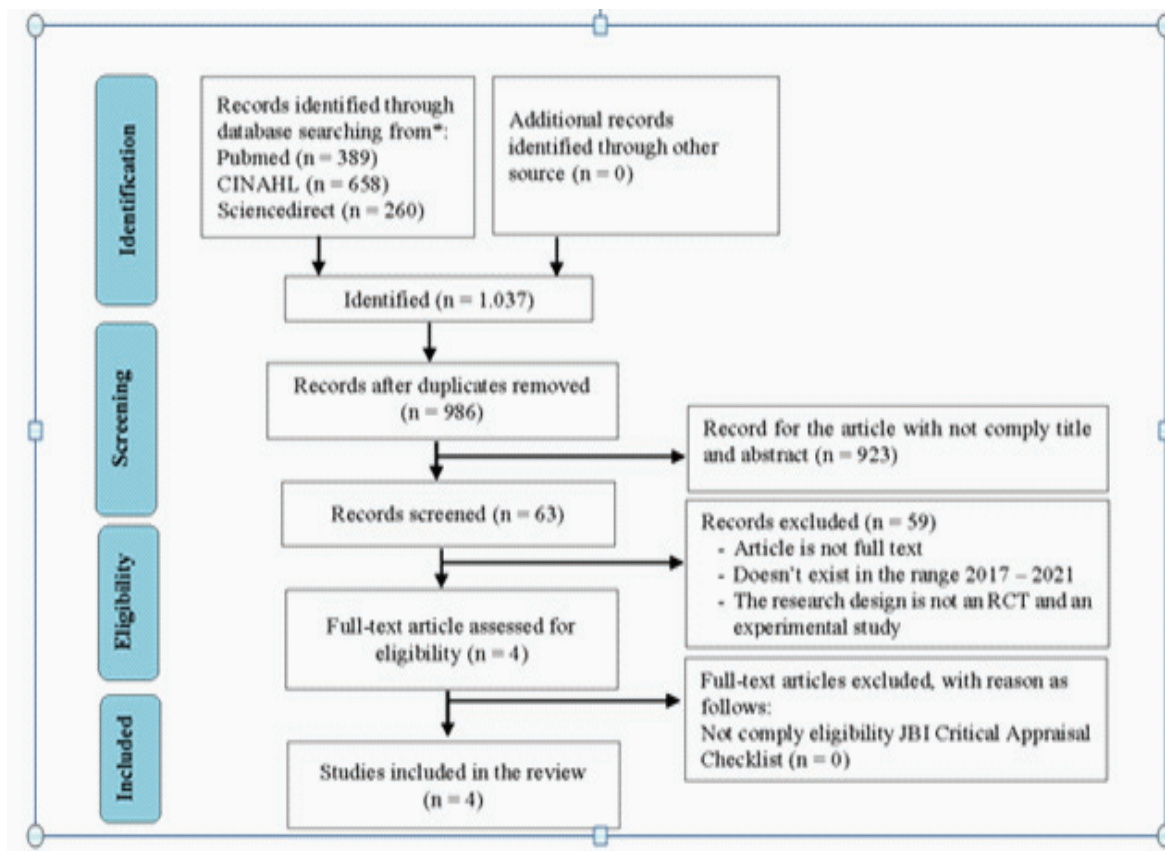
The use of BPT is carried out regularly and continuously with a combination of tele counseling and management under the supervision of a team of health professionals and is able to significantly lower blood pressure compared to usual care (Parati et al., 2018). Thus, a literature review is needed to find out an overview of health care practices in controlling blood pressure in hypertensive patients during the Covid-19 pandemic. The purpose of writing this literature review is to provide an overview of health service practices with online-based remote monitoring of blood pressure of hypertensive patients' management with telemonitoring which is expected to be a recommendation for adaptation during the Covid-19 pandemic.

The design in this literature is a scoping review, which presents an overview of a potentially large and diverse collection of literature relating to a broad topic. The articles were search using the keyword "Hypertension" AND "Blood pressure monitoring" AND "Covid-19". Search articles identified by combining keywords with PCC approach, namely population: hypertensive patient, concept: telemonitoring blood pressure, context: home monitoring. Articles were obtained based on three databases, namely CINAHL, Science Direct, and PubMed.

The studies reviewed are full-text articles published from 2017 – 2021, using a Randomized Control Trial or Study Experimental research design, and published in English and Indonesian. This literature review uses the literature review method by conducting a systematic search according to the 2009 PRISMA diagram and critical appraisal journals using The Joanna Briggs Institute Critical Appraisal. The diagram of 2009 PRISMA is below to:

Research Methodology

Design and study selection



Gambar 1. Prisma Flowchart Diagram

Results

In this scoping review, there are 4 studies that were reviewed. Among them, one Quasi Experimental article and three Randomized

Control Trial (RCT) articles. The study was conducted in four countries, namely China, England, UK, and Scotland. The year of publication ranges from 2017-2021.

Table 1. Result of Literature Review

Writer	Sample	Method	Intervention and Comparison	Data Analysis Test	Results
Pan., et al. (2018)	Location in China, in 110 patients with essential hypertension KI n=55 KK n=55. Age 35-75 years.	RCT	KI: Telemonitoring of blood pressure at home by patients monitored by general practitioners, hypertension specialists, and general nurses KK: Usual care (every 2-4 weeks)	Student's t-test, Chi-Square test	In the results of KI, there was a greater reduction in blood pressure than in KK. There was a moderate correlation ($r = 0.302$, $P = 0.029$) between the decrease in systolic blood pressure and the use of telemonitoring BP applications in KI, but the correlation between the decrease in diastolic blood pressure and the use of the application was not significant ($r = 0.035$, $P = 0.184$).
Bryant KB., et al. (2020)	Location in England, on 2,590 samples of elderly people with uncontrolled hypertension, average 66.6 years, 53.9% male and dominated by white race (95.6%) TASMINH (N=440), TASMINH2 (N=527), TASMIN-SR (N=450), and TASMINH4 (N=1173).	RCT	TASMINH: Level 1 - SMBP at the clinic 1 time/month, given a BP target card and control schedule for medical services. TASMINH4: Level 2 - SMBP at home 2 times/day, accompanied by a message about instructions on when to call the doctor and sending the results of BP monitoring to the service provider by post. Level 3 - SMBP at home with telemonitoring: patient sends BP results to healthcare provider via text, warns patient to call office if BP is high or low, sends alert if low BP results are reported, and sends monitoring results to doctor's office. TASMINH2 and TASMIN-SR: Level 3 - SMBP at home 2 times/day, BP measurement results are color-coded to assess BP. If the BP is "above target" for 2 consecutive months, the patient can self-titrate (treatment) according to a predetermined schedule.	Random effects generalized least squares regression, random effects regression	SMBP plus telemonitoring or self-management for one year can reduce the intensity of hypertension and can improve the level of blood pressure control over 5 years; blood pressure can be better controlled by continuing BP for 5 years.

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Writer	Sample	Method	Intervention and Comparison	Data Analysis Test	Results
McManus RJ., et al. (2020)	Location in UK, in 622 essential hypertension patients with KI: 305, KK: 317 with an age range of 18-65 years.	RCT	KI: Digital Intervention (HOME BP) by doctors combined with self-monitoring KK: Usual Care (routine care of blood pressure by taking antihypertensive drugs) for 12 months	PEI (patient enablement instrument)	After one year of experimentation, only 522 eligible (eligible) participants, the results occurred significantly in KI (digital intervention) with drop in blood pressure from 151.7/86.4 becomes 138.4/80.2 mmHg while in KK experienced decreased from 151.6/85.3 to 141.8/79.8. Self-monitoring interventions in combination with home digital BPM, have the potential to be both supportive and cost-effective for patients and are successful in lowering blood pressure with p value < 0.05.
Hammersley V., et al. (2020)	Location in Oxford (UK), in 905 patients with uncontrolled hypertension, mean age 65 years in female respondents in 8 primary care practices in Lothian, Scotland.	Quasi-experimental	Scale-up BP (regular BP monitor, improved professional response, efficient processes for monitoring and feedback (via Docman))	IQR (Interquartile range)	There was an increase in the number of participating practices (75 practices at Lothian) with 3200 patients. There is an increasing number of hypertension medications being prescribed. Average DDD rose from 2.08 to 2.35. There was a median difference between the second and last tele-monitored BP, which was 6 mmHg for systolic and 4 mmHg for diastolic. There is a decrease in the percentage of appointments with hypertension patients by 15% from the number of face-to-face appointments. However, this did not show a significant difference in the total number of appointments.

Information:

KI: Intervention group, KK: Control group, RCT: Randomized Control Trial, BP: Blood Pressure, SMBP: Self-Monitoring Blood Pressure, BPM: Blood Pressure Monitoring, DDD: Defined Daily Dose, TD: Blood Pressure, **TASMINH (Telemonitoring and Self-Management in the Control of Hypertension)**.

Discussion

One of the risk factors of cardiovascular disease is hypertension. Several randomized controlled trials have shown that this risk can be reduced by lowering blood pressure (Brunström & Carlberg, 2018). Most hypertension is identified by clinicians routinely by assessing blood pressure in the primary care clinic (Kitt et al., 2019). However, the Covid-19 pandemic has become an obstacle in monitoring of blood pressure by health workers in health care facilities.

The development of technology to measure blood pressure based on technology's chance to improve the detection of hypertension. Self-screening allows patients to measure blood pressure in their own home with an automated sphygmomanometer that is publicly validated by following simple instructions, without requiring training (Kitt et al., 2019).

The study conducted by McManus RJ et al. (2021) discusses Home and Online Management and Evaluation of Blood Pressure (HOME BP) with digital intervention. Participants are given online instructions on how to properly monitor themselves (using an Omron M3 monitor) and show cavalcade videos. When the home blood pressure reading is extremely high ($>180/110$ mmHg) or very low (systolic blood pressure <100 mmHg), then patients are advised to contact their GP within three days and reassess the HOME BP. Furthermore, health practitioners will be notified via email. The HOME BP digital intervention, combined with self-monitoring, has the potential to provide cost-effective support for patients and professionals in lowering blood pressure (McManus et al., 2021).

In line with research Agarwal, R., et al (2021) said that compared with clinic BP monitoring alone, home BP monitoring has the potential to overcome therapeutic inertia and lead to a small but significant reduction in systolic and diastolic BP. Hypertension control with home BP monitoring can be enhanced further when accompanied by plans to monitor and treat elevated BP such as through telemonitoring.

Subsequent studies conducted by Pan et al. (2018) regarding evaluation use

home telemonitoring in patients with high blood pressure. The team provided for this trial consisted of general practitioners, hypertension specialists, general nurses and information managers. Patients use an automatic sphygmomanometer, which functions to upload readings of hypertension results to the management platform at primary healthcare by an application on the patient's gadget. Then, the patient was invited to attend a training session held at the community health centre (Pan et al., 2018).

Home telemonitoring has several advantages including being able to provide extensive and ongoing data for health workers to evaluate their treatment regimens. Telemonitoring is also able to improve coordination and interprofessional communication in the health sector. This is very important in the management of hypertensive patients if complications occur due to poor blood pressure control (Omboni & Ferrari, 2015).

A qualitative study in the UK, assessed that people who do self-monitoring of blood pressure at home are less likely to communicate blood pressure measurement results with their nurses or doctors. This is due to a lack of understanding, or they just want to know their blood pressure at any time, and some of them are also afraid to get additional drug prescriptions from health workers (Grant et al., 2015). With a self-monitoring blood pressure system at home that is integrated with a management platform at a primary healthcare like this, it will increase the responsiveness of health workers and make it easier for patients to share real time with health workers (Omboni & Ferrari., 2015).

The results of research on TASMINH (Telemonitoring and Self-Management in the Control of Hypertension) conducted by Bryant et al. (2020) also showed that the implementation of SMBP (Self-Monitoring Blood Pressure) can increase the intensification of antihypertensive treatment within 12 months of intervention. Compared with usual care, projection of SMBP by telemonitoring or self-management at 5 years had a significant improvement in blood pressure control. It can be concluded that SMBP with telemonitoring is an effective way to control blood pressure in the long

term (Bryant et al., 2020).

The same study was conducted by Vicky et al. (2020) with telemonitoring intervention scale-up blood pressure, applied in primary care. This study shows that there is an improvement in blood pressure control in hypertensive patients, and it can be applied in routine primary care practice on a large scale without increasing the workload of health workers. Scale-up blood pressure using an implementation strategy in the form of regular monitoring of blood pressure using an electronic oscillometric sphygmomanometer performed by hypertensive patients after being shown how to read blood pressure. The results of the patient's blood pressure readings are sent via the internet or via a short message service (SMS) to general practitioners. The doctor will provide feedback and prescribe antihypertensive drugs if needed. Then, the data of patient will be recap by Docman (Hammersley et al., 2020).

Based on these four studies, telemonitoring blood pressure at home allows it to be applied during the Covid-19 pandemic as a solution for remote blood pressure monitoring in hypertensive patients. In addition, the use of internet technology in telemonitoring makes it easier for patients to connect with health workers.

There was an 8% increase in internet users in 2017 to 262 million from 143.26 million. According to APJII data (2020), this is a good opportunity for telemedicine as much as 600% and continues to increase. So that the application of home telemonitoring to monitor and measure blood pressure during a pandemic is very potential (Tim APJII, 2021). In addition to the purpose of monitoring blood pressure, self-monitoring blood pressure can be an early detection tool for hypertension in the community (Roy et al., 2021).

It is necessary to conduct training and education related to the use of blood pressure detection devices as an important instrument in implementing telemonitoring blood pressure at home (Roy et al., 2021). The study conducted by Ringrose et al. (2017) found that the blood pressure measurement tools owned by many patients were inaccurate to more than or equal to 5 mmHg. Of course, this is very influential on clinical decisions to be taken (Ringrose et al., 2017). The American

Medical Association in 2018 has made a self-measured blood pressure device accuracy test sheet that can help health workers and patients test the accuracy of reading blood pressure results. Devices can be tested annually, every time a blood pressure reading is taken (American Medical Association, 2018).

Based on research conducted by Schwartz et al. (2018) people who have done self-monitoring for 12 months tend to continue these activities, because of the positive results obtained and their blood pressure being controlled (Roy et al., 2021). Another research conducted by Roy et al. (2021) found that patients felt satisfied after doing telemonitoring because their blood pressure was better controlled and they understood hypertension better (Roy et al., 2021).

Conclusion

Telehealth Blood Pressure Monitoring Models for hypertensive patients at home using a digital sphygmomanometer accompanied by direct monitoring of doctors and nurses via the internet can be a solution for monitoring blood pressure during a pandemic. The results of the analysis of four articles show that blood pressure telemonitoring can improve blood pressure control, save costs, and make it easier for patients and interdisciplinary health workers to connect with one another.

In the future, it is hoped that more research and studies will discuss the accuracy of using telemonitoring blood pressure at home. There is a need for collaboration between interprofessional professions and IT, the role of the Ministry of Health in donating funds and disseminating information, also expected to be able to develop policies regarding telemonitoring of blood pressure at home, especially during the pandemic. It is also necessary to consider the potential for human error when reading blood pressure results by patients, validate the accuracy of using telemonitoring blood pressure at home, and supervise the implementation of this program

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