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Effectiveness of the "CEPAT" (Smart and Compliant) Health Promotion Model on Blood Pressure Control in Hypertensive Patients

A Quasi-Experimental Study

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ABSTRACT

The necessity for efficient non-pharmacological methods to supplement medical therapy is highlighted by the fact that hypertension remains a major global public health concern. In Kudus Regency, Indonesia, this study looked at how well the CEPAT health promotion model worked to lower blood pressure in hypertensive individuals. Purposive sampling was used to choose 32 individuals from PRM 02 Pasuruhan Lor for a quasi-experimental study with a pre-test–post-test control group design. Participants were split equally between a control group (n = 16) and an intervention group. While the control group got standard care, the intervention group participated in a four-week CEPAT health promotion program. Following the intervention, the diastolic blood pressure decreased from 103.71 ± 1.03 mmHg to 93.13 ± 0.93 mmHg ($p = 0.001$) and the systolic blood pressure decreased significantly from 167.81 ± 32.19 mmHg to 135.63 ± 16.43 mmHg ($p < 0.001$). On the other hand, the control group showed no statistically significant changes. A substantial difference between the two groups was also shown by post-intervention analysis ($p < 0.001$). These results imply that the CEPAT health promotion model is a useful community-based intervention for improving blood pressure control and could be a useful tactic for managing hypertension.

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Introduction

Hypertension is recognized as one of the most significant public health problem worldwide because it frequently develops without noticeable clinical manifestations during its initial stages. This characteristic has led to its designation as the *"silent killer,"* as many individuals remain undiagnosed until complications arise [1]. Persistent elevation of blood pressure substantially increases the likelihood of developing serious cardiovascular and renal disorders, such as heart failure, stroke, and chronic kidney disease [2]. The World Health Organization (WHO) estimates that nearly 1.13 billion people are living with hypertension globally; however, only 36.8% of affected individuals receive adequate antihypertensive treatment [3]. In Indonesia, the prevalence of non-communicable diseases (NCDs) has shown a rising trend. Data indicates that the prevalence of hypertension in the population has reached 34.11%, with Central Java province reporting an even higher prevalence of 37.57% [4]. These statistics underscore the urgent need for effective management strategies to control blood pressure and prevent associated morbidity [13].

Hypertension arises from the interaction of numerous determinants rather than from a single underlying cause. The condition develops through the combined influence of inherited susceptibility, environmental conditions, and individual health-related behaviors. Several determinants, including increasing age, biological sex, and a positive family history, are classified as non-modifiable because they cannot be altered. Conversely, behavioral and lifestyle factors including excessive salt consumption, sedentary habits, excess body weight, tobacco smoking, and persistent psychological stress are modifiable and represent important targets for hypertension prevention and management [5]. As individuals age, physiological changes such as the thickening of arterial walls and increased peripheral resistance contribute to the elevation of blood pressure [1]. Furthermore, psychological stress can trigger the release of adrenaline, increasing heart rate and cardiac output, which exacerbates hypertension [6]. Therefore, management strategies must encompass not only pharmacological interventions but also comprehensive lifestyle modifications.

Although effective pharmacological therapies for hypertension are widely available, achieving adequate blood pressure control continues to be a major clinical challenge. A significant barrier to effective control is patient non-compliance with treatment regimens and lifestyle recommendations [7]. Poor adherence is often driven by a lack of knowledge regarding the disease and the misconception that absence of symptoms equates to absence of disease. Education plays a pivotal role in addressing this gap. Health education aims to improve patient knowledge (cognitive), which in turn influences attitudes (affective) and practices (psychomotor), leading to sustainable behavior change [8]. Studies have shown that increased

knowledge about hypertension management is significantly associated with better medication adherence and lifestyle modification [9].

To address the burden of NCDs, the Indonesian government has introduced health promotion campaigns known as "CERDIK" and "PATUH." CERDIK targets healthy and at-risk populations, advocating for: Cek kesehatan secara rutin (Routine health checks), Enyahkan asap rokok (Eliminate cigarette smoke), Rajin aktivitas fisik (Regular physical activity), Diet seimbang (Balanced diet), Istirahat cukup (Adequate rest), and Kelola stress (Manage stress) [10]. For individuals already diagnosed with hypertension, the PATUH acronym emphasizes compliance: Periksa kesehatan rutin (Routine check-ups), Atasi penyakit dengan pengobatan yang tepat (Treat disease with appropriate medication), Tetap diet gizi seimbang (Maintain a balanced diet), Upayakan aktivitas fisik dengan aman (Safe physical activity), and Hindari asap rokok (Avoid smoke) [2]. While these programs are theoretically sound, their implementation at the community level often requires simplified, memorable models to ensure patient engagement.

In this study, we introduced the "CEPAT" (Cerdik dan Patuh / Smart and Compliant) model, a novel health promotion strategy that integrates the principles of CERDIK and PATUH into a cohesive and actionable framework for hypertensive patients. The CEPAT model emphasizes the synergy between preventive behaviors and strict adherence to medical advice. The primary objective of this study was to evaluate the effectiveness of the CEPAT health promotion model on blood pressure control among hypertensive patients in Kudus Regency. It is hypothesized that patients receiving the CEPAT intervention will demonstrate significantly improved blood pressure outcomes compared to those receiving standard care.

Literature Review

A persistent rise in systemic arterial pressure is the hallmark of hypertension, which is identified when repeated measurements show a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher. Often termed the "silent killer," this condition typically presents without specific symptoms in its early stages, yet it significantly increases the risk of severe cardiovascular events such as stroke, myocardial infarction, and renal failure [22]. The physiological progression of hypertension is often associated with aging, which leads to the thickening of arterial walls due to collagen accumulation and increased peripheral resistance [1]. Additionally, hormonal factors play a crucial role; for instance, post-menopausal women experience a decline in estrogen—a hormone that protects vascular endothelium—thereby increasing arterial stiffness and blood pressure [2].

A comprehensive strategy that takes into account both modifiable and non-modifiable risk factors is necessary for the effective management of hypertension. While factors such as

age, gender, and genetics are non-modifiable, lifestyle determinants including smoking, high sodium intake, physical inactivity, obesity, and chronic stress are modifiable targets for intervention [22]. To address these risk factors systematically, the Indonesian Ministry of Health introduced the CERDIK program. CERDIK is an acronym designed to promote healthy behaviors in both the general population and high-risk groups. It encompasses routine health screenings, elimination of tobacco smoke, and regular physical activity, which has been shown to significantly influence blood pressure stability in the elderly [10]. Furthermore, the program emphasizes a balanced diet, particularly low-salt intake to reduce sodium retention [5], adequate rest to ensure metabolic recovery [11], and stress management to prevent hormonal surges that exacerbate hypertension [6] [21].

For individuals already diagnosed with hypertension, adherence to treatment protocols is critical to prevent complications. This is encapsulated in the PATUH framework, which emphasizes compliance and disease management. The PATUH protocol advocates for routine medical check-ups, appropriate pharmacological treatment, maintenance of a balanced nutritional diet, safe physical activity, and the avoidance of carcinogenic substances such as alcohol and tobacco smoke. Adherence to these guidelines is essential, as irregular medication intake and poor lifestyle choices are identified as primary contributors to uncontrolled blood pressure and subsequent hypertensive crises [7] [14].

Recognizing the need for a unified and memorable educational strategy, this study integrates these two established frameworks into the CEPAT (Cerdik dan Patuh) model. The CEPAT model serves as a cohesive health promotion tool that combines preventive measures with strict therapeutic compliance. By synthesizing the preventive aspects of CERDIK with the management focus of PATUH, the CEPAT model aims to enhance patient cognitive retention and facilitate the practical application of healthy behaviors in daily life. This integrated approach is hypothesized to be more effective in improving self-management capabilities, thereby leading to better blood pressure control among hypertensive patients.

Material and Methods

This research adopted a quantitative methodology based on a quasi-experimental design incorporating a non-equivalent control group with pre-intervention and post-intervention measurements. The study was carried out between August and September 2024 in the service area of Pimpinan Ranting Muhammadiyah (PRM) 02 Pasuruhan Lor, located in Jati District, Kudus Regency. The target population comprised 80 registered PRM members. Using the Slovin formula, the required sample size was calculated to be 32 participants. Participant recruitment was conducted through purposive sampling, whereby individuals were selected according to predetermined eligibility criteria that reflected the characteristics of the study population, consistent with the sampling approach described by Pasaribu [12].

The final sample was allocated equally into an intervention group and a control group, with 16 participants assigned to each group. The inclusion criteria established for this study were members of PRM 02 Pasuruhan Lor diagnosed with hypertension who were willing to participate in the research and were in good physical condition, defined as having good consciousness and being free from disabilities that would hinder participation. Conversely, the exclusion criteria included members who were illiterate or unwilling to participate. The intervention group received the "CEPAT" (Cerdik dan Patuh) health promotion model using a module developed by the researchers, which was implemented over a period of 4 weeks, while the control group received standard care. Data collection was carried out using primary instruments, specifically a sphygmomanometer and stethoscope for blood pressure measurement, alongside documentation sheets. The study closely followed ethical guidelines, guaranteeing each participant's informed consent, anonymity, and confidentiality. Both univariate and bivariate techniques were used in the data analysis. To choose the right statistical tests, the data distribution's normality was evaluated. The Paired t-test and Wilcoxon test were used for within-group analysis to evaluate changes prior to and during the intervention. The significance of differences between the intervention and control groups was assessed for between-group comparisons using the Man-Whitney test and the Independent t-test, with a significance level of $p < 0.05$.

Results and Discussions

A. Results

The univariate analysis presented in Table 1 explains the age distribution of respondents. Based on the research results, the general overview of the sample based on age showed that the youngest sample was 60 years old and the oldest was 81 years old. Table 1 explains that the highest number of respondents participating in this study was in the 60-63 years age group, with 18 people (56.2%), while the lowest number was in the 80-83 years age group, with 1 person (3.1%).

Table 1. Age Interval Distribution.

Range	f	%
60-63	18	56.2
64-67	3	9.4
68-71	3	12.5
72-75	4	9.4
76-79	3	12.5
80-83	1	3.1
Total	32	100.0

Table 2 explains the distribution of the sample according to the characteristics of the respondents. Compared to the control group, which had ten respondents, the treatment group

had more female respondents. Respondents' educational backgrounds also differed; 11 members of the treatment group and 10 members of the control group had completed elementary school (SD) or its equivalent. 10 respondents in the treatment group and 9 in the control group were unemployed. It is known from the data that none of the respondents who took part as samples smoked or drank alcohol prior to or during the study. 12 respondents in the treatment group and 11 in the control group had no prior history of hypertension. In contrast, there were 8 respondents in the therapy group and seven in the control group who had a history of other illnesses.

Table 2. Distribution of Respondent Characteristics.

Respondent Characteristics		Treatment		Control		Total
		f	%	f	%	
Gender	Male	6	18.8	8	25	14
	Female	10	31.2	8	25	18
Education	No Schooling	0	0	0	0	0
	Elementary	11	34.4	10	31,2	21
	Junior High	4	12.5	4	12.5	8
	Senior High	1	3.1	2	6.3	3
Occupation	Employed	6	18.7	7	21.9	13
	Unemployed	10	31.3	9	28.1	19
Alcohol	Yes	0	0	0	0	0
	No	16	50	16	50	32
Smoking	Yes	0	0	0	0	0
	No	16	50	16	50	32
History of Hypertension	Yes	4	12.5	5	15.6	9
	No	12	37.5	11	34.4	23
Other Diseases	Yes	8	25	7	21.9	15
	No	8	25	9	28.1	17

Table 3 shows a parametric statistical test, namely the paired t-test, can be used to ascertain the difference in systolic blood pressure before and after therapy in the control and treatment groups. Because the systolic blood pressure in both groups was normally distributed before and after therapy, the paired t-test was employed. The significance value obtained was 0.432 ($p > 0.05$), which explains why there was no significant effect before and after treatment in the control group. Nonetheless, the therapy group showed a substantial effect both before and after treatment, as indicated by the significance value of <0.001 ($p < 0.05$).

Table 3. Difference in Systolic Blood Pressure (Paired Sample T-Test).

	Group	Mean	MD	SD	p value	N
Systolic	Pre	166.88±1.67	1.250	6.191	0.432	16
Control	Post	165.63±1.65				
Systolic	Pre	167.81±1.67	32.188	16.429	<0.001	16
Treatment	Post	135.63±1.35				

Table 4 shows the results of the Wilcoxon test. It was employed to ascertain the difference in diastolic blood pressure before and after in the treatment and control groups. The test findings show that there was no significant difference in the control group's diastolic blood

pressure before and after because the significance value was 0.115 (p > 0.05). The pre- and post-diastolic pressure in the treatment group differed significantly, with a significance value of 0.001 (p < 0.05).

Table 4. Difference in Diastolic Blood Pressure (Wilcoxon Test).

	Group	Mean	Min	Max	p value	N
Diastolic	Pre	105.31±1.05	100	120	0.115	16
Control	Post	102.81±1.02	90	110		
Diastolic	Pre	103.71±1.03	100	115	0.001	16
Treatment	Post	93.13±0.93	90	100		

The parametric Independent T-Test (Table 5) was used to compare the systolic blood pressure before treatment between the control and treatment groups. Due to the data's normal distribution, this test was employed. The control and treatment groups did not differ significantly prior to treatment, according to the results (p = 0.851). The control and treatment groups did, however, differ significantly after treatment, with a significance value of <0.001 (p < 0.05).

Table 5. Difference in Systolic Blood Pressure Between Groups (Independent T-Test).

	Group	Mean	MD	SD	p value	N
Systolic	Control	166.88±1.67	-0.938	4.955	0.851	32
Pre	Treatment	165.63±1.65				
Systolic	Control	167.81±1.67	29.375	4.092	<0.001	32
Post	Treatment	136.25±1.36				

Because the data were not normally distributed, the Man-Whitney test was utilized to examine the differences in pre-diastolic and post-diastolic blood pressure between the control and treatment groups (Table 6). The diastolic blood pressure before to treatment did not significantly differ between the groups, according to the statistical test results (p = 0.468). Nonetheless, the diastolic blood pressure following treatment differed significantly between the treatment and control groups, with a significance value of <0.001 (p < 0.05).

Table 6. Difference in Diastolic Blood Pressure Between Groups (Mann-Whitney Test).

	Group	Mean	Min	Max	p value	N
Diastolic	Control	105.31±1.05	100	120		
Pre	Treatment	103.71±1.03	100	115	0.468	32
Diastolic	Control	102.81±1.02	90	110		
Post	Treatment	93.13±0.93	90	100	<0.001	32

Discussion

Age-related physiological changes brought on by hypertension include the thickening of artery walls from collagen buildup, which causes blood arteries to narrow and stiffen beginning at age 45. Peripheral resistance, sympathetic activity, and baroreceptor sensitivity are also elevated. People who pay less attention to their health as they age are more likely to develop hypertension. To avoid difficulties, routine health examinations and upholding a

healthy lifestyle such as a balanced diet, frequent exercise, and quitting smoking are crucial [16][17].

Gender is closely related to hypertension, where it is higher in women after menopause. Premenopausal women are protected by estrogen, which increases High-Density Lipoprotein (HDL) levels. High cholesterol levels act as a protective factor against atherosclerosis. Estrogen levels decrease when women enter old age (menopause), causing arterial blood vessels to become stiff and damaging the endothelial layer. This condition triggers plaque formation and activates body systems that increase blood pressure[15].

The result of this study indicates that factors influencing CERDIK behavior and blood pressure in hypertensive patients include a balanced diet, stress management, adequate rest, routine health checks, regular physical activity, and eliminating cigarette smoke. The results showed that 32 respondents (100%) were able to eliminate cigarette smoke. In older males, smoking behavior and hypertension are significantly correlated. Education regarding eliminating cigarette smoke is effective for the elderly in preventing hypertension [21] [22].

Based on observations, respondents who were not diligent in physical activity cited a lack of time, and some were in recovery, doing only light physical activity. Lack of physical activity increases the risk of hypertension [20]. Physical activity can affect the blood pressure of elderly people with hypertension. A low-salt nutrition diet can reduce salt intake in the body. According to researchers, a person's low-salt diet behavior is their own decision to control blood pressure. This aligns with research stating that a low-salt diet can lower patient blood pressure [18][19].

Based on researcher observations, respondents had good rest patterns. Education for the elderly is necessary to maintain adequate rest because it is effective in preventing hypertension. Elderly people with good sleep quality can control blood pressure. Other research results state that elderly people who can manage stress well will avoid hypertension. If someone experiences stress, adrenaline hormones increase, causing an increased heart rate and resulting in hypertension [20].

Compliance is a multidimensional phenomenon involving patient factors, therapy, health systems, environment, and socio-economics. Non-compliance with taking hypertension medication can cause uncontrolled hypertension. Forms of non-compliance include not taking medication at all, incorrect dosage, taking medication for the wrong reasons, incorrect timing, or drug interactions. Hypertensive patients who are non-compliant with medication are a complicating factor in hypertension management and a barrier to blood pressure control [22].

The findings show that putting the CEPAT (Smart and Compliant) Health Promotion Model into practice significantly improved the way people with hypertension managed their blood pressure. After finishing the program, those who got the intervention saw statistically

significant drops in their systolic and diastolic blood pressure. Participants in the control group, on the other hand, did not show any appreciable changes in either blood pressure measure during the course of the study.

After using the CEPAT (Smart and Compliant) Health Promotion Model, the intervention group showed a significant improvement in systolic blood pressure. The average systolic blood pressure decreased by 32.19 mmHg, which was statistically significant ($p < 0.001$), from 167.81 ± 1.67 mmHg at baseline to 135.63 ± 1.35 mmHg following the four-week intervention. In contrast, the control group's participants' blood pressure decreased just little, from 166.88 ± 1.67 mmHg to 165.63 ± 1.65 mmHg, and this drop was not statistically significant ($p = 0.432$).

These results show that among people with hypertension, taking part in the CEPAT program was linked to a significant drop in systolic blood pressure. This result is especially significant from a clinical standpoint since high systolic blood pressure is commonly acknowledged as one of the best indicators of cardiovascular problems and early death. The effectiveness of the CEPAT model may be explained by its emphasis on enhancing patients' knowledge, strengthening self-care abilities, and encouraging consistent adherence to recommended lifestyle modifications and treatment plans. By improving patients' understanding of hypertension and promoting active participation in disease management, educational interventions such as CEPAT can facilitate healthier behavioral changes that contribute to better blood pressure control. Comparable evidence has been reported by Kordvarkane *et al*. [26], who demonstrated that a self-regulation–based educational program significantly decreased systolic blood pressure by improving patients' self-management practices and treatment adherence.

The significant reduction in systolic blood pressure may be explained by the core components of the CEPAT model, which emphasize patient empowerment, health education, adherence reinforcement, and continuous monitoring. These components encourage patients to actively participate in disease management, adhere to medication regimens, monitor blood pressure regularly, and adopt healthier lifestyles. Previous studies have demonstrated that interventions focusing on self-management and behavioral modification effectively improve hypertension outcomes. Mobile health and self-management programs have also been shown to significantly reduce systolic blood pressure through improved adherence and self-care behaviors.

Diastolic blood pressure showed a similar pattern. While there was no statistically significant improvement in the control group ($p = 0.115$), the therapy group experienced a substantial decrease from 103.71 ± 1.03 mmHg to 93.13 ± 0.93 mmHg ($p = 0.001$). These findings suggest that the CEPAT model effectively addressed factors contributing to elevated

diastolic blood pressure. Improvements in medication adherence, dietary practices, physical activity, stress management, and routine health monitoring may have contributed to the observed reduction. Lifestyle modification and adherence enhancement are recognized as essential components of successful hypertension management and have consistently been associated with better blood pressure outcomes.

The intervention's efficacy was further reinforced by the between-group study. Systolic blood pressure ($p = 0.851$) and diastolic blood pressure ($p = 0.468$) did not significantly differ between the control and treatment groups prior to the intervention, suggesting similar baseline characteristics. However, following the intervention, there were statistically significant changes between the groups for both the diastolic and systolic blood pressure ($p < 0.001$). The treatment group achieved substantially lower blood pressure values than the control group, demonstrating that the observed improvements were attributable to the CEPAT intervention rather than to natural variation or routine care alone.

The finding of this study is consistent with recent evidence demonstrating that patient-centered educational interventions, self-management programs, and adherence-focused health promotion strategies are effective in improving hypertension control. These interventions enhance patients' knowledge, self-efficacy, and engagement in disease management, thereby promoting sustainable health behavior changes. A systematic review and meta-analysis published in 2024 reported that interventions targeting treatment adherence and self-management significantly improved blood pressure control among individuals with hypertensin. Furthermore, motivational and patient-centered approaches have been shown to strengthen medication adherence, encourage healthy lifestyle modifications, and contribute to sustained reductions in both systolic and diastolic blood pressure. These findings support the effectiveness of the CEPAT (Smart and Compliant) Health Promotion Model, which emphasizes patient knowledge and adherence as key determinants of successful hypertension management [23]-[25].

The effectiveness of the CEPAT model can also be interpreted through behavioral change theories. The model promotes patient awareness ("Smart") and treatment adherence ("Compliant"), two critical determinants of successful hypertension management. Enhanced knowledge enables patients to understand the consequences of uncontrolled hypertension, while improved adherence supports consistent implementation of recommended treatment and lifestyle modifications. Previous studies have demonstrated that educational interventions combined with continuous follow-up and adherence support yield better blood pressure outcomes than standard care alone.

The results of this study have significant ramifications for community health services and nursing practice. The CEPAT model offers a methodical and useful strategy that may be

included into primary healthcare facilities' hypertension treatment initiatives. When it comes to providing health information, keeping an eye on patient compliance, and encouraging behavioral change, nurses are essential. Healthcare professionals may improve long-term blood pressure control and patient self-management skills by implementing the CEPAT paradigm into normal hypertension therapy.

Overall, the findings point to the CEPAT Health Promotion Model as a successful intervention for hypertensive patients' blood pressure control. Its potential as a nursing-led health promotion strategy to lessen the burden of hypertension and prevent cardiovascular consequences is supported by the notable drops in both systolic and diastolic blood pressure.

Conclusion

The "CEPAT" (Cerdik dan Patuh) health promotion model is a very successful strategy for controlling hypertension in the community, according to the study's findings. Patients in the intervention group had significantly lower systolic and diastolic blood pressure than those receiving normal care, according to the statistical analysis. This demonstrates that the integration of preventive behaviors (CERDIK) and strict compliance protocols (PATUH) creates a synergistic effect that empowers patients to manage their condition better than partial or singular interventions. The study validates that structured education focusing on physical activity, dietary adjustments, stress management, and medication adherence is fundamental in mitigating the physiological risks associated with hypertension, particularly in the elderly population. Consequently, the CEPAT model serves as a practical, evidence-based tool that can be implemented to bridge the gap between clinical advice and patient daily practice.

Limitation and Suggestions

Although the results of this study are encouraging, a number of limitations must be noted in order to present a fair picture. First, the study was limited to a particular geographic area (PRM 02 Pasuruhan Lor, Kudus) and used a quasi-experimental approach with a somewhat small sample size (n=32). This restriction may limit the findings' applicability to larger groups with diverse cultural or demographic backgrounds. Second, because the intervention period was just four weeks, it is still necessary to assess the long-term sustainability of the behavior change and blood pressure reduction. Thirdly, the study used self-reported lifestyle adherence data, which could be skewed by memory. Based on these findings and limitations, several recommendations are proposed for future research and clinical practice. It is recommended that community health centers and nursing practitioners adopt the CEPAT module as a standard educational resource for hypertensive patients. For future research, it is advisable to conduct longitudinal studies with larger, multi-center samples

to assess the long-term efficacy of the CEPAT model. Additionally, developing the CEPAT module into a digital application or mobile health (m-health) platform could significantly enhance accessibility and patient engagement, particularly in the digital era. Further research should also explore the effectiveness of this model across different age groups and comorbidity profiles to broaden its clinical applicability.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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