

Manuscript received December 14, 2022; revised January 7, 2023; accepted January 7, 2023; date of publication February 26, 2023

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v3i1.156>

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How to cite: Jujuk Proboningsih, Sriyono, Mohammad Najib, Fitriah, "Chronic Care Model Based Nursing Interventions Improve Hypertension Patient's Medication Compliance by Preventing Patients Forget and Fear", International Journal of Advanced Health Science and Technology, vol. 3, no. 1, pp. 55–60, February 2023

Chronic Care Model Based Nursing Interventions Improve Hypertension Patient's Medication Compliance by Preventing Patients Forget and Fear

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ABSTRACT Hypertension remains the leading cause of mortality worldwide and poses significant public health challenges, particularly in Indonesia, where a substantial portion of hypertensive patients exhibit poor medication adherence. Non-compliance with antihypertensive therapy is often attributed to factors such as forgetfulness and fear of adverse effects, which hinder effective disease management and increase the risk of complications. Addressing these barriers through targeted interventions is critical to improving patient outcomes. This study aims to evaluate the effectiveness of nursing interventions based on the Chronic Care Model (CCM) in enhancing medication adherence among hypertensive patients. Employing a quasi-experimental design, the research involved 50 hypertensive individuals recruited from primary health centers in Surabaya, Indonesia. Participants were divided into two groups: an intervention group receiving structured CCM-based nursing guidance via educational modules and frequent reminders, and a control group receiving standard care without additional intervention. The intervention spanned a 14-day period, during which adherence was assessed using the Wilcoxon signed-rank test and Mann-Whitney U test to analyze pre- and post-intervention differences. The findings demonstrate that patients in the intervention group exhibited a significant improvement in medication adherence ($p < 0.001$) compared to the control group, which showed minimal change. The results suggest that systematic, model-based nursing strategies such as regular reminders, patient education, and encouragement effectively address barriers like forgetfulness and fear, thereby promoting consistent medication intake. In conclusion, integrating the CCM into nursing practice presents a viable approach to fostering better medication adherence among hypertensive patients. Implementing such interventions can significantly contribute to the control of blood pressure, reducing long-term health risks. Future research should explore the scalability of these strategies across diverse settings and among broader patient populations to optimize chronic disease management.

INDEX TERMS Chronic Care Model, hypertension, medication adherence, nursing intervention, patient compliance

I. INTRODUCTION

Hypertension is a major global health issue and remains one of the leading causes of death worldwide, contributing significantly to the burden of cardiovascular disease [1], [2]. In Indonesia, the prevalence of hypertension continues to rise, posing serious challenges to public health infrastructure and treatment adherence strategies [3], [4]. According to the Indonesian Ministry of Health, the prevalence of hypertension among adults aged 18 years and older is approximately 34.1%, with nearly one-third of diagnosed individuals either not taking medication or failing to adhere consistently to treatment regimens [5]. Common reasons for non-compliance include a perceived sense of well-being, irregular medical visits, preference for traditional medicine, medication side effects, forgetfulness, and economic constraints [6]–[8].

Effective management of hypertension, especially as a chronic condition, requires a comprehensive, patient-centered approach that goes beyond prescribing medication. The Chronic Care Model (CCM), developed by Wagner, offers a structured framework for delivering high-quality care to individuals with

chronic diseases [9], [10]. This model emphasizes six key components: self-management support, delivery system design, decision support, clinical information systems, health care organization, and community resources [11]. CCM has been implemented successfully in various settings, demonstrating improvements in clinical outcomes, patient satisfaction, and health-related quality of life [12]–[14]. Studies conducted in China, the United States, and Australia have shown that integrating CCM into nursing interventions significantly enhances medication adherence and reduces health disparities [15]–[17].

Despite its global recognition, the application of CCM in Indonesia remains limited. There is a scarcity of evidence supporting its integration into local nursing practices, especially within the framework of community-based primary care [18], [19]. Cultural beliefs, socioeconomic status, health literacy, and limited health infrastructure continue to pose barriers to implementing standardized models of chronic care in Indonesian settings [20], [21]. Moreover, the existing literature rarely investigates how CCM can address behavioral barriers

such as forgetfulness and fear two dominant factors affecting hypertensive patients' medication compliance in Indonesia [22], [23].

To address this gap, the present study aims to evaluate the effectiveness of nursing interventions based on the Chronic Care Model in improving medication adherence among hypertensive patients in Surabaya, Indonesia. Specifically, it seeks to examine whether integrating CCM into nursing practice can mitigate patient forgetfulness and fear regarding medication side effects and health outcomes.

This study contributes to the field in three significant ways. First, it provides empirical evidence on the application of CCM in a culturally specific, resource-constrained Indonesian context. Second, it identifies psychosocial factors that influence treatment adherence and demonstrates how nursing interventions can address them through structured care delivery. Third, it informs policy and practice by offering a scalable intervention model for improving chronic disease management at the primary health care level.

This article is structured as follows: Section II describes the research methodology, including study design, sampling, and intervention procedures. Section III presents the findings, highlighting statistical results and thematic insights from qualitative interviews. Section IV discusses the implications of the results, compares them with previous studies, and identifies study limitations. Finally, Section V provides the conclusion and outlines potential directions for future research.

II. METHODS

This research employed a mixed-methods approach, combining quasi-experimental design with phenomenological analysis to comprehensively evaluate the effects of nursing interventions based on the Chronic Care Model (CCM) on medication adherence among hypertensive patients. The study was conducted in Surabaya, Indonesia, at three selected community health centers (Puskesmas) that met specific inclusion criteria. The quantitative component utilized a pre-test and post-test control group design, while the qualitative component aimed to capture participants' experiential perspectives regarding the intervention process.

A. STUDY POPULATION AND SETTING

The target population comprised hypertensive patients aged 40 to 60 years who had been diagnosed with hypertension for a duration of 2 to 5 years. Patients with co-morbidities or acute illnesses were excluded to minimize confounding factors impacting adherence behaviors. The study settings included three Puskesmas with high patient volumes and low medication adherence rates: Puskesmas Pucang Sewu, Puskesmas Pacar Keling, and Puskesmas Tambak Rejo. These centers were chosen to represent typical community-based healthcare facilities in Surabaya, each characterized by limited implementation of evidence-based hypertension management practices and inadequate community engagement.

B. SAMPLE SIZE AND SAMPLING TECHNIQUE

The total sample consisted of 50 hypertensive patients, divided equally into control and treatment groups (n=25 each). The sampling process employed a consecutive sampling method initially to select eligible participants who met the inclusion criteria from the patient registry at each Puskesmas. Subsequently, simple randomization was performed using a

computer-generated randomization sequence to assign participants to either the intervention or control group, mitigating allocation bias. This combination of sampling techniques ensured both the representativeness of the sample and the methodological rigor necessary for comparative analysis.

C. STUDY DESIGN

This prospective, quasi-experimental study adopted a pre-test and post-test control group design to evaluate the effectiveness of the CCM-based nursing intervention. The intervention group received structured nursing guidance integrated with CCM principles, whereas the control group received standard care without additional intervention. The intervention spanned 14 days, during which the treatment group received targeted education, motivational reminders, and regular follow-up support.

D. INTERVENTION MATERIALS AND PROCEDURES

The intervention comprised educational modules developed based on CCM components tailored to local contextual needs. These modules emphasized medication management, lifestyle modifications, and strategies to address common barriers such as forgetfulness and fear of side effects that impair adherence. The intervention package included printed educational materials, mobile reminder messages, and scheduled home visits by trained nurses every 3 to 4 days to reinforce compliance and provide supportive counseling.

Nurses involved in delivering the intervention underwent standardized training to ensure consistency in communication and educational content delivery. Data collection tools included structured questionnaires to assess medication adherence, validated using the Morisky Medication Adherence Scale (MMAS-8), and thematic interview guides for qualitative exploration. The adherence assessments were conducted at baseline and at the end of the 14-day period.

E. DATA COLLECTION AND INSTRUMENTS

Quantitative data were collected through interviews using validated adherence questionnaires, supplemented by blood pressure measurements to correlate clinical outcomes with adherence levels. The qualitative data involved semi-structured interviews with a subset of participants from the intervention group to explore their personal experiences and perceptions regarding the nursing intervention and barriers to adherence.

F. DATA ANALYSIS

Quantitative data were analyzed employing descriptive statistics to characterize the sample, with inferential analyses utilizing the Wilcoxon signed-rank test for within-group comparisons and the Mann-Whitney U test for between-group differences in medication adherence pre- and post-intervention. The significance level was set at $p < 0.05$. These non-parametric tests were appropriate due to the ordinal nature of the adherence data. All statistical analyses were conducted using SPSS version 26 [26], [27].

G. ETHICAL CONSIDERATIONS

Prior to data collection, ethical approval was obtained from the Ethics Committee of Poltekkes Kemenkes Surabaya via the KEPPKN system. Participants provided written informed consent, ensuring voluntary participation and confidentiality in

accordance with ethical standards [28]. Permissions to access the healthcare facilities and patient data were secured from the Surabaya City Health Office and respective Puskesmas.

H. LIMITATIONS

Recognized limitations of this study include the constrained duration of the intervention period and potential biases inherent in the non-randomized component of the sampling process. Additionally, conducting research during the COVID-19 pandemic imposed logistical challenges, necessitating strict adherence to personal protective equipment (PPE) protocols and limiting face-to-face interactions, which may influence the generalizability of findings [29], [30].

I. SUMMARY

This methodological framework ensures a rigorous, reproducible approach to evaluating the impact of CCM-based nursing interventions on medication adherence among hypertensive patients. The integration of quantitative and qualitative data, coupled with randomization and standardized procedures, provides robust evidence to inform community health practices and policy implementation.

III. RESULTS

The three previously specified Puskesmas were used in the study. This condition was found on those Puskesmas 1) Community nurses were active in the community, 2) Have health information systems but not conveyed to patients, 3) No implementation of evidence-based practice, 4) Have little active health cadres, and 5) Actively hold posyandu activities for the elderly, 6) CCM is an outlandish term. Further explanation of the study result is presented below. There were 50 respondents recruited from the three Puskesmas's. They were divided as follows 25 respondents into the control group and 25 respondents into the treatment group. The characteristics of the respondents from both groups were quite alike, there were no significant difference.

A. RESPONDENTS CHARACTERISTICS

Table 1 showed that the two groups had general characteristics that were not much different. Sex in both groups was mostly women 60% in the control group and 72% in the treatment group. Almost half of the education was high school or equivalent 44% in the control group and 48% in the treatment group. The occupation of the control group was mostly 60% private, in the treatment group almost half 48% were housewives and 40% private. The proportion in the control group was for a minimum age of 41 years and a maximum of 60 years, while in the treatment group a minimum age of 43 years and a maximum of 60 years. The minimum height of the control group was 140 cm, and the maximum was 180 cm, while the minimum height of the treatment group was 142 cm and the maximum was 168 cm. Comparison of body weight for the control group was minimum 47 kg and maximum 90 kg, in the treatment group was minimum 49 kg and maximum 81 kg.

1. COMPARISON TEST BEFORE AND AFTER TREATMENT

This study conducted a nursing intervention based on the Chronic Care Model on medication compliance in hypertensive patients in Surabaya. Observed before and after intervention. The variables measured were adherence, the patient's taking medication before and after treatment. Treatment adherence

tested using Wilcoxon signed rank test because the data was ordinal scale. The full test results were presented in the Table 2. The results found that the control group had no significant difference in drug adherence between before and after the intervention with p value 0.177 ($\alpha \leq 0.05$). Moreover, there was a decrease of medication adherence of control group post treatment. The opposite happened in the treatment group, it was found that there was a significant difference in drug adherence between the pre and post treatment with a p value of 0.000 ($\alpha \leq 0.05$). Furthermore, there was an increase in the mean rank after the intervention. It was concluded that there were improve adherence in the treatment group but not in the control group. The result verified the benefit of CCM in the patient's adherence to take medication.

2. CONTROL AND TREATMENT GROUP COMPARISON TEST

The second test was to see the differences between the control and treatment groups both before and after the intervention. The test used was the Mann Whitney U Test for compliance and ability data. Meanwhile, to see the difference in cholesterol between the treatment and control groups both before and after the intervention, using the two-sample free T test difference. In the activity variable, because the data was nominal, the test used chi square test. The full results were explained in the Table 3. The results of the Mann Whitney test both on the pre-test and post drug adherence showed that there were significant differences between the treatment and control groups with $p < 0.05$. The treatment group had a higher post value than the control group. This showed that patient adhere medication better if got nursing interventions based on the Chronic Care Model compared to those who did not get the intervention.

3. RESEARCH SUBJECT EXPERIENCE

The different finding between the treatment and the control group was addressed deeper by conducting interview. The interview only conducted to the few respondents that represent the average respondents. They mention that the reason they were disobedient to the medication plan was either they were forgetting the medication, forget the medical check up schedule, or they are afraid. The respondents mentioned they were afraid if they found the medical check-up was bad, they will feel down and deteriorate. Other form of afraid was mentioned that they afraid by the side effect of the drug. They added that they have already took too many drugs since they were diagnosed Hypertension[11][7]. Other respondents reported that they feel that working is more important than following the treatment regiments.

IV. DISCUSSION

A. INTERPRETATION OF FINDINGS

The findings of this study underscore the significant impact of nursing interventions based on the Chronic Care Model (CCM) on medication adherence among hypertensive patients. Statistical analysis demonstrated a clear improvement in adherence within the intervention group compared to the control group. Specifically, the Wilcoxon signed-rank test indicated a statistically significant enhancement in adherence post-intervention ($p = 0.000$), while the control group exhibited no notable changes ($p = 0.177$).

This result supports the hypothesis that structured care using CCM components such as patient education, routine follow-ups,

and reminder systems can effectively address barriers to adherence. Qualitative data from patient interviews revealed that forgetfulness and fear (especially fear of side effects) were primary deterrents to consistent medication use. These behavioral and psychological barriers align with known challenges in chronic disease self-management, particularly among low- to middle-income populations.

The intervention's emphasis on health literacy, empowerment, and regular monitoring contributed to improved patient understanding of the benefits of adherence, minimizing the influence of fear and forgetfulness. These insights confirm CCM's potential in modifying both knowledge-based and behavior-driven adherence determinants.

B. COMPARISON WITH EXISTING LITERATURE

The current study's outcomes are consistent with findings from prior research that affirmed the effectiveness of the Chronic Care Model in improving chronic disease management, particularly for hypertension. For instance, Zhang et al. demonstrated in a cluster-randomized trial in China that CCM-based integrated care led to improved blood pressure control and reduced treatment costs among hypertensive patients.

Similarly, a study by Aryani et al. in Malaysia found that implementing CCM in primary care settings significantly enhanced patients' health-related quality of life compared to those receiving routine care. These results echo the current study's findings, reinforcing that consistent care supported by interdisciplinary teams, clinical decision support, and information systems results in better clinical outcomes.

Sendall et al. reported similar findings in Australia, where CCM was associated with increased patient participation and improved coordination between healthcare institutions. Moreover, CCM has shown positive effects across diverse patient populations, including older adults with multiple chronic conditions and minority communities with limited access to care.

Despite cultural and systemic differences, the core elements of CCM patient self-management support, evidence-based decision-making, and proactive care remain universally applicable. Nundy et al. suggested that using mobile health interventions as part of CCM can enhance communication between patients and providers, an approach that may further improve adherence in low-resource settings.

Furthermore, research by Weber et al. emphasized that continuous monitoring and scheduled follow-ups are critical in maintaining long-term medication compliance, particularly among patients with complex treatment regimens. These findings align with the present study, where regular contact between nurses and patients facilitated trust, accountability, and consistent medication use.

However, while several international studies validate the success of CCM, few have explored its adaptation to the Indonesian context. The cultural relevance, resource limitations, and health behavior of Indonesian patients necessitate localized implementation strategies, such as integrating health cadres and involving family support systems approaches utilized in this study.

C. STUDY LIMITATIONS AND IMPLICATIONS

Despite the promising findings, several limitations must be acknowledged. First, the use of a consecutive sampling technique may introduce selection bias. Although simple

randomization was used to assign participants to control and intervention groups, the initial selection may have been influenced by researcher discretion or accessibility.

Second, the study's duration was relatively short (14 days), which may not capture the long-term sustainability of improved adherence. Chronic conditions like hypertension require lifelong treatment, and adherence tends to fluctuate over time. Longer follow-up periods would allow for a more comprehensive evaluation of the intervention's durability.

Third, the study was conducted during the COVID-19 pandemic, which imposed several operational constraints, including limited patient access, stringent health protocols, and reduced funding availability. These challenges restricted in-person interactions, thereby limiting the depth of patient engagement, particularly in the qualitative component of the study.

Moreover, adherence was measured through self-report and module completion, which may be subject to reporting bias. Although these methods are common in behavioral intervention studies, future research should consider incorporating digital pill monitoring or electronic health record tracking for more objective assessments. Nonetheless, the study offers several important implications for clinical practice and public health:

1. SCALABILITY OF CCM IN LOW-RESOURCE SETTINGS

The integration of CCM elements such as nurse-led education, structured modules, and community health cadres proves feasible and effective, even in under-resourced urban communities in Indonesia. These findings can inform broader implementation strategies across Puskesmas (community health centers).

2. BEHAVIORAL INSIGHTS FOR INTERVENTION DESIGN

The identification of fear and forgetfulness as key adherence barriers highlights the importance of addressing psychological and behavioral determinants in chronic disease care. Simple interventions like regular reminders and reassurance about side effects can yield significant adherence improvements.

3. POTENTIAL FOR MULTI-DISEASE APPLICATION

While this study focused on hypertension, CCM's framework is applicable to other chronic diseases such as diabetes mellitus and chronic obstructive pulmonary disease. Implementing a shared model across disease types could optimize resource utilization and streamline care delivery.

4. POLICY RECOMMENDATIONS

The Ministry of Health and local government bodies may consider mandating structured chronic care protocols within primary care services, encouraging collaboration between nurses, midwives, and community volunteers to support ongoing treatment.

5. TECHNOLOGY INTEGRATION

Given the rise in mobile phone usage across Indonesia, mHealth applications that offer daily reminders, schedule tracking, and health education could enhance CCM-based interventions further. As shown by Nundy et al., digital integration can mitigate personnel shortages while maintaining high-quality care delivery.

V. CONCLUSION

This study aimed to evaluate the effectiveness of nursing

interventions based on the Chronic Care Model (CCM) in improving medication adherence among hypertensive patients in Surabaya, Indonesia. The findings clearly demonstrate that CCM-oriented nursing interventions significantly enhance adherence compared to standard care. A total of 50 participants were recruited and evenly divided into control and intervention groups. The intervention group, which received structured education, regular follow-ups, and behavioral support rooted in the CCM framework, showed a statistically significant improvement in medication adherence. The Wilcoxon signed-rank test indicated a substantial increase in adherence within the intervention group, with a p-value of 0.000 ($p < 0.05$), whereas the control group exhibited no significant change ($p = 0.177$). Additionally, the Mann-Whitney U test revealed that post-intervention adherence scores in the treatment group were significantly higher than those in the control group. These results suggest that consistent and structured nursing interventions, supported by reminder systems and patient education, can effectively address key barriers such as forgetfulness and fear of side effects. Furthermore, qualitative interviews affirmed that patients valued ongoing guidance, which contributed to a better understanding of the benefits and reduced anxiety about long-term medication. While the study was conducted over a relatively short duration and during the constraints of the COVID-19 pandemic, it provides robust evidence that CCM-based nursing approaches are both practical and impactful in resource-limited, community health settings. Future research should explore the long-term sustainability of such interventions, integrate digital tools like mobile health applications to support adherence monitoring, and examine the model's applicability to other chronic diseases such as diabetes and cardiovascular conditions. Additionally, larger-scale studies with more diverse populations and extended observation periods are necessary to validate the generalizability of these findings and inform public health policies aimed at strengthening chronic disease management in primary care.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Surabaya City Health Office and the staff of Puskesmas Pucang Sewu, Pacar Keling, and Tambak Rejo for their support and collaboration throughout the research process. Special thanks are also extended to all study participants for their valuable time and contributions. This research would not have been possible without their trust and cooperation.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

DATA AVAILABILITY

The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request. Due to privacy and ethical considerations, individual participant data have been anonymized to protect confidentiality. Access to data may be granted for academic and non-commercial purposes following institutional approval and compliance with applicable data protection regulations.

AUTHOR CONTRIBUTION

Jujuk Proboningsih contributed to the conceptualization, study design, data collection, and manuscript drafting. Sriyono was

responsible for methodology development, statistical analysis, and supervision throughout the research process. Mohammad Najib assisted with literature review, data interpretation, and editing the manuscript. Fitriah contributed to field coordination, participant recruitment, and ethical compliance. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

DECLARATION

ETHICAL APPROVAL

Ethical approval for this study was secured from the Poltekkes Kemenkes Surabaya Ethics Committee through the KEPPKN platform before initiating any data collection.

CONSENT FOR PUBLICATION PARTICIPANTS.

All participants were fully informed about the objectives and procedures of the study and provided written consent for the use of anonymized data in publications. They were assured that their identities would remain confidential and that the information collected would be used solely for academic and scientific purposes.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest, whether financial, professional, or personal, that could be perceived to have influenced the research, analysis, or conclusions presented in this study.

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