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Effectiveness of Nursing Counseling with Short Message Service Intervention (NC-SMSI) on Self-Care Behavior among Hypertension Patients: A Cross-Sectional Study

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Abstract

Background: Hypertension represents a significant global health challenge, characterized by increasing prevalence and inadequate self-care, including in Banjarmasin, Indonesia. Factors such as poor medication adherence, irregular physical activity, and insufficient blood pressure monitoring contribute to uncontrolled hypertension. This study assessed the impact of the Ners Counseling–Short Message Service Intervention (NC-SMSI) on self-care behaviors among hypertensive patients in Banjarmasin.

Methods: A quasi-experimental one-group pretest–posttest design was utilized, involving 30 hypertensive patients recruited through purposive sampling. The intervention integrated direct nursing counseling with structured short message service reminders based on the Self-Care Deficit Nursing Theory. Self-care was evaluated using the DSCAI-90 instrument.

Result: Prior to the intervention, 53.3% of respondents exhibited very poor self-care, whereas only 3.3% attained high self-care levels. Following the NC-SMSI intervention, 63.3% of participants achieved high self-care levels, with none remaining in the very poor category. The Wilcoxon signed-rank test indicated a significant improvement in self-care scores ($Z = -4.783$, $p < 0.001$, $r = 0.84$).

Conclusion: The NC-SMSI intervention was associated with significant improvements in self-care behaviors among hypertension patients.

Keywords: Hypertension, Nursing Theory, Nurses Counseling, Self-Care, Short Message Service.

BACKGROUND

Hypertension constitutes a major global health challenge, significantly contributing to cardiovascular disease and premature mortality (1). It affects over one billion adults worldwide, with higher prevalence in low- and middle-income countries (2). A substantial proportion of affected individuals remain undiagnosed, untreated, or inadequately controlled .

Indonesia experiences a rising and uneven burden of hypertension, with regions such as Kalimantan exhibiting some of the highest prevalence rates. This situation necessitates context-appropriate and scalable primary care interventions (3).

Poor self-care behaviors including medication non-adherence, inadequate dietary modification, insufficient physical activity, and infrequent blood pressure self-monitoring—are consistently linked to suboptimal blood pressure control (4). The determinants of self-care are multifactorial, encompassing health literacy, access to services, socioeconomic status, and psychosocial factors (5). These findings indicate that interventions should both educate patients and provide regular cues or support to sustain behavior change (6).

Mobile health (mHealth) interventions, particularly structured short message service (SMS) programs, have emerged as pragmatic methods to deliver ongoing education, reminders, and motivation to patients with chronic diseases (7). Systematic reviews and randomized trials from 2020 to 2023 indicate that text-message interventions, often combined with brief counselling or home monitoring, can enhance medication adherence and modestly improve blood pressure control and self-management behaviors (8). However, effect sizes vary depending on intervention design (e.g., one-way versus two-way messaging, personalization, frequency), population, and setting; consequently, evidence from primary care settings in Indonesia remains limited (9).

From a nursing theory perspective, Orem's Self-Care Deficit Nursing Theory (SCDNT) offers a clear conceptual framework for integrating nurse-led counselling with SMS reinforcement. SCDNT positions nurses in a supportive-educative role to identify self-care deficits, develop patient capabilities (self-care agency), and provide tailored support enabling patients to meet therapeutic self-care demands. Digital reminders serve as environmental "cues to action" that sustain newly acquired behaviors between face-to-face contacts. Recent reviews emphasize the ongoing relevance of Orem's theory in designing nursing interventions targeting self-care in chronic illness (10).

Despite international evidence, studies evaluating nurse counselling combined with SMS in Indonesian primary care (NC-SMSI) remain scarce. Factors influencing program success are frequently underreported. Local implementation research is necessary to assess feasibility, acceptability, and self-care outcomes.

The identified research findings reveal several methodological gaps: few studies employ robust experimental designs, particularly randomized controlled trials, to evaluate technology-based interventions, such as short message service (SMS), for hypertension patients in Indonesia. Most prior research has utilized observational or quasi-experimental designs. Furthermore, while previous studies have emphasized clinical outcomes like blood pressure, changes in self-care behavior as a primary outcome remain underexplored. Interventions rarely incorporate behavior change theories or highlight the active role of nurses in counseling combined with SMS communication. To address these gaps, this study employs a quasi-experimental pre-post design to evaluate the effectiveness of the NC-SMSI intervention, which integrates nurse counselling and SMS, focusing on changes in self-care behaviors among hypertensive patients in Banjarmasin, Indonesia. Eligible participants were recruited from primary care clinics, and self-care behavior was assessed using validated instruments before and after the intervention. Outcomes were compared within the study cohort.

This study evaluates the impact of NC-SMSI, a nurse-led counselling and SMS intervention grounded in Orem's SCDNT, on self-care behaviors among hypertensive patients in Banjarmasin,

Indonesia. The findings may inform future primary care practices; however, scalability, long-term outcomes, and broader applicability warrant further investigation.

METHODS

Study Design

This study employed a one-group pretest–posttest quasi-experimental design to evaluate the effect of the Ners Counseling–Short Message Service Intervention (NC-SMSI) on self-care among hypertensive patients.

This design was selected due to field constraints that precluded inclusion of a control group and because the intervention could directly benefit participants. Furthermore, limited resources and participant accessibility necessitated its use as a pilot to explore pre- and post-intervention changes. Several strategies were implemented to minimize potential methodological bias. To reduce historical effects, the intervention period was brief and conducted under controlled environmental conditions, limiting the influence of external events. To control for temporal effects, the study was conducted within a limited timeframe to prevent confounding from natural changes unrelated to the intervention. Additionally, to minimize testing effects, instruments were consistently designed and administered using identical procedures for both pretest and posttest. Nonparametric statistical analysis was employed, considering the data characteristics, to enhance the accuracy of result interpretation. This design facilitated measurement of changes in self-care behaviors before and after the intervention within the same participant group. The study took place in a primary healthcare setting in Banjarmasin, South Kalimantan, Indonesia, from June to August 2024.

Intervention

Several mechanisms were implemented to control potential confounding factors. First, respondent homogeneity was maintained through strict inclusion and exclusion criteria, including hypertension diagnosis, stable condition, and ability to fully participate, minimizing irrelevant variation. Second, intervention procedures were standardized with respect to materials, duration, and NC-SMSI delivery method to ensure uniform treatment across participants. Third, to minimize the influence of external environmental factors, the intervention and pretest-posttest measurements were conducted within a short timeframe under uniform conditions, thereby limiting their impact. Fourth, consistent and validated measurement instruments were employed for both the pretest and posttest, with identical administration procedures to minimize measurement bias and ensure accurate interpretation. However, perfect control for all confounding factors is not achievable, so results should be interpreted with caution, and further research with a stronger design is needed.

The NC-SMSI intervention consisted of two main components. First, face-to-face counseling sessions were conducted individually by a registered nurse in a single session lasting approximately 30–45 minutes. These sessions utilized a standardized counseling guide developed based on the Self-Care Deficit Nursing Theory (SCDNT), covering topics such as lifestyle modification, medication adherence, diet, physical activity, and blood pressure monitoring. To maintain consistency, nurses employed the same educational format for all participants.

In this study, SMS messages were sent in a one-way format, with participants receiving reminder messages without a reply mechanism or direct interaction via the SMS system. This approach was chosen to maintain the simplicity of the intervention and maintain consistency in message delivery. Regarding personalization, the SMS content was semi-standardized according to the principles of the Self-Care Deficit Nursing Theory (SCDNT). While the main message content was uniform across participants, some minor elements were adjusted, such as the use of common, personal greetings (e.g., names), to increase participant engagement without altering the message's substance.

Adherence to intervention delivery was ensured by monitoring the SMS distribution process through a message-delivery system log recording the delivery status of each message (delivered/failed). Additionally, regular monitoring was conducted to prevent technical glitches during the intervention period. However, the study did not directly assess whether participants read or responded to the messages; thus, actual exposure to the messages remains a recognized limitation.

Sample/Participants

Thirty hypertensive patients were recruited via convenience sampling, a nonprobability technique selected for its feasibility. However, this approach may introduce selection bias, as participants were included based on accessibility rather than random selection, thereby limiting the representativeness of the findings. Inclusion criteria comprised adults (≥18 years), a hypertension diagnosis, mobile phone proficiency for text messaging, and consent to participate. Exclusion criteria included cognitive impairment, severe hypertension complications (such as stroke or heart failure), or participation in other formal self-care programs.

Instruments

The Self-Care Deficit Nursing Theory (SCDNT), developed by Dorothea Orem, is a grand nursing theory rather than a measurement instrument; therefore, it does not undergo psychometric validation or cultural adaptation. In the Indonesian context, SCDNT has been widely applied as a theoretical framework in clinical practice and research. However, no evidence indicates that SCDNT itself has been culturally adapted and validated as an instrument in the Indonesian population. Instead, studies typically employ derived self-care instruments that are culturally adapted and psychometrically tested using standard procedures such as translation, expert validation, and reliability testing. Previous reviews have demonstrated that various self-care instruments used in Indonesia have undergone validation processes, although they are not direct representations of SCDNT (11).

The questionnaire instrument used was the DSCAI-90. Validity test results indicated that all items had corrected item-total correlations greater than 0.30, confirming validity. Construct validity tests using factor analysis yielded factor loadings ranging from 0.45 to 0.82. A Cronbach's alpha value of 0.93 demonstrated very high reliability. Scores were categorized into four levels: very poor, poor, moderate, and high self-care. Data collection was conducted by trained research assistants at baseline (pretest) and four weeks post-intervention (posttest).

Data Analysis

Nonparametric statistical analysis was employed, considering the data characteristics, to enhance the accuracy of result interpretation. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26, employing the Wilcoxon test.

Ethical Consederation

This study was approved by the Health Research Ethics Committee of Sari Mulia University under Decree No. 465/KEP-UNISM/VII/2024. Informed consent was obtained from all participants prior to enrollment. Participant confidentiality and anonymity were strictly maintained throughout the study.

RESULT AND DISCUSSION

Demographic Characteristics

Table 1. Demographic Characteristics of Respondents (n=30)

Characteristics	Category	n	%
Age	40–59 years	17	56.7
	≥60 years	13	43.3
Sex	Male	12	40.0
	Female	18	60.0
Education	Primary school or lower	6	20.0
	Junior high school	10	33.3
	Senior high school	14	46.7
Occupation	Housewife	12	40.0
	Informal worker	11	36.7
	Unemployed/Retired	7	23.3

Note: n (total); % (precentage)

Distribution of Self-Care Behavior Pre–Post Intervention (NC-SMSI). The majority of respondents were aged 40–59 years (56.7%), with an average age of 56.2 years. Most were female (60.0%), had completed high school (46.7%), and worked as housewives (40.0%).

Table 2. Distribution of Self-Care Behavior Pre–Post Intervention (NC-SMSI)

Category	Pretest n (%)	Posttest n (%)
Very poor	16 (53.3)	0 (0.0)
Poor	9 (30.0)	5 (16.7)
Moderate	4 (13.3)	6 (20.0)
High	1 (3.3)	19 (63.3)
Total	30 (100)	30 (100)

Note: Pretest;postest

Based on Table 2, before the intervention (pretest), the majority of respondents were in the very poor category (16 people) (53.3%), followed by 9 (30.0%) in the poor category, 4 (13.3%) in the moderate category, and only 1 (3.3%) in the high category. Following the NC-SMSI intervention (posttest), a significant change in distribution was observed. Specifically, the number of respondents in the high category increased to 19 (63.3%), the moderate category rose to 6 (20.0%), and the poor category decreased to 5 (16.7%). Notably, there were no longer any respondents in the very poor category (0.0%).

To further illustrate this improvement, the data categories were converted to ordinal scores in order to calculate medians and interquartile ranges (IQRs). The ordinal data analysis showed that the pretest score had a median of 1 (Very Poor) and an IQR of 1–2. Following the intervention, posttest scores increased to a median of 4 (High) with an IQR of 3–4. Together, these results indicate a significant increase in the respondent's score in the post-intervention period.

Table 3. Wilcoxon Signed-Rank Test of Self-care Score (n=30)

Variable	N	Negative Ranks n (%)	Positive Ranks n (%)	Ties n (%)	Mean Rank	Z	p-value
Pretest – Posttest	30	0(0,00)	29 (96.7)	1 (3.3)	7.5	-4.783	0.001*

Note: Wilcoxon Signed-Rank Test Significant at α = 0.05

The Wilcoxon Signed-Rank Test results indicated that the majority of respondents (29, 96.7%) showed an increase in self-care scores following the intervention, with no respondents exhibiting a decrease (negative rating = 0, 0.0%). One respondent (3.3%) showed no change in score (tie). The mean rank was 7.5, with a Z value of -4.783 and a p-value of < 0.001, indicating a significant difference between pretest and posttest scores.

DISCUSSION

Distribution of Self-Care Behavior Pre–Post Intervention

The present study demonstrated that the Ners Counseling–Short Message Service Intervention (NC-SMSI) was associated with significant improvement in self-care behaviors among patients with hypertension. As shown in Table 1, the distribution of self-care categories shifted markedly after the intervention. Prior to NC-SMSI, 53.3% had very poor self-care, and only 3.3% had high self-care. After four weeks, none were in the very poor category, while 63.3% achieved high self-care. These improvements were statistically confirmed by the Wilcoxon Signed-Rank Test, which yielded a p-value of 0.001, indicating a significant difference in self-care scores before and after the intervention.

These findings align with international evidence on the effectiveness of mobile health interventions. In a systematic review, SMS-based interventions significantly reduced systolic blood pressure and halved the odds of uncontrolled hypertension within the first 6 months of implementation, largely through mechanisms that promote adherence and reinforce self-care behaviors. Although the primary outcome in that review was blood pressure rather than self-care scores, the underlying pathway, which improved adherence to medication, diet, physical activity, and blood pressure monitoring, is directly relevant to the current study (12).

Other meta-analyses report similar benefits. Structured digital messages help reduce blood pressure (a statistical measure of the force of blood against artery walls), improve quality of life (often quantified using standardized patient surveys), and support beneficial changes in anthropometric indicators (such as body mass index and waist circumference) (13). These results reinforce the foundation of NC-SMSI, where structured SMS reminders complement the nurse's counseling, helping patients consistently adopt self-care practices.

The theoretical underpinning of these results can be explained through Orem's Self-Care Deficit Nursing Theory (SCDNT), which emphasizes the nurse's role in the supportive–educative system. According to this model, nurses help patients recognize self-care deficits and develop the capacity to meet therapeutic self-care demands. The SMS component of NC-SMSI functioned as a ' cue to action,' reinforcing counseling messages and helping patients internalize and sustain healthier behaviors. Tam reaffirmed the relevance of SCDNT in modern nursing practice, particularly in interventions aimed at enhancing patients' self-care agency, and highlighted that the positive effects of SMS-based interventions may diminish over time unless supported by longer-term strategies. Our findings, therefore, not only confirm the utility of SCDNT but also extend its application into mobile-based nursing interventions (12).

Evidence from Indonesia supports these findings. Maharani found that SMS reminders and home monitoring reduced systolic blood pressure in hypertensive patients in Banyumas, even in primary healthcare settings with limited resources (14). This shows NC-SMSI could be scaled to other primary care centers in Indonesia. International trials further corroborate these results. Borgström Bolmsjö conducted a trial in Sweden that tested one-way text messages as an adjunct to standard hypertension management and found that, while no significant effects were observed in the general population, improvements were significant among subgroups with poor self-rated health and sedentary lifestyles (15). This suggests that SMS interventions may be particularly effective for vulnerable populations, a

finding consistent with NC-SMSI, which combines personalized nurse counseling with digital reminders to support patients who may otherwise struggle with self-care.

Overall, these findings indicate that the NC-SMSI is a nursing intervention associated with improved self-care behaviors in patients with hypertension. The integration of personalized nurse counseling with structured digital reminders provides both the human element of supportive education and the technological reinforcement needed to sustain behavior change. In Indonesia's primary healthcare system, where resources are limited and hypertension prevalence is high, NC-SMSI is a feasible and scalable strategy to strengthen chronic disease management. Future research should focus on randomized controlled trials with longer follow-up periods to evaluate sustainability, assess cost-effectiveness, and identify the optimal frequency and content of SMS messages to maximize impact. The NC-SMSI intervention has the potential to be developed more widely (scalable), but its scalability has not been empirically evaluated in this study. The NC-SMSI intervention has the potential to be developed more widely (i.e., be scalable), but its scalability has not been empirically evaluated in this study and warrants further investigation.

Wilcoxon Signed-Rank Test of Self-Care Scores

The Wilcoxon Signed-Rank Test ($Z = -4.783$, $p < 0.001$; $r = 0.84$), presented in Table 3, indicates that NC-SMSI significantly improves self-care behaviors among patients with hypertension. These results, along with the descriptive improvements in Table 1, demonstrate both statistical and practical significance, confirming that the observed changes are meaningful and unlikely to be due to chance. This evidence supports NC-SMSI as an effective model for integrating digital support into nursing practice.

The Wilcoxon test was selected because the Shapiro–Wilk test indicated non-normality, which precludes parametric tests such as the paired t-test. In such cases, the Wilcoxon test is widely recognized as a reliable nonparametric alternative for detecting median differences in paired data when normality assumptions are violated. This methodological rigor enhances the credibility of the findings, particularly given the relatively small sample size.

The observed statistical significance aligns with findings from other trials of SMS-based interventions in chronic disease management. For example, Bhandari and Tam conducted a meta-analysis reporting significant improvements in hypertension management outcomes, particularly in medication adherence and self-monitoring behaviors (12). Similarly, Bressman found that structured text-message support enhanced self-care compliance and blood pressure control among patients with chronic conditions. The consistency between their pooled results and the present study underscores the external validity of NC-SMSI as a nursing intervention (16).

In the Indonesian context, the effectiveness of SMS interventions has also been demonstrated. Maharani found that patients receiving SMS reminders combined with home self-monitoring exhibited significant reductions in systolic blood pressure compared to baseline, further confirming the utility of text messaging in resource-limited settings (14). Similar results were reported by Belete. who observed improvements in adherence and self-care behaviors among hypertensive patients receiving SMS reminders in primary care clinics (17). The present study extends these findings by focusing on behavioral outcomes, specifically self-care, which serves as a precursor to long-term blood pressure control.

The magnitude of change, as indicated by the Z-value, highlights the strength of NC-SMSI. A negative Z-value with a highly significant p-value suggests that most patients improved their self-care scores following the intervention. This consistency across participants is critical for assessing the intervention's generalizability. However, studies in other contexts have shown that SMS-based interventions may not be uniformly effective, often depending on message personalization, frequency,

and patient demographics. For instance, Borgström Bolmsjö found that one-way text messages produced significant benefits only among subgroups with poor self-rated health and sedentary lifestyles (15). Similarly, Boima reported differential effects of SMS-based behavioral support by age and baseline health status. The consistent improvements observed in this study across a relatively heterogeneous patient group underscore the potential of NC-SMSI as a broadly applicable model (18).

Combining nurse counseling with SMS reinforcement likely accounts for these strong results. While SMS alone can provide reminders, it may lack the personal engagement necessary for sustained change. NC-SMSI's integration of face-to-face counseling and SMS support ensured that patients received both knowledge and ongoing encouragement. Self-Care Deficit Nursing Theory (SCDNT) positions nurses as facilitators of patient agency through supportive and educational strategies. In this framework, counseling provided the educational component, while SMS reminders served as supportive cues that reinforced patients' ability to meet their therapeutic self-care demands (19).

Furthermore, the statistical confirmation provided by the Wilcoxon test strengthens the evidence base for integrating digital health into nursing practice. Ambrosi e argued that digital interventions are most effective when combined with interpersonal components, as they bridge the gap between patient education and real-life application (20). This assertion is supported by Kes , who found that blended nurse-led counseling with SMS follow-up significantly improved adherence and perceived self-efficacy in Indonesian hypertensive patients. The present findings empirically validate these claims within the Indonesian primary healthcare context (21,22), emphasizing the importance of hybrid models that combine digital reminders with human support to promote sustained behavior change (23).

Despite the strong significance, the Wilcoxon results have limitations. The small sample size (n = 30) limits statistical power and increases the risk of overlooking smaller effects. Nevertheless, the large observed effect suggests the intervention had a meaningful impact. Future research should employ larger, more diverse samples to confirm these results and validate effects across different subgroups (24,25).

Another limitation is the intervention's short duration. Although four weeks demonstrate short-term effectiveness, long-term effects remain unknown. Previous reviews suggest that SMS intervention effects may diminish without ongoing reinforcement (26). Future studies should incorporate longer follow-up periods to evaluate whether NC-SMSI's impact on self-care persists in primary care.In conclusion, the results presented in Table 3 indicate that NC-SMSI led to a statistically significant improvement in self-care among hypertensive patients. The Wilcoxon Signed-Rank Test confirmed these improvements, demonstrating the intervention's methodological rigor. Supported by evidence from local and international studies, these findings suggest that combining personalized nurse counseling with digital reinforcement constitutes a promising, cost-effective, and scalable approach for managing hypertension.

The study's findings have important implications for nursing practice and health policy. The NC-SMSI model integrates personalized nurse counseling with structured SMS reminders and has demonstrated feasibility, cost-effectiveness, and scalability for improving self-care among hypertensive patients in primary care. This supports global digital health integration and aligns with Indonesia's community-based programs. Additionally, the intervention exemplifies the practical application of Orem's Self-Care Deficit Nursing Theory using mobile technology. Furthermore, the adaptable NC-SMSI framework provides a model for managing chronic conditions that require long-term behavior change, such as diabetes or asthma.

Despite these promising findings, several limitations warrant acknowledgment. The one-group pretest–posttest design without a control group restricts causal inference and raises the possibility of confounding factors, such as the Hawthorne effect. The use of accidental sampling, although practical, may introduce selection bias and limit sample representativeness. The relatively small sample size (n =

30) reduces statistical power and further limits generalizability. Additionally, the short intervention period of 4 weeks is insufficient to assess the sustainability of behavioral improvements, as most self-care interventions require at least 3 to 6 months of follow-up to evaluate long-term impact. Finally, reliance on self-report instruments, despite their standardization and reliability, may introduce recall and social desirability biases. These biases could lead participants to overreport positive behaviors, potentially inflating the intervention's observed effectiveness. Future research should address these limitations by employing randomized controlled trial designs, recruiting larger and more diverse samples across multiple sites, extending follow-up periods, and incorporating objective outcome measures. Such methodological refinements will strengthen the evidence base, provide more robust causal conclusions, and support broader integration of NC-SMSI into primary healthcare systems.

CONCLUSION

The results of this study concluded that the majority of respondents were in the 40–59 age group, predominantly female, with a high school education, and housewives. Before the intervention, respondents' self-care behavior was predominantly in the very low category. However, after the NC-SMSI intervention, there was a clear shift in distribution to the higher category, with the majority of respondents in the high category. Statistical analysis showed an increase in self-care scores, as indicated by a median change from 1 (IQR: 1–2) in the pretest to 4 (IQR: 3–4) in the posttest. The Wilcoxon Signed-Rank Test also showed that almost all respondents (96.7%) experienced an increase in their scores, with no decreases, and the difference was statistically significant ($Z = -4.783$; $p < 0.001$). Therefore, the NC-SMSI intervention was associated with increased self-care behavior among respondents. However, given the study's single-group design without a control group, interpretation of the results should be done with caution, and further research with a more robust design is needed to confirm these findings.

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AUTHOR'S CONTRIBUTION STATEMENT

RT: Conceptualization, Methodology, Supervision, Writing – Original Draft. S: Data Collection, Formal Analysis, Writing – Review & Editing. Other contributors: Investigation, Validation, and Project Administration

CONFLICTS OF INTEREST

The authors declare no conflict of interest

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

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