



COMPARISON OF THE EFFECTIVENESS OF PILL BOXES AND MEDICATION CHARTS IN IMPROVING MEDICATION ADHERENCE AMONG ELDERLY PATIENTS IN SOCIAL SERVICE CENTERS

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ABSTRACT

Medication errors (ME) are medication-related problems that are the most common safety incidents in the elderly, one of them is about medication adherence. One intervention that can be provided to improve adherence is by using a medication reminder chart, or pill box, starting with education on the importance of medication adherence and training on how to use the pill box/medication chart by involving social care providers who can later play a role in assisting the elderly if there are obstacles in the future. The purpose of this study was to compare the effectiveness of pill boxes and medication charts in improving medication adherence in elderly patients at social service centers in Yogyakarta. This research will be conducted with a quasi-experimental study design; with a two-group pretest-posttest research design. This research was conducted from July to September 2025 at two Social Service Centers in Yogyakarta. Sampling using a purposive sampling technique involving 30 clients in each group, data collection prospectively on elderly subjects, undergoing chronic disease treatment. The level of adherence is measured by interviews using the Morisky Medication Adherence Scale (MMAS-8) questionnaire. Validity and reliability test of the Indonesian version of the MMAS-8 Questionnaire, which has been tested for validity and reliability by previous researchers, with a convergent validity value of $r = 0.883$, and the Cronbach's alpha coefficient reliability result was 0.824. The characteristics of the clients in this study were mostly female, pre-elderly, had basic education, no comorbidities, duration of drug use < 5 years, received drugs from polyclinics, and the type of therapy was > 1 type of drug. There was a significant effect between the pill box and medication chart groups in increasing client adherence with a P value of 0.033. There was no significant effect in changes in the level of adherence between the two groups (P-value 0.232), and there was a positive change in the increase in the average value of client adherence scores. A significant difference was observed between the pill box and medication chart groups in improving medication adherence.

Keywords: adherence; improvement; medication; MMAS-8

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INTRODUCTION

Medication errors (MEs) are treatment-related problems and are the most common safety incidents in the elderly. As many as 75% to 96% of elderly patients report making frequent medication errors. This occurs primarily due to the interconnectedness of three main causes: advanced age, multiple pathology, and polypharmacy (Mira, 2019). The elderly are the population aged 65 years and over (OECD, 2025). As we age, changes in the structure and function of cells, tissues, and organ systems occur, such as hearing loss, memory loss, and other health disorders that affect susceptibility to disease (Mulyono, 2022).

According to the World Health Organization (WHO), the elderly population in Indonesia is estimated to reach 38 million by 2030 and increase to 61 million by 2050. The province with the highest percentage of elderly people in Indonesia is the Special Region of Yogyakarta. Based on BPS data from the 2020 Susenas (National Survey), the percentage of elderly in Yogyakarta Province was 15.75% (BPS, 2021). Medication adherence is a critical component in the treatment of chronic diseases in the elderly (Yap et al., 2016). Furthermore, adverse drug reactions are

considered the most common and unavoidable adverse drug reactions (ADRs). Professional errors in prescribing, preparing, administering, and administering medications have been analyzed as direct causes of avoidable ADRs (Mira, 2019). Other factors include taking the wrong medication, forgetting the time of taking medication, or incorrect medication administration due to a lack of understanding or forgetting the medication information provided by the pharmacist (Wang & Cho, 2022).

Polypharmacy, or multi-drug therapy, in cases where older adults have multiple illnesses, complex medication regimens, and doses exceeding twice daily are factors that negatively impact medication adherence and continuous medication use in older adults (Ranjbaran et al., 2022). This presents a challenge for pharmacists to find ways to improve medication adherence in elderly patients. One intervention pharmacists can provide to improve adherence is the use of a medication reminder chart, a tool that can help patients overcome medication forgetfulness by marking the appropriate column on the medication reminder chart after taking their medication (Conn et al., 2009). Another method is the use of a pill box. A pill box is a container used to organize a patient's medication doses for a specific period of time and prevent missed doses (Schwartz, 2017).

Previous research showed an 86% adherence rate for patients using conventional pill boxes and 81% for those using daily pill bottles. These devices can help patients organize their medications according to their schedule. Patients were 61% more satisfied with daily pill boxes compared to 11% with conventional pill bottles due to ease of use (A. M. Pratiwi & Andrie, 2022). Other research has shown that pill boxes can significantly improve adherence and lower systolic and diastolic blood pressure ($P=0.000$ and $P=0.002$), while medication reminder charts were only effective in improving adherence ($P=0.000$) (Sammulia et al., 2016).

Several previous studies have examined the effectiveness of pill boxes or medication charts separately for improving adherence in older adults in hospitals or community health centers, but direct head-to-head comparisons between the two tools in the context of older adults living in social care facilities are limited. The elderly population living in social care facilities has different adherence characteristics due to the closed community setting and the involvement of caregivers as additional factors in adherence. This answers previous research that suggests the need for social support and education to assist with the use of medication-taking aids. These aids are only effective if patients are able to use them consistently (Aljumah & Hassali, 2015; Sammulia et al., 2016).

This study will measure the effectiveness of using pill boxes compared to medication reminder charts in improving medication adherence in elderly patients attending social service centers. This will be done by providing education to subjects and involving social service caregivers to help organize medications, thus facilitating the use of intervention tools in the future. The development of pill boxes will assist the elderly in managing their medication schedules. Pill boxes not only remind the elderly to take their medications at the prescribed times, but also provide easy portability thanks to their convenient packaging. Through the use of pill boxes and medication charts, it is hoped that disease management in the elderly will become more effective, reduce the risk of health complications, and improve their quality of life. The purpose of this study was to compare the effectiveness of pill boxes and medication charts in improving medication adherence in elderly patients at social service centers in Yogyakarta

METHOD

This study was conducted using a quasi-experimental study design, with a two-group pretest-posttest design, from July to September 2025 at the Social Service Centers (BPS) in Yogyakarta, namely BPS Tresna Werdha Abiyoso Sleman and BPS Tresna Budi Luhur Bantul. Sampling in this study used a purposive sampling technique with predetermined inclusion and exclusion criteria. Inclusion criteria: patients aged 60 years and above, patients with chronic diseases undergoing routine therapy, able to communicate well (not experiencing severe cognitive impairment), and willing to participate in the study by signing an informed consent. Exclusion criteria: elderly with

severe memory impairment/dementia, elderly who were inconsistent in their residence. Dropout criteria included subjects who did not attend the evaluation within the specified timeframe, patients withdrew during the study, or subjects who died during the study.

A total of 60 participants were recruited, divided into two groups: 30 clients in the Pill Box group and 30 clients in the medication chart group. The provision of pill boxes as a daily medication management tool and medication charts aims to assist clients in and remind them to take their medications. This study received permission from the Research Ethics Committee (KEP) of Jenderal Achmad Yani University, Yogyakarta, under No. Skep/317/KEP/VI/2025, and a memorandum from the Head of the Yogyakarta Special Region (DIY) Social Services Office, No. B/000.9.2/2943/D16.

Both groups received the same treatment: education from pharmacists regarding the importance of medication adherence, along with training in the use of pill boxes and medication charts. Data were collected prospectively from elderly subjects on chronic disease medications. Subject adherence levels were measured before and after treatment. Adherence levels were assessed through interviews using the Morisky Medication Adherence Scale (MMAS-8) questionnaire (Morisky et al., 2008), adapted into Indonesian and adopted from The MMAS-8 questionnaire was assessed by calculating points based on the answers provided. Each “Yes” answer was scored as “0” and each “No” answer as “1,” with the exception of question 5, where a “Yes” answer was scored as “1” and a “No” answer as “0.” After all scores were totaled, the level of adherence was interpreted as follows: a score of 8 indicates high adherence, a score of 6–7.75 indicates moderate adherence, and a score of less than 6 indicates low adherence (Kang et al., 2015).

Item 8 on the MMAS-8 questionnaire was designed to assess the frequency of patient difficulty remembering to take medication. The assessment was conducted using a five-level Likert scale, with scores assigned in stages: “never” was scored as 1, “rarely” as 0.75, “sometimes” as 0.5, “often” as 0.25, and “very often” as 0. This was based on the original guidelines of Morisky. The MMAS-8 (Morisky Medication Adherence Scale) questionnaire showed a sensitivity of 93% and a specificity of 53% in a study of adherence to antihypertensive medication use. (Morisky et al., 2008). This study adopted the Indonesian version of the MMAS-8, which had been tested for validity and reliability by previous researchers. The validity test was conducted with convergent validity using Spearman's rank correlation between MMAS-8 scores, while reliability was tested by measuring internal consistency reliability assessed using Cronbach's alpha coefficient and test-retest reliability using Spearman's rank correlation. The convergent validity results for the Indonesian version of the MMAS-8 were $r = 0.883$. Sensitivity, specificity, positive and negative predictive will be determined based on validation data. The results of the psychometric properties of the reliability test and validity test indicate that the Indonesian version of the MMAS-8 has good reliability and validity with internal consistency reliability assessed using Cronbach's alpha coefficient of 0.824 and test-retest reliability using Spearman's rank correlation of 0.881 (Riani et al., 2017).

The intervention consisted of providing a pill box or medication reminder chart, followed by mentoring and education for the elderly on the importance of regular medication use, as well as guidance on how to fill out the pill box or medication chart and how to apply the patient's medications to the device, involving caregivers. After three weeks, a post-test was administered.

Descriptive analysis was conducted to obtain an overview of the frequency distribution and proportions of the variables studied, including subject characteristics. Normality tests were used to ensure that both groups were normally/homogeneously distributed to avoid bias. Bivariate analysis: The Chi-Square test was used to examine the differences in proportions of each characteristic variable between the two intervention groups and to examine the effect of confounding variables on adherence. The Kolmogorov-Smirnov test was used to test data normality. Paired t-tests or Wilcoxon test were used for within-group (pre vs. post) differences (Dahlan, 2017).

RESULT

This study was conducted at the Budi Luhur Bantul and Abiyoso Sleman DIY Social Services Centers (BPSTWs) and included 60 elderly clients aged 60 years and older who suffered from chronic illnesses and underwent routine therapy and met the inclusion and exclusion criteria. Participants were divided into two groups: 30 in the Pill Box group and 30 in the Medication Chart group. The Pill Box served as a daily medication management tool, while the Medication Chart served as a tool to assist clients in and remind them to take their medications. This study received permission from the Research Ethics Committee (KEP) of Jenderal Achmad Yani University, Yogyakarta, under No. Skep/317/KEP/VI/2025, and a memorandum from the Head of the Yogyakarta Special Region Social Service, No. B/000.9.2/2943/D16.

Table 1 shows the sociodemographic characteristics of clients, consisting of gender, age, highest education, comorbidities, type of disease, duration of medication use, access to medication, and treatment patterns received by clients.

Table 1.
Client Characteristics Data

Characteristics		Intervention				P-value ^a
		Pill Box n=30		Medication Chart n=30		
		f	%	f	%	
Gender	Male	11	36.67	12	40.00	0.914
	Female	19	63.33	18	60.00	
Age	Pre-elderly (60-69 years)	16	53.33	13	43.33	0.502
Highest Education	Early elderly (70-79 years)	9	30.00	15	50.00	
	Late elderly (≥80 years)	5	16.67	2	6.67	
Comorbidities	No schooling	6	20.00	8	26.67	0.442
	Primary education (elementary-junior high school)	15	50.00	15	50.00	
Type of Disease	Secondary education (high school)	7	23.33	5	16.67	
	Higher education (university)	2	6.67	2	6.67	
Duration of Medication Use	Yes	12	40.00	4	13.33	0.185
	No	18	60.00	26	86.67	
Access to Medication	Hypertension	16	53.33	20	66.67	0.674
	Diabetes Mellitus	8	26.67	4	13.33	
	Other	6	20.00	6	20.00	
Treatment Pattern	<5 years	22	73.33	23	76.67	0.413
	5-10 years	4	13.33	7	23.33	
Gender	>10 years	4	13.33	0	0.00	
Age	Community health center	7	23.33	1	3.33	0.820
	Polyclinic	15	50.00	29	96.67	
Highest Education	Hospital	8	26.67	0	0.00	
	Single	12	40.00	9	30.00	0.680
	>1 type of medication (combination)	18	60.00	21	70.00	

Description: a. Chi-Square Test

Statistical testing in this study was conducted using a Chi-Square test on the characteristics of the study subjects, namely gender, age, highest level of education, comorbidities, type of illness, duration of medication use, access to medication, and treatment patterns received by the clients. The baseline adherence characteristics used yielded a P value > 0.05, indicating no difference in the proportion of each variable between the pill box and medication chart groups before the intervention (Table 1).

Table 2 shows the results of the Wilcoxon Signed Rank statistical test which shows that there is a significant effect on the use of pill boxes on the level of medication adherence ($p = 0.001$) compared to the medication chart group which shows no significant effect on the initial level of medication adherence (before intervention) and the final level of adherence (after intervention) ($p = 0.394$). The results of the Mann-Whitney statistical analysis show that there is a difference in the value of the results of the level of medication adherence between the pill box group and the medication chart group ($p = 0.033$).

Tabel 2.
Comparison of the Effectiveness of Pill Boxes and Medication Charts in Improving Medication Adherence

Group	Medication Adherence (MMAS-8 Score)		<i>P-value</i> ^a	<i>P-value</i> ^b
	Before Intervention	After Intervention		
<i>Pill Box</i>	Low (score 0-5)	9 (30.00%)	0.011	0.033
	Moderate (score 6-7.75)	14 (46.67%)		
	High (score 8)	7 (23.33%)		
<i>Medication Chart</i>	Low (score 0-5)	5 (16.67%)	0.394	
	Moderate (score 6-7.75)	11 (36.67%)		
	High (score 8)	14 (46.67%)		

Description: ^aWilcoxon test; ^bMann-Whitney test; p-value <0.05 is considered statistically significant

Table 3.
Comparison of Pill Box and Medication Chart in Changes in Client Adherence Levels

Comparison of Pill Box and Medication Chart in Changes in Client Adherence Levels					
Changes in Medication Adherence Levels	Intervention				P-value
	Pill Box n=30		Medication Chart n=30		
	f	%	f	%	
Increases	15	50.00	10	33.33	0.232
Constantly	11	36.67	11	36.67	
Decreases	4	13.33	9	30.00	

Source: Primary data processed 2025

The results of the comparison of changes in the level of client medication adherence seen from the initial adherence score (before intervention) with the final adherence score (after intervention) in the pill box group showed that the majority of the adherence levels increased (50.00%), while in the medication chart group the changes in the adherence level remained the same. The chi-square test results showed a value of 0.232 ($p > 0.05$) which means there was no significant difference between the two groups.

Tabel 4.
Comparison of the Effectiveness of Pill Boxes and Medication Charts on the Average Improvement in Medication Adherence Scores

Variabel	Change in Group Mean Value	
	<i>Pill box</i>	<i>Medication Chart</i>
MMAS-8 Scores Before Intervention	6.03	6.86
MMAS-8 Scores After Intervention	7.03	7.27
Difference in Increase	1.00	0.41

Source: Primary data processed 2025

The results of the adherence score using the MMAS-8 questionnaire showed that there was an increase in the average score before and after the intervention in both the pill box group, namely from 6.03 to 6.86 and in the medication chart group from 7.03 to 7.27. This indicates that the intervention of providing pill boxes or medication charts to elderly clients accompanied by assistance in drug management and how to use the intervention tool had a positive impact on increasing patient adherence scores in the two groups.

DISCUSSION

Sociodemographic data presented in Table 1 indicate that, most clients were female in both the pill box category (63.33%) and the medication chart category (60.00%). In the group of clients who received pill boxes, the majority were pre-elderly (60-69 years old), namely 53.33%, while in the group of clients with medication charts, the majority were early elderly (70-79 years old), namely 50%. The majority of clients had primary education (50%). Most patients had comorbidities, and the most common disease group suffered by clients was hypertension. Most clients had been using medication for <5 years, most clients had access to treatment at polyclinic health facilities, and the majority received more than one type of medication. Findings from the Indonesian Health Survey

(SKI) conducted by the Ministry of Health demonstrate a marked increase in hypertension prevalence among older adults, with rates of 45.9% in the 55–64 age group, 57.6% in the 65–74 age group, and 63.8% in those aged over 75 years. Moreover, additional data indicate that around 8.5% of the Indonesian population is diagnosed with diabetes mellitus (DM), and approximately 40–80% of these patients concurrently experience hypertension. The 2023 SKI further reported that 34.11% of Indonesians are affected by hypertension, while the prevalence of diabetes among the elderly continues to escalate with age, largely driven by lifestyle factors including obesity and insufficient physical activity (Kemenkes RI, 2024).

Elderly patients commonly present with multiple comorbidities, including dyslipidemia, diabetes mellitus, ischemic heart disease, stroke, heart failure, sleep apnea, chronic pulmonary disease, and chronic kidney disease (Wong et al., 2014). In this study, the most frequently observed comorbid conditions were hypertension, hypertension accompanied by diabetes mellitus, cardiovascular disease, and psychiatric disorders. The findings further indicated that the majority of patients were prescribed more than one medication as part of their treatment regimen. These results are consistent with prior evidence suggesting that hypertensive patients with comorbidities, such as cardiovascular disease, diabetes mellitus, and other chronic conditions, benefit from combination therapy. Recommended regimens include either an angiotensin-converting enzyme inhibitor (ACEI) combined with a diuretic or a calcium channel blocker (CCB), or an angiotensin receptor blocker (ARB) combined with a diuretic or CCB (Schmieder & Ruilope, 2008).

This study demonstrated an improvement in medication adherence among patients in the pill box group following the intervention. In contrast, patients in the medication chart group exhibited a decline in adherence levels after the intervention, with the majority categorized as having moderate adherence. Statistical analysis revealed a significant association between the use of pill boxes and improved medication adherence ($p = 0.001$) when compared to the medication chart group. This result is in accordance with previous research conducted by Sammulia et al. which found that there was a significant difference between Pill box and Medication reminder chart in increasing adherence ($P=0.008$) (Sammulia et al., 2016), this result is also supported by other research which obtained a significant value from the Paired Sample t-Test, namely 0.000 (<0.05) which shows that pill box can increase patient adherence in taking medication. Pill box makes it easier for patients to manage their medication taking time (A. M. Pratiwi & Andrie, 2022)

A comparison of changes in medication adherence levels between pill boxes and medication charts in Table 3 shows that adherence levels increased in the pill box group, while adherence levels remained nearly the same in the medication chart group. Therefore, the comparison values do not show a statistically significant difference. This is consistent with previous research. (Y. E. Pratiwi & Kaaffah, 2023). Supported by other similar research showing that regular patients are 2.4 times more likely to forget to take their medication compared to those who use pill boxes, while cardiovascular patients are 4 times more likely to forget to take their medication. (Choi, 2019). The superiority of pill boxes over medication charts may be attributed to several factors. In the pill box group, medication adherence showed improvement, consistent with findings from previous studies. The contributing factors include: (1) their ability to serve as a direct reminder for patients in daily activities to take their medication; (2) the requirement for patients to verify whether a dose has been taken; (3) their small and lightweight design, which allows patients to conveniently carry them during travel, work, or other activities; and (4) their ease of use. In contrast, the use of medication charts relies primarily on checking boxes, which can often be neglected—either because patients forget to mark the chart despite taking the medication, or because they fail to take the medication altogether (Mehdinia et al., 2020).

The results of adherence scores using the MMAS-8 questionnaire showed an increase in the mean scores before and after the intervention in both the pill box and medication chart groups.

As presented in Table 4, the pill box group demonstrated an increase of 1.0 between pre- and post-intervention, whereas the medication chart group showed a smaller increase of 0.41. This indicates that the intervention of providing pill boxes or medication charts to elderly clients, accompanied by assistance with medication management and how to use the intervention tool, had a positive impact on increasing patient adherence scores in both groups. These results are consistent with previous research that explained that the use of pill boxes can improve elderly patient adherence in taking antihypertensive medication (Mpila et al., 2024). This is in accordance with previous research which found that the average increase in MMAS-8 scores in the pill box group was higher than the medication chart, namely 4.12 and 2.9 (Sammulia et al., 2016). The measurement of medication adherence is essential for ensuring effective and efficient treatment, as well as for monitoring the therapeutic success of hypertension management. Without adequate patient awareness and adherence to prescribed therapy, optimal treatment outcomes cannot be achieved (Wati et al., 2024).

CONCLUSION

The characteristics of the clients in this study were mostly female, pre-elderly, had basic education, no comorbidities, duration of drug use <5 years, received drugs from polyclinics, and the type of therapy was >1 type of drug. There was a significant effect between the pill box and medication chart groups in increasing client adherence with a P value of 0.033. There was no significant effect in changes in the level of adherence between the two groups (P-value 0.232), and there was a positive change in the increase in the average value of client adherence scores.

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