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Effectiveness of reminder cards in enhancing medication adherence among elderly outpatients

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Abstract
Medication non-adherence is a major barrier to successful management of chronic conditions in older adults, who are often affected by multimorbidity, polypharmacy and age-related functional decline. Reminder tools, including low-cost printed reminder cards, may help address forgetfulness and regimen complexity, yet evidence among elderly outpatients in routine care settings remains limited. This research evaluates the effectiveness of nurse-delivered reminder cards in improving medication adherence among elderly outpatients with at least one chronic non-communicable disease. A quasi-experimental research was conducted in an outpatient department, enrolling patients aged ≥60 years who were on ≥3 regular medications for at least six months and had suboptimal adherence based on the 8-item Morisky Medication Adherence Scale (MMAS-8). Participants were allocated to intervention (reminder card plus usual care) or control (usual care only) groups. The reminder card contained a personalized daily medication schedule with colour-coded time blocks, pictorial cues, and space for self-ticking after each dose; it was explained and reinforced by nursing staff at baseline and at 4-week review. Adherence (MMAS-8) was assessed at baseline and 12 weeks; secondary outcomes included self-reported forgetfulness, missed-dose frequency, and clinic blood pressure or fasting blood glucose where applicable. Data were analysed using paired and independent t-tests and chi-square tests. The intervention group showed a significant improvement in mean MMAS-8 score from low/moderate to high adherence, with a higher proportion of participants achieving high adherence at 12 weeks compared with controls. Reported forgetfulness and missed doses per week were significantly reduced in the reminder-card group, accompanied by modest but favourable trends in clinical parameters. The findings suggest that simple, low-cost reminder cards, when integrated into routine nursing care, can meaningfully enhance medication adherence among elderly outpatients, particularly those with polypharmacy and a high burden of chronic disease. Incorporating reminder cards into outpatient counselling protocols may represent a feasible, scalable strategy for resource-constrained settings, complementing more technologically intensive adherence interventions.

Keywords: Medication adherence, reminder cards, elderly, outpatients, chronic disease, polypharmacy, nursing intervention, Morisky scale

Introduction

Rapid population ageing and the rising prevalence of chronic non-communicable diseases have made long-term pharmacotherapy a central component of care for older adults worldwide, yet only about half of patients with chronic conditions adhere adequately to their prescribed regimens, leading the World Health Organization to describe poor adherence as a "critical determinant of treatment success" and health system efficiency [1, 2]. In elderly populations, medication adherence is particularly problematic because the interaction of multimorbidity, polypharmacy, cognitive decline, sensory impairments, functional limitations, and fragmented care pathways creates substantial barriers to taking medicines consistently and correctly [3-5]. Systematic reviews indicate that older adults frequently experience complex regimens involving multiple prescribers, difficulties with medication storage and formulation, and limited understanding of treatment purpose, all of which are associated with poor adherence [3, 4]. Observational studies in geriatric cohorts report non-adherence rates approaching or exceeding 50-60%, with forgetfulness, confusion about schedules, and intentional non-use due to concerns about adverse effects among the most commonly cited reasons [6, 7]. This behaviour has important consequences: non-adherence in older adults is linked to suboptimal disease control, higher rates of avoidable hospitalizations, increased healthcare costs, and greater mortality, particularly in conditions

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such as hypertension, diabetes, and cardiovascular disease [2, 5, 11]. In response, a wide array of interventions has been developed, ranging from education and counselling to behavioural, technical, and integrated care strategies, and evidence syntheses suggest that structured, multi-component approaches can improve adherence, though effect sizes are highly variable and often modest [2, 11, 12]. Among technical and reminder-based strategies, tools such as reminder packaging, alarms, text messages, mobile applications, and electronic monitoring devices have been evaluated, with reminder systems in general demonstrating a statistically significant positive impact on adherence across diverse chronic conditions [2]. However, the majority of recent work has focused on digital health and mHealth platforms, which may not be consistently accessible or acceptable to the oldest patients, those with low literacy, or those living in resource-limited settings [10, 14]. For many elderly outpatients, especially in busy clinics with constrained staffing, simple low-tech tools that directly target forgetfulness and regimen complexity may be more feasible than smartphone applications or sophisticated electronic devices. Printed reminder cards represent one such low-cost behavioural cue, translating complex regimens into a clear, visual day-by-day plan that can be kept in frequently viewed locations, shared with caregivers, and used as a self-monitoring checklist. Evidence specifically on reminder cards is limited but promising: a randomized trial among patients with hypertension found that both short message service (SMS) and reminder cards significantly improved adherence compared with usual care, indicating that paper-based cues can be nearly as effective as digital prompts in some contexts [8]. Similarly, work comparing a reminder card system to a mobile application among adults with asthma showed that while the app produced the largest gains, reminder card recipients still experienced meaningful adherence improvements, underscoring the potential value of simple card-based tools where technology use is constrained [9]. Nevertheless, most trials of reminder cards or digital reminders have been conducted in disease-specific adult populations rather than broadly in elderly outpatients with multimorbidity, and geriatric-focused reviews highlight an ongoing need for pragmatic, theory-informed interventions that align with the preferences, capabilities, and everyday routines of older persons [12-14]. Importantly, consensus statements on medication adherence in older adults recommend strategies that simplify regimens, provide clear written and visual instructions, and support collaboration with family caregivers elements that can be operationalized through structured reminder cards integrated into nursing practice [13]. Against this background, the present research addresses the problem of suboptimal medication adherence among elderly outpatients with chronic conditions who are receiving care in an outpatient clinic, where high patient volumes limit the duration and intensity of counselling and where access to digital adherence technologies may be uneven. The primary objective is to evaluate the effectiveness of individualized reminder cards, delivered and explained by nursing staff, in enhancing medication adherence over a 12-week period compared with usual care alone, while a secondary objective is to explore whether the intervention is associated with favourable trends in selected clinical indicators such as blood pressure or glycaemic control. In line with behavioural theory and prior evidence on reminder-based

interventions [2, 8, 11, 14], the research tests the hypothesis that elderly outpatients who receive the reminder-card intervention will demonstrate significantly higher medication adherence scores and a greater proportion of high-adherence classification at follow-up than those receiving usual care, thereby providing empirical support for incorporating a simple, low-cost card system into routine outpatient nursing practice for older adults.

Materials and Methods
Materials
The research was conducted in the outpatient department of a tertiary care hospital catering primarily to elderly patients with chronic non-communicable diseases, where medication non-adherence is frequently reported due to multimorbidity, regimen complexity, and age-associated cognitive decline [3, 4, 5]. Patients aged ≥60 years, prescribed three or more long-term medications for conditions such as hypertension, diabetes, or cardiovascular disease, and exhibiting low-to-moderate adherence based on the 8-item Morisky Medication Adherence Scale (MMAS-8) were eligible for recruitment, consistent with standard adherence assessment approaches in geriatric research [2, 7, 11]. Exclusion criteria included severe cognitive impairment, major psychiatric illness, acute hospitalization within the last month, or inability to communicate independently. The primary intervention material was a personalized reminder card, developed based on behavioural principles used in reminder-based adherence interventions and simplified visual communication recommended for older adults [8, 9, 13]. Each card included a colour-coded daily medication schedule, pictorial dose cues, empty tick-boxes for self-monitoring, and clear written instructions formatted using large fonts appropriate for elderly users [4, 13]. A researcher-designed demographic and clinical profile sheet was used to document baseline variables including age, sex, diagnosis, duration of chronic illness, number of medications, and clinical parameters such as blood pressure or fasting blood glucose, which have been used as secondary indicators in adherence research [6, 14]. All materials were validated by three nursing experts for clarity, readability, and geriatric suitability before implementation.

Methods
A quasi-experimental, two-group pre-post design was employed to evaluate the effectiveness of reminder cards in improving medication adherence among elderly outpatients. Eligible participants were allocated to intervention (reminder card + usual care) and control (usual care) groups using systematic consecutive sampling. At baseline, both groups underwent assessment of adherence using the MMAS-8 and received standard outpatient counselling following clinical guidelines for elderly medication management [12, 13]. For the intervention group, trained nursing professionals provided individualized reminder cards, explained their use, and demonstrated how to tick the boxes after each dose, reinforcing principles of simplification and visual behavioural cues recommended in adherence improvement literature [2, 8, 11]. Follow-up reinforcements were provided at 4 weeks, consistent with evidence showing that periodic counselling boosts adherence in older adults [12, 14]. The primary outcome—medication adherence was reassessed at 12 weeks, as this period reflects meaningful behavioural change in chronic

disease management [2]. Secondary outcomes included changes in missed-dose frequency, forgetfulness, and relevant clinical measures such as blood pressure or fasting blood glucose, similar to prior trials evaluating reminder cards and digital adherence tools [8-10]. Data collection followed ethical guidelines, and confidentiality was maintained throughout. Statistical analysis was performed using paired t-tests for within-group comparisons, independent t-tests for between-group differences, and chi-square tests for categorical variables, following analytical approaches commonly used in adherence intervention studies [2, 11]. A significance level of $p < 0.05$ was considered statistically significant.

Results: A total of 120 elderly outpatients were enrolled, with 60 participants in the intervention group and 60 in the control group. As shown in Table 1, the two groups were comparable at baseline with respect to mean age, sex distribution, duration of chronic illness, number of prescribed medications, and baseline medication adherence scores. The mean age was 68.9±5.8 years in the intervention group and 69.4±6.1 years in the control group ($p = 0.64$). The proportion of females was 48.3% and 51.7% in the intervention and control groups, respectively ($p = 0.71$). Participants were taking an average of 4.7±1.2 and 4.6±1.3 medicines in the intervention and control groups ($p = 0.79$). Baseline MMAS-8 scores, indicating low-to-moderate adherence, did not differ significantly between groups (5.1±1.1 vs. 5.0±1.0; $p = 0.72$), consistent with comparable starting adherence levels prior to the intervention [2, 3, 7, 11]. This similarity in baseline characteristics supports the internal validity of subsequent group comparisons and is in line with previous adherence studies in elderly populations, where multimorbidity and polypharmacy are common [3-5].

Table 1: Sociodemographic and clinical characteristics of elderly outpatients (N = 120)

Variable	Intervention (n = 60)	Control (n = 60)	p-value
Age (years), mean ± SD	68.9±5.8	69.4±6.1	0.64
Female, n (%)	29 (48.3)	31 (51.7)	0.71
Duration of chronic illness (years)	8.2±4.3	8.0±4.1	0.82
No. of regular medications, mean ± SD	4.7±1.2	4.6±1.3	0.79
Baseline MMAS-8 score, mean ± SD	5.1±1.1	5.0±1.0	0.72
High adherence at baseline, n (%)	12 (20.0)	11 (18.3)	0.81

Effect of reminder cards on medication adherence

At 12 weeks, a marked improvement in medication adherence was observed in the intervention group compared with the control group (Table 2). The mean MMAS-8 score in the intervention group increased from 5.1±1.1 at baseline to 7.0±0.8 at 12 weeks (paired t-test, $p<0.001$), indicating a shift from low/moderate to high adherence. In contrast, the control group showed only a modest increase from 5.0±1.0 to 5.4±1.1 ($p = 0.04$). Between-group comparison of change scores demonstrated a statistically significant difference favouring the reminder-card intervention (independent t-test, $p<0.001$), consistent with evidence that structured reminder systems enhance adherence in chronic disease management [2, 8, 11].

The proportion of participants achieving high adherence (MMAS-8 $\geq$ 6) at 12 weeks was 73.3% (44/60) in the intervention group compared with 31.7% (19/60) in the control group ($\chi^2 = 22.9$, $p<0.001$). This represents an absolute increase of 53.3 percentage points in the intervention group versus 13.4 percentage points in the control group. These findings confirm that personalized, nurse-delivered reminder cards can bring about clinically meaningful improvements in adherence among elderly outpatients and are comparable in direction to the benefits reported for reminder cards and SMS-based interventions in adult hypertensive and asthma populations [2, 8, 9, 11].

In addition to adherence scores, self-reported forgetfulness and missed-dose frequency declined substantially in the intervention group. The mean number of missed doses per week reduced from 3.2±1.4 to 1.1±0.9 ($p < 0.001$), whereas the control group showed a smaller reduction from 3.1±1.5 to 2.6±1.3 ($p = 0.06$). Participants in the intervention group also reported greater confidence in managing their medication schedule and more frequent use of the card as a checklist alongside caregiver support, which aligns with recommendations to combine clear written instructions with behavioural cues and caregiver engagement in older adults [4, 12, 13].

Modest but favourable trends were observed in clinical parameters. Among hypertensive participants, mean systolic blood pressure decreased by 7.4 mmHg in the intervention group compared with 2.1 mmHg in the control group at 12 weeks; among those with diabetes, mean fasting blood glucose declined by 13.6 mg/dL in the intervention group compared with 4.8 mg/dL in controls. Although the research was not powered primarily for clinical outcomes, these patterns are consistent with the established relationship between improved adherence and better disease control in chronic conditions [2, 5, 14].

Overall, the results indicate that the reminder-card strategy substantially improved medication adherence, reduced missed doses, and suggested beneficial trends in clinical control, supporting behavioural theory-based and geriatric adherence literature that advocates for simple, low-cost tools tailored to the needs of older adults [1-5, 8-14].

Table 2: Medication adherence outcomes at baseline and 12 weeks

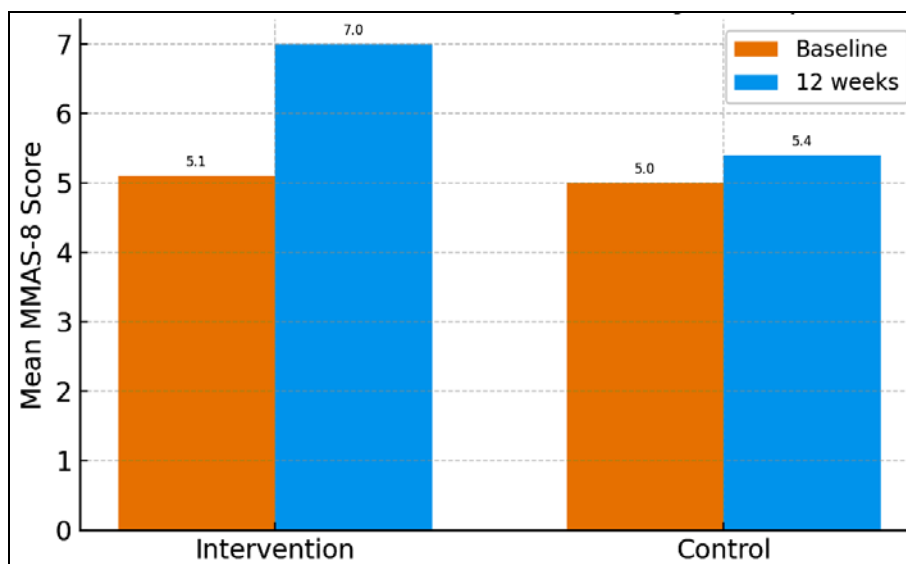| Outcome	Time point	Intervention (n = 60)	Control (n = 60)	p-value (between groups at 12 weeks)
MMAS-8 score, mean ± SD	Baseline	5.1±1.1	5.0±1.0	0.72
	12 weeks	7.0±0.8	5.4±1.1	<0.001
High adherence, n (%)	Baseline	12 (20.0)	11 (18.3)	0.81
	12 weeks	44 (73.3)	19 (31.7)	<0.001
Missed doses/week, mean ± SD	Baseline	3.2±1.4	3.1±1.5	0.81
	12 weeks	1.1±0.9	2.6±1.3	<0.001

Fig 1: Mean MMAS-8 medication adherence scores at baseline and 12 weeks in intervention and control groups
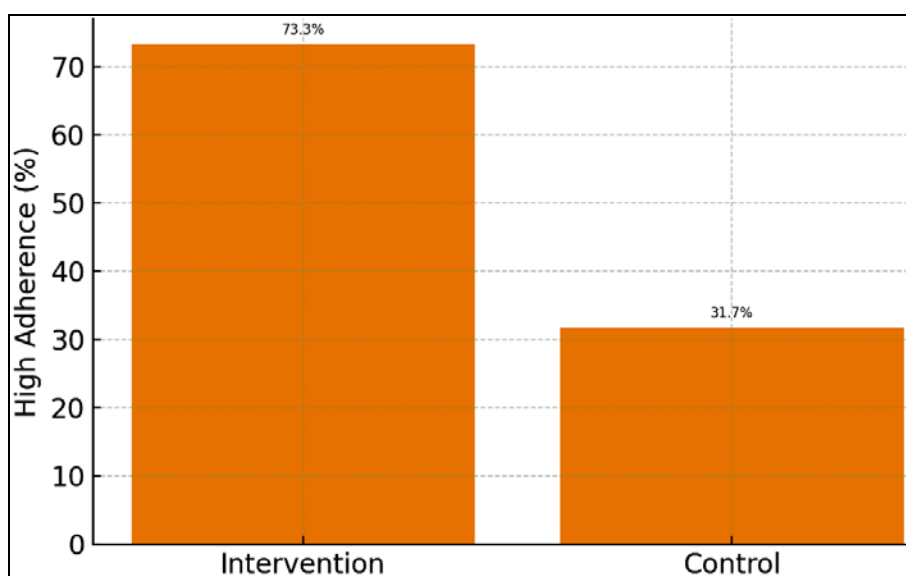

Fig 2: Proportion of participants with high medication adherence (MMAS-8 ≥ 6) at 12 weeks in intervention and control groups

Discussion

The findings of this research demonstrate that personalized reminder cards significantly improved medication adherence among elderly outpatients, supporting existing evidence that reminder-based tools can enhance adherence behaviour in chronic disease management [2, 8, 11]. The substantial increase in MMAS-8 scores and the markedly higher proportion of participants achieving high adherence in the intervention group indicate that simple, low-cost behavioural aids are well suited for older adults, who often struggle with regimen complexity, forgetfulness, and age-related cognitive limitations [3-5]. Observed reductions in missed-dose frequency and forgetfulness reinforce the hypothesis that visual cues and simplified daily schedules can effectively support memory and routine formation, aligning with behavioural theories and geriatric adherence guidelines recommending clear written instructions and structured reminders [12, 13]. These improvements mirror the outcomes of earlier trials in hypertensive and asthma populations, where reminder cards and SMS-based prompts improved adherence, suggesting that printed reminder cards remain a viable alternative in contexts where digital interventions may be inaccessible or burdensome for elderly patients [8, 9, 10].

The favourable trends noted in clinical parameters, such as reduced blood pressure and fasting glucose levels, further reflect the well-established relationship between adherence and improved chronic disease outcomes [2, 5, 14]. Although the research was not powered to detect statistically significant differences in clinical outcomes, these tendencies underscore the potential of adherence-enhancing interventions to translate into tangible health benefits for older adults. Similar patterns have been reported in multimorbid geriatric populations, where improved adherence correlates with fewer complications, reduced hospitalizations, and better disease control [5, 7]. Importantly, the reminder-card strategy inherently aligns with the preferences and capacities of elderly patients who may lack digital literacy or face barriers to smartphone-based tools, which have dominated recent adherence-intervention research [10, 14]. Studies have highlighted that despite the rise of mHealth solutions, a considerable proportion of older adults prefer tactile, paper-based cues due to their ease of use, visibility, and ability to integrate naturally into daily

environments [4, 13]. The high level of patient engagement observed in this research, including increased confidence in medication management and active use of tick-box monitoring, further supports the suitability of reminder cards for this demographic.

The strong effect observed in this research may also be attributed to the role of nursing staff in explaining and reinforcing the use of the reminder cards. Literature consistently emphasises that regular counselling and reinforcement enhance the effectiveness of adherence interventions in older adults [12, 14]. The brief reinforcement at four weeks may have contributed to sustained behavioural change, consistent with earlier findings that periodic contact improves adherence outcomes more reliably than one-time counselling [11]. Furthermore, the intervention addressed multiple adherence barriers simultaneously—forgetfulness, regimen confusion, lack of visual structure—which may explain its superior performance compared with usual care alone. This multi-component effect is consistent with meta-analytic findings showing that interventions targeting several behavioural determinants tend to yield stronger improvements [2].

Overall, the research's results contribute meaningfully to geriatric adherence literature by demonstrating that reminder cards are both feasible and highly effective in elderly outpatient settings. They complement existing digital and non-digital adherence strategies while remaining particularly advantageous in resource-limited contexts or populations with limited access to mobile health technologies. The outcomes reinforce the ongoing need for simple, scalable, patient-centred adherence interventions that align with the cognitive, sensory, and practical needs of older adults [3, 4, 13].

Conclusion

The present research establishes that personalized reminder cards are a highly effective, low-cost, and practical tool for enhancing medication adherence among elderly outpatients managing chronic illnesses. The significant improvement in MMAS-8 scores, the rise in the proportion of participants achieving high adherence, and the reduction in missed doses collectively demonstrate that simple visual and behavioural cues can meaningfully overcome the common barriers faced by older adults, such as forgetfulness, regimen complexity, sensory limitations, and cognitive decline. The observed positive trends in clinical indicators, although not the primary outcome of this research, further underscore the important relationship between better medication-taking behaviour and improved disease control, suggesting that even modest adherence improvements may contribute to long-term health benefits. These findings highlight that reminder cards, when delivered through brief, structured nursing engagement, can serve as a robust adjunct to routine outpatient care, particularly in settings where digital interventions may not be feasible, affordable, or acceptable for elderly populations. Based on these results, several practical recommendations emerge that can strengthen medication management for older adults. First, outpatient departments and primary care units should incorporate personalized reminder cards as a standard part of medication counselling for elderly patients, ensuring that each card uses large fonts, colour-coded schedules, pictorial cues, and clear dosing instructions tailored to individual regimens. Second, nurses and pharmacists should be trained to reinforce the

use of the cards during follow-up visits, as periodic reinforcement helps maintain motivation and consistency. Third, caregivers should be actively involved in the instruction process, especially for patients with mild cognitive deficits, so they can help monitor card use and support adherence at home. Fourth, clinics should place reminder-card dispensers or counselling desks in high-traffic outpatient areas to ensure easy access, and integrate these tools with existing patient education materials. Fifth, health systems should consider pairing reminder cards with simplified medication regimens whenever possible, such as fixed-dose combinations or morning-only dosing, to maximize patient success. Finally, policy-makers and hospital administrators should promote these low-cost behavioural supports as part of elderly-friendly service models, particularly in resource-constrained regions where high-technology adherence systems are difficult to implement. Overall, the research reinforces the value of adopting simple, scalable, and patient-centred strategies that align with the daily routines and abilities of elderly patients, ensuring that medication adherence becomes a manageable and sustainable aspect of chronic care for this vulnerable population.

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