Original Research Article

Effectiveness of a Pharmacist-Delivered Educational Intervention on Medication Adherence Among Older Adults in Residential Aged Care: A Pre–Post Study Using MyMAAT-12

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ABSTRACT

Older adults living in residential aged care facilities (RACFs) often take multiple medications and rely on staff for administration, but they may still face challenges in understanding and managing their medicines. This study aimed to evaluate whether a one-time, pharmacist-led educational session could improve medication adherence among RACF residents in Muar, Johor, Malaysia. We conducted a pre–post study involving 100 residents aged 60 years and above across six RACFs. Adherence was assessed using the Malaysian Medication Adherence Assessment Tool (MyMAAT-12), a validated questionnaire that covers both behavioral and psychological aspects of medication use. Each resident was interviewed by a pharmacist who assessed their adherence and then provided tailored education using the teach-back method. The same adherence assessment was repeated three months later. Results showed that the proportion of residents with good adherence (score ≥54) increased from 76% to 85% after the intervention (McNemar's test, $p = 0.004$). Statistically significant but modest improvements were observed in residents' confidence in managing their own medications and in their motivation to take medicines without needing reminders or support from others. However, most items related to routine medication behaviors, such as forgetting doses or missing appointments, did not show much change, possibly because these were already well managed in the RACF setting. No strong link was found between adherence and demographic or clinical characteristics such as age, gender, or number of illnesses. This study shows that a simple, one-time pharmacist intervention can improve important aspects of medication adherence, especially motivation and self-management, in institutionalized older adults. It highlights the valuable role pharmacists can play in supporting safer and more informed medication use in aged care settings.

Keywords: Pharmacist intervention, Medication adherence, Residential aged care, Older adults

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1.0 Introduction

Medication adherence is critical for achieving optimal therapeutic outcomes, particularly among older adults with chronic conditions who are frequently prescribed multiple medications (1). In this population, non-adherence is associated with increased morbidity, hospitalizations, and healthcare expenditures (2, 3). As the global population continues to age, ensuring the safe and effective use of medications in older individuals has become a pressing healthcare priority.

Although medication adherence among community-dwelling older adults has been widely investigated (1, 4), residents of residential aged care facilities (RACFs) remain underrepresented in adherence research. Despite the structured environment of RACFs and the presence of medication administration systems, non-adherence behaviors still occur. These behaviors are often obscured by routine-based care, limited resident autonomy, and cognitive impairments (5, 6). Hughes posited that compliance in nursing homes may reflect either imposed routines or irregular, poorly understood patterns, underscoring the importance of distinguishing between passive compliance and informed, intentional adherence (7).

In the Malaysian context, Ismail *et al*. (2021) (8) reported that 40% of care home residents in the Klang Valley were at moderate risk of medication non-adherence, with beliefs about medication-related harm and overuse identified as major contributors. However, the study employed a cross-sectional design and primarily included Chinese participants, limiting causal inference and generalizability. Similarly, Neoh *et al*. (2017) (9) found that among multi-ethnic, community-dwelling older adults, adherence was positively associated with perceived medication necessity and negatively associated with concerns about side effects and labeling difficulties. These findings suggest that adherence is shaped not only by individual behaviors but also by psychosocial and contextual factors.

International literature indicates that pharmacist-led interventions, particularly those incorporating patient education and individualized counselling improve medication adherence and disease knowledge across chronic conditions (10, 11). Evidence from post-myocardial infarction patients shows significant improvements in adherence and comprehension following 12 weeks of individualized education (12). In COPD, adherence increased from 49% to 80% over 24 months alongside improved disease knowledge (10), while a Malaysian community-based study on hypertension reported a rise in adherence from 29.3% to 70.7% within four months, with better blood pressure control (13). These findings are reinforced by a meta-analysis of 40 randomized controlled trials, which demonstrated that pharmacist-delivered interventions significantly enhanced adherence in older adults, particularly in home or community settings (14).

In Malaysia, pharmacist-led initiatives such as the Medication Therapy Adherence Clinic (MTAC) have shown success in managing chronic diseases through structured education and follow-up (15). However, limited research has explored the applicability and impact of such interventions within institutionalized care settings, where the determinants of adherence may differ. RACFs in Malaysia differ from those in many high-income and neighboring Asian countries in several important aspects. While RACFs in many high-income countries are structured with greater integration of medical services and staffed with a larger proportion of trained geriatric nurses, Malaysian RACFs are often privately operated, variably regulated, and primarily staffed by care aides with limited formal training in medication management (16).

Pharmacists are not routinely integrated into RACF care teams, and medication administration is frequently managed by

non-pharmacist staff or family caregivers (16). In addition, strong cultural expectations of filial piety and reliance on family support often result in older adults being cared for at home for as long as possible, with institutional placement typically occurring only at later stages of frailty or illness. Consequently, RACF residents frequently present with multiple comorbidities and polypharmacy needs (17, 18). These contextual differences underscore the importance of locally conducted research to evaluate the applicability and effectiveness of pharmacist-led interventions in Malaysian RACFs. Furthermore, it remains uncertain which domains of adherence (e.g., behavioral, cognitive, or motivational) are most amenable to change among RACF residents. Interventions targeting community-based individuals or caregivers have yielded mixed results, often improving knowledge and routine integration while failing to fully address motivation and self-efficacy gaps (19, 20). As such, it is essential to understand how educational interventions influence various dimensions of adherence in institutionalized older adults.

Addressing these gaps, the present study evaluated the impact of a pharmacist-delivered educational intervention on medication adherence among residents in six RACFs located in Muar, Johor. Adherence was assessed using the Malaysian Medication Adherence Assessment Tool (MyMAAT-12), a validated instrument capturing both behavioral and sociocognitive dimensions (21). The study aimed to determine the magnitude of adherence changes following the intervention and to identify the specific adherence components most responsive within this institutionalized population.

2.0 Materials and methods

2.1 Study design

This pre-post study was conducted among residents aged 60 years and above across six RACFs in Muar, Johor. Data collection was carried out from 22 January 2024 to 24 December 2024, spanning a period of 11 months. Ethical approval was obtained from the Research Ethics Committee of Universiti Teknologi MARA (REC/11/2023 [PG/MR/432]) and the Medical Research and Ethics Committee of the Ministry of Health Malaysia (NMRR ID-23-03693-0DO (IIR)).

2.2 Study setting

RACFs were identified through a comprehensive internet search and official list from the Ministry of Health (MOH), Malaysia. The researchers subsequently contacted the facility managers to explain the study objectives and to convey their intention to conduct research on site. Formal invitations were extended to RACFs that expressed interest in participating. Of the 12 RACFs contacted, six granted permission for the study to be conducted at their premises. These participating RACFs were Pusat Jagaan Teduhan Zafra, Pusat Jagaan Ai Xin, Pusat Jagaan Graceville, Pusat Jagaan Bakti Murni, Pusat Jagaan Ummi Naura, and Pusat Jagaan Ramya Balan. Collectively, these facilities housed a total of 130 residents. The sample size was calculated using G*Power for the Wilcoxon signed-rank test, with an effect size of 0.3, a significance level of 0.05, and a power of 0.90, yielding an estimated requirement of 100 participants.

2.3 Study population

The study population consisted of older persons aged 60 years and above who resided in the six selected RACFs.

Inclusion criteria were: being a resident of an RACF, aged 60 years or older, receiving follow-up care at health clinics in the Muar district, and currently using at least one long term medication (≥3 months of continuous use). Residents who were

diagnosed with dementia, lacked accessible health documentation, or declined to participate were excluded from the study. In each RACF, a member of the research team (MLAB) screened all residents to assess their eligibility based on the inclusion and exclusion criteria. Individuals who met the criteria and agreed to participate provided written informed consent prior to enrollment.

2.4 Study tool

The study utilized the MyMAAT, a 12-item self-report questionnaire developed to assess medication adherence among Malaysian patients (11). Originally designed for individuals with type 2 diabetes, MyMAAT was created in response to the limitations of using foreign instruments such as the Morisky Medication Adherence Scale (MMAS-8), which included licensing restrictions and limited contextual relevance.

The development of MyMAAT followed a rigorous process that involved a comprehensive literature review, expert consultations, and application of psychometric theory. It also incorporated constructs from health psychology, including self-efficacy, perceived barriers, and health beliefs. The validated version used in this study, MyMAAT-12, consists of 12 items grouped into two main dimensions: (1) medication-taking behaviors and (2) sociocognitive factors such as self-efficacy and social support (21). In this study, the tool was administered to residents during the first visit and again during the second visit, three months later. The MyMAAT-12 was available in both Malay and English, and residents were given the option to respond in their preferred language. To account for variable literacy levels, the questionnaire was interviewer-administered by a pharmacist researcher. Residents provided their responses verbally, and the researcher recorded them. This approach ensured that all items were completed and that no missing data occurred.

MyMAAT-12 is scored using a 5-point Likert scale, where responses range from "strongly disagree" (5 points) to "strongly agree" (1 point), with higher total scores indicating better medication adherence. The total score ranges from 12 to 60, and a cutoff score of 54 is used to classify adherence levels: scores ≥54 indicate good adherence, while scores <54 suggest moderate to poor adherence.

2.5 Study procedures

First visit

For each resident who agreed to take part in the study, a pharmacist who was also a member of the research team scheduled an appointment to assess medication adherence and deliver an educational intervention. Adherence was first assessed using the MyMAAT. Based on the residents' responses, the pharmacist provided tailored education to address individual adherence-related issues.

The educational intervention focused on key aspects of medication use, including the name of each medication, the reason for taking it, how and when to take it, potential side effects, what to do if side effects occur, and what to do if a dose is missed. The intervention was delivered once for each resident. Education was provided face to face and verbally, and continued until the resident demonstrated satisfactory understanding.

During the session, the teach-back method was used, in which residents were asked to repeat the instructions in their own words to confirm understanding and retention. Residents were also encouraged to ask questions to promote clarity and engagement. Caregivers and RACF staff were not directly involved in the educational sessions or in reinforcing the intervention. Their usual role in medication administration and routine care continued throughout the study period.

Second visit

During the second visit, which took place three months after the initial session, residents' medication adherence was reassessed using the MyMAAT. Based on the results, the pharmacist once again provided targeted education to reinforce key messages and address any ongoing or newly identified adherence issues.

2.6 Data analysis

Residents' demographic characteristics were analyzed using descriptive statistics. For each item in the MyMAAT, the frequency of responses across the five-point Likert scale (strongly disagree [SD], disagree [D], neutral [N], agree [A], and strongly agree [SA]) was recorded. Data were first assessed for normality using the Shapiro–Wilk test. As the adherence scores were not normally distributed, the Wilcoxon signed-rank test was applied to evaluate changes in continuous adherence scores between baseline and post-intervention. Item scores were summarised using the median and interquartile range (IQR) for descriptive purposes. Residents were further categorised into two adherence levels: good adherence (score ≥54) and moderate/poor adherence (score <54). McNemar's test was used to assess whether the change in the proportion of residents with good adherence over time was statistically significant. Associations between adherence levels and sociodemographic characteristics were examined using the chi-square test or Fisher's exact test, as appropriate.

3.0 Results

3.1 Residents' sociodemographic and clinical characteristics

Table 1 presents the sociodemographic and clinical characteristics of the 100 RACF residents included in this study. The majority were aged 80 years and above (56%), while 44% were between 60 and 79 years. There was an approximately equal distribution of male and female residents (45% and 55%, respectively). The ethnic composition comprised 41% Malays and 59% non-Malays.

In terms of comorbidities, hypertension was the most commonly reported condition (61%), followed by diabetes mellitus (40%) and cardiovascular disease (28%). Other less frequent diagnoses included renal disease (10%), dyslipidaemia (6%), respiratory disorders (6%), schizophrenia (6%), benign prostatic hyperplasia (4%), depression (5%), and anxiety disorder (5%). Notably, 70% of residents reported having experienced at least one fall in the past year. Regarding medication device use, 12% of residents were using insulin pens and 6% used inhaler devices.

3.2 Self-reported medication adherence

Table 2 summarises responses to the 12-item MyMAAT obtained during baseline and follow-up assessments. Item 1 yielded a uniform score of 5.0 (0), 5–5 across both timepoints, indicating no variability. Similarly, Items 2–8 and 10 showed identical medians and interquartile ranges, with no changes detected by the Wilcoxon signed-rank test.

For Item 9 (*"I will miss/not take my medication if no one reminds me to do so"*), the median score remained stable between baseline and follow-up at 4.0 (1), 3–5, with no statistically significant difference ($Z = -1.000$, $p = 0.317$, $r = -0.10$). A statistically significant improvement was observed for Item 11 (*"I am unable to manage my medication intake properly"*), with scores remaining at a median of 4.0 (0), 3–5 but showing a shift in distribution ($Z = -2.070$, $p = 0.038$, $r = -0.21$). Item 12 (*"Without support or help from loved ones, I lack motivation to take my medication as prescribed by the doctor"*) also improved significantly, with medians stable at 4.0 (1), 3–5 but a more favourable distribution ($Z = -3.162$, $p = 0.002$, $r = -0.32$).

Table 1: Residents' sociodemographic and clinical characteristics (n = 100)

Residents' characteristics	n (%)
Age group	
60 – 79	44 (44)
≥ 80	56 (56)
Gender	
Male	45 (45)
Female	55 (55)
Ethnicity	
Malays	41 (41)
Non-Malays	59 (59)
Diagnosed with diabetes	
Yes	40 (40)
No	60 (60)
Diagnosed with hypertension	
Yes	61 (61)
No	39 (39)
Diagnosed with dyslipidaemia	
Yes	6 (6)
No	94 (94)
Diagnosed with a respiratory disorder	
Yes	6 (6)
No	94 (94)
Diagnosed with benign prostatic hyperplasia	
Yes	4 (4)
No	96 (96)
Diagnosed with cardiovascular disease	
Yes	28 (28)
No	72 (72)
Diagnosed with depression	
Yes	5 (5)
No	95 (95)
Diagnosed with schizophrenia	
Yes	6 (6)
No	94 (94)
Diagnosed with anxiety disorder	
Yes	5 (5)
No	95 (95)
Diagnosed with renal disease	
Yes	10 (10)
No	90 (90)
Had a history of fall[a]	
Yes	70 (70)
No	30 (30)
Using insulin pen	
Yes	12 (12)
No	88 (88)
Using inhaler device	
Yes	6 (6)
No	94 (94)

[a] Within the past one year

3.3 Association between medication adherence and residents' characteristics

Table 3 presents the association between self-reported medication adherence and sociodemographic and clinical characteristics of RACF residents at baseline and post-intervention. At the first visit, 76.0% of all residents demonstrated good adherence (MyMAAT total score ≥54), while 24.0% were classified as having moderate or poor adherence. At the second visit, the proportion of residents with good adherence increased to 85.0%, with 15.0% reporting moderate or poor adherence. Among the 24 residents who were initially non-adherent, 9 (9.0%) transitioned to the adherent category, while 15 (15.0%) remained non-adherent. No residents shifted from adherence to non-adherence. McNemar's test confirmed that the observed increase in the proportion of adherent participants was statistically significant ($p = 0.004$).

Significant differences in adherence by age group were observed at baseline, with 65.9% of residents aged 60–79 years and 83.9% of those aged ≥80 years demonstrating good adherence ($p = 0.036$). By the second visit, this increased to 77.3% and 91.1%, respectively, though the difference was not statistically significant ($p = 0.055$).

No statistically significant associations were observed between adherence level and gender at either time points. At baseline, 77.8% of males and 74.5% of females demonstrated good adherence ($p = 0.707$), and at follow-up, the proportions were 84.4% and 85.5%, respectively ($p = 0.888$). Ethnicity also showed no significant association with adherence, with 75.6% of Malays and 76.3% of non-Malays reporting good adherence at baseline ($p = 0.939$), increasing to 82.9% and 86.4%, respectively, at follow-up ($p = 0.628$).

Table 2: Self-reported medication adherence among RACF residents assessed using the MyMAAT at baseline and post-intervention (n = 100)

	MyMAAT Items	First Visit (n)						Second Visit (n)						Z / p value[a]	Effect size (r)
		SD	D	N	A	SA	Median score (interquartile range), min–max	SD	D	N	A	SA	Median score (interquartile range), min–max		
Item 1	In the past one month, I frequently failed to take my medication in accordance with the doctor's instruction.	100	0	0	0	0	5.0 (0), 5–5	100	0	0	0	0	5.0 (0), 5–5	None	None
Item 2	In the past one month, I reduced my medication intake when I felt better.	81	19	0	0	0	5.0 (0), 4–5	81	19	0	0	0	5.0 (0), 4–5	None	None
Item 3	In the past one month, I took my medication alternately.	80	20	0	0	0	5.0 (0), 4–5	80	20	0	0	0	5.0 (0), 4–5	None	None
Item 4	I was often late on / missed the appointment date to get the supplies of my follow-up medication at the pharmacy counter.	68	32	0	0	0	5.0 (0), 4–5	68	32	0	0	0	5.0 (0), 4–5	None	None
Item 5	I have excess supply of the prescribed medication at home.	63	37	0	0	0	5.0 (1), 4–5	63	37	0	0	0	5.0 (1), 4–5	None	None
Item 6	I did not fully comply with the prescriptions because I felt it was unnecessary/insignificant.	58	42	0	0	0	5.0 (1), 4–5	58	42	0	0	0	5.0 (1), 4–5	None	None
Item 7	In the past one month, I frequently failed to remember to take my medication.	51	49	0	0	0	5.0 (1), 4–5	51	49	0	0	0	5.0 (1), 4–5	None	None
Item 8	I regularly take less medication than prescribed for fear of the side effects to my body.	86	14	0	0	0	5.0 (1), 4–5	86	14	0	0	0	5.0 (1), 4–5	None	None

Item 9	I will miss/not take my medication if no one reminds me to do so.	25	67	8	0	0	4.0 (1), 3–5	25	68	7	0	0	4.0 (1), 3–5	Z = –1.000, p = .317	–0.10
Item 10	I am uncertain about my daily medication doses.	12	74	14	0	0	4.0 (0), 3–5	12	74	14	0	0	4.0 (0), 3–5	None	
Item 11	I am unable to manage my medication intake properly.	12	66	22	0	0	4.0 (0), 3–5	16	66	18	0	0	4.0 (0), 3–5	Z = –2.070, p = .038	–0.21
Item 12	Without support or help from the loved ones, I lack motivation to take my medication as prescribed by the doctor.	27	65	8	0	0	4.0 (1), 3–5	33	63	4	0	0	4.0 (1), 3–5	Z = –3.162, p = .002	–0.32

[a] Wilcoxon signed-rank test used, [b] Identical pre- and post-intervention responses, hence no test statistic could be computed

Table 3: Self-reported medication adherence among RACF residents assessed using the MyMAAT at baseline and post-intervention, and its association with sociodemographic characteristics (n = 100)

Residents' characteristics	All	First visit		p value [a]	Second visit		p value [a]
		Good adherence (Total score ≥ 54)	Moderate and poor adherence (< 54)		Good adherence (Total score ≥ 54)	Moderate and poor adherence (< 54)	
Age group							
60 – 79	44 (44)	29 (65.9)	15 (34.1)	***0.036***	34 (77.3)	10 (22.7)	0.055
≥ 80	56 (56)	47 (83.9)	9 (16.1)		51 (91.1)	5 (8.9)	
Gender							
Male	45 (45)	35 (77.8)	10 (22.2)	0.707	38 (84.4)	7 (15.6)	0.888
Female	55 (55)	41 (74.5)	14 (25.5)		47 (85.5)	8 (14.5)	
Ethnicity							
Malays	41 (41)	31 (75.6)	10 (24.4)	0.939	34 (82.9)	7 (17.1)	0.628
Non-Malays	59 (59)	45 (76.3)	14 (23.7)		51 (86.4)	8 (13.6)	
Diagnosed with diabetes							
Yes	40 (40)	31 (77.5)	9 (22.5)	0.774	32 (80.0)	8 (20.0)	0.253
No	60 (60)	45 (75.0)	15 (25.0)		53 (88.3)	7 (11.7)	
Diagnosed with hypertension							
Yes	61 (61)	48 (78.7)	13 (21.3)	0.431	54 (88.5)	7 (11.5)	0.217
No	39 (39)	28 (71.8)	11 (28.2)		31 (79.5)	8 (20.5)	
Diagnosed with dyslipidaemia							
Yes	6 (6)	5 (83.3)	1 (16.7)	1.000 [b]	5 (83.3)	1 (16.7)	1.000 [b]

No	94 (94)	71 (75.5)	23 (24.5)		80 (85.1)	14 (14.9)	
Diagnosed with a respiratory disorder							
Yes	6 (6)	4 (66.7)	2 (33.3)	0.628 [b]	6 (100.0)	0 (0.0)	0.587 [b]
No	94 (94)	72 (76.6)	22 (23.4)		79 (84.0)	15 (16.0)	
Diagnosed with benign prostatic hyperplasia							
Yes	4 (4)	4 (100.0)	0 (0.0)	0.570 [b]	4 (100.0)	0 (0.0)	1.000 [b]
No	96 (96)	72 (75.0)	24 (25.0)		81 (84.4)	15 (15.6)	
Diagnosed with cardiovascular disease							
Yes	28 (28)	21 (75.0)	7 (25.0)	0.884	24 (85.7)	4 (14.3)	1.000 [b]
No	72 (72)	55 (76.4)	17 (23.6)		61 (84.7)	11 (15.3)	
Diagnosed with depression							
Yes	5 (5)	5 (100.0)	0 (0.0)	0.333 [b]	5 (100.0)	0 (0.0)	1.000 [b]
No	95 (95)	71 (74.7)	24 (25.3)		80 (84.2)	15 (15.8)	
Diagnosed with schizophrenia							
Yes	6 (6)	6 (100.0)	0 (0.0)	0.331 [b]	6 (100.0)	0 (0.0)	0.587 [b]
No	94 (94)	70 (74.5)	24 (25.5)		79 (84.0)	15 (16.0)	
Diagnosed with anxiety disorder							
Yes	5 (5)	5 (100.0)	0 (0.0)	0.333 [b]	5 (100.0)	0 (0.0)	1.000 [b]
No	95 (95)	71 (74.7)	24 (25.3)		80 (84.2)	15 (15.8)	
Diagnosed with renal disease							
Yes	10 (10)	7 (70.0)	3 (30.0)	0.699 [b]	8 (80.0)	2 (20.0)	0.643 [b]
No	90 (90)	69 (76.7)	21 (23.3)		77 (85.6)	13 (14.4)	
Had a history of fall[a]							
Yes	70 (70)	55 (78.6)	15 (21.4)	0.358	61 (87.1)	9 (12.9)	0.372 [b]
No	30 (30)	21 (70.0)	9 (30.0)		24 (80.0)	6 (20.0)	
Using insulin pen							
Yes	12 (12)	9 (75.0)	3 (25.0)	1.000	10 (83.3)	2 (16.7)	1.000 [b]
No	88 (88)	67 (76.1)	21 (23.9)		75 (85.2)	13 (14.8)	
Using inhaler device							
Yes	6 (6)	4 (66.7)	2 (33.3)	0.628 [b]	6 (100.0)	0 (0.0)	0.587 [b]
No	94 (94)	72 (76.6)	22 (23.4)		79 (84.0)	15 (16.0)	

[a] Chi-squared test used
[b] Fisher exact test used

Similarly, no significant differences in adherence levels were observed based on diabetes, hypertension, cardiovascular disease, or other comorbid conditions, including dyslipidaemia, respiratory disorders, benign prostatic hyperplasia, depression, schizophrenia, anxiety disorder, and renal disease (all $p > 0.05$). Adherence was also not significantly associated with history of falls, insulin pen use, or use of inhaler devices at either time point. For instance, at follow-up, 87.1% of residents with a history of falls and 80.0% of those without reported good adherence ($p = 0.372$). Among insulin pen users, 83.3% showed good adherence, compared to 85.2% among non-users ($p = 1.000$).

4.0 Discussion

This study examined the impact of a pharmacist-delivered educational intervention on medication adherence among residents of six RACFs in Muar, Johor. The findings offer valuable insights into adherence behaviors among institutionalized older adults and underscore the potential of individualized, pharmacist-led strategies to improve specific aspects of medication adherence.

Following the intervention, the proportion of residents demonstrating good medication adherence increased from 76% to 85%. This improvement aligns with previous evidence indicating that pharmacist-led interventions can positively influence medication-taking behavior among older adults. A meta-analysis of 40 randomized controlled trials reported a moderate effect size for such interventions (Cohen's $d = 0.57$), with greater effectiveness observed in home or community-based settings that included educational components (14). Similarly, a Malaysian mini-review found that pharmacist-led programs implemented under the MTAC framework were associated with improved adherence, particularly among patients with chronic conditions (15).

Although the magnitude of change in this study was modest, the improvement is noteworthy considering the single-session nature of the intervention and the advanced age of the residents. It is plausible that the structured environment of RACFs contributed to the intervention's effectiveness by supporting behavioral consistency, a factor that has been reported in previous studies on medication administration within institutional settings (6, 7).

Significant improvements were noted in self-reported confidence in managing medication intake (Item 11) and in intrinsic motivation to take medications without external assistance (Item 12). These findings indicate that the intervention was particularly effective in enhancing the sociocognitive dimensions of medication adherence. This is consistent with results from a quasi-experimental study conducted in Turkey, where nurse-led home visits improved self-efficacy and glycemic control among older adults with chronic conditions (20). Additionally, the use of the teach-back method in the present study likely supported greater cognitive assimilation and resident engagement, aligning with evidence from caregiver-based interventions that emphasized problem-solving strategies and personalized education (19).

In contrast, a study conducted in the United States involving cognitively impaired patient-caregiver dyads reported only modest improvements in medication management following the intervention (19). The limited effect may reflect the challenges of addressing adherence among residents with cognitive decline, where proxy engagement is essential and resident autonomy is restricted. While such findings provide a

useful benchmark, the relevance to Malaysia and other Asian settings lies in the different dynamics of care. In many Asian contexts, including Malaysia, family involvement and caregiver participation remain central to medication management, and health literacy levels among residents and caregivers vary widely (18). These sociocultural factors may influence both the receptiveness to pharmacist-led education and the sustainability of adherence gains. By highlighting the responsiveness of sociocognitive dimensions of adherence in this study, our findings contribute to the regional literature and suggest that interventions tailored to strengthen self-efficacy and caregiver engagement may be particularly valuable in Asian RACFs.

Most items in the MyMAAT instrument showed no significant change, with consistently high scores recorded at both time points. This ceiling effect suggests that routine aspects of medication adherence, such as dose timing, refill practices, and concerns about side effects, were already well-managed. This is likely attributable to the structured and supervised environment of RACFs. A similar pattern was observed in a study of community-dwelling older adults in Malaysia, where about 50 percent demonstrated high adherence and reported strong beliefs in the necessity of their medications (9).

However, other studies have reported greater variability in adherence levels among institutionalized populations. For instance, a study involving 258 care home residents in the Klang Valley identified a moderate to high risk of non-adherence, which was associated with concerns about medication harm and overuse (8). These differing findings may reflect heterogeneity in facility types, variations in staff involvement, cultural beliefs about health and medication, and differences in the demographic profiles of study residents.

Medication adherence did not significantly differ by gender, ethnicity, or most clinical comorbidities. This finding is consistent with a national study from South Korea involving 8,651 older adults receiving home health care, which reported minimal influence of demographic factors on adherence levels (22). Notably, the trend toward higher adherence among the oldest residents (aged 80 years and above) in the present study mirrors findings from the Korean cohort, where older age was associated with better adherence. This may reflect heightened health consciousness or increased reliance on structured support systems in advanced age.

In contrast, studies conducted in community and outpatient settings have identified cognitive decline, limited health literacy, and reduced access to healthcare as significant predictors of poor adherence (5, 23). The structured medication management protocols in residential aged care facilities may help to alleviate these barriers. However, such environments may also conceal underlying motivational challenges that are less evident in routine, staff-assisted care contexts.

4.1 Strengths and limitations of study

A notable strength of this study is its focus on a seldom-examined population: older adults residing in RACFs in Malaysia. This demographic is frequently underrepresented in community-based adherence research, despite their increased susceptibility to medication-related problems. By targeting RACF residents, the study addresses a critical evidence gap in geriatric pharmacotherapy. The use of the MyMAAT-12, a culturally adapted and psychometrically validated instrument, contributes methodological rigor

and ensures contextual appropriateness. The multidimensional structure of MyMAAT-12 allowed for the assessment of both behavioral and sociocognitive components of adherence, providing a more comprehensive understanding of the intervention's impact.

The pharmacist-delivered educational intervention, which incorporated the teach-back method, reflects real-world, person-centered clinical practice and aligns with national initiatives promoting pharmacist engagement in medication optimization. Implementation across six RACFs managed by multiple operators enhances the transferability of the findings to similar institutional settings.

The main limitation of this study is its reliance on self-reported adherence data, which may be influenced by recall bias and social desirability, particularly given the face-to-face interview format. Although the MyMAAT-12 instrument has been validated, the absence of objective adherence measures, such as pill counts, pharmacy refill records, or electronic monitoring, limits the ability to verify self-reported outcomes. Furthermore, the study utilized a pre-post design without a control group, which restricts causal interpretation. Although improvements in adherence were observed, the potential influence of external variables, such as changes in routine care or environmental factors, cannot be excluded.

The three-month follow-up period may also be insufficient to determine the long-term sustainability of adherence improvements. Evidence from systematic reviews indicates that the benefits of single-session or one-off educational interventions are often modest and may diminish over time without reinforcement, whereas multi-component or repeated pharmacist-led interventions are more likely to achieve durable effects (24). Given that motivation and self-efficacy can vary over time, extended follow-up is necessary to assess the persistence of intervention effects.

In this study, caregivers and RACF staff were not directly involved in the intervention, which may have limited the reinforcement of key messages between pharmacist visits. Since caregivers are directly involved in medication administration and daily resident care, their active participation could enhance continuity, provide reinforcement between sessions, and address barriers related to motivation and self-efficacy. Future interventions should therefore consider integrating caregivers and staff alongside residents to achieve more sustainable improvements in adherence. Additionally, longer-term follow-up, use of objective adherence measures, and inclusion of more diverse RACFs across different regions would help clarify the durability and generalizability of intervention effects.

Lastly, the study sample that was relatively small and drawn from a single district in Malaysia, which may limit generalizability to RACFs in other regions with differing administrative structures, staffing models, or resident demographics. The exclusion of residents with dementia or insufficient documentation further constrains the applicability of findings to cognitively impaired or more clinically complex populations.

5.0 Conclusion

This study provides evidence that pharmacist-delivered educational interventions can improve medication adherence among older adults in institutional settings, particularly by enhancing self-management confidence and intrinsic motivation. These findings underscore the important role of pharmacists in delivering person-centered care that extends beyond routine medication administration to include

behavioral support. While the structured environment of RACFs likely contributed to high baseline adherence, the addition of targeted education appeared to further strengthen internal drivers of adherence. However, the study's short follow-up period and reliance on self-reported measures limit the ability to evaluate sustained behavior change and objective adherence outcomes. Future research should investigate the long-term effects of repeated or reinforced interventions, evaluate their cost-effectiveness, and incorporate clinical endpoints such as hospitalizations or adverse drug events. Additionally, exploring the contributions of residential care staff and caregivers in supporting adherence may provide a more comprehensive understanding of the institutional factors that influence medication-taking behavior.

Authorship contribution statement

ML: Data analysis, Methodology, Formal analysis, Writing–original draft. **MSAW:** Data analysis, Methodology, Writing – review & editing.

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Conflict of Interest

The authors declare no conflicts of interest related to this study.

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