Original Article

Impact of a Pharmacist Consult Clinic on a Hospital-based Geriatric Outpatient Clinic in Singapore

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Abstract

Introduction: We study the impact of a pharmacist consult clinic on the care of elderly outpatients based on the Health Belief Model that the perceived benefits (improvement in medication knowledge, clinical status and perception) and attached barriers (cost and number of medication and adverse drug reactions) can influence health behaviour (medication compliance). Materials and Methods: A randomised controlled study of 136 eligible patients with risk factors for non-compliance, using Zelen's design, was conducted in a hospital-based geriatric outpatient clinic from November 2001 to June 2002. All patients were assessed for outcome variables at baseline and 2 months later. Results: One hundred and twenty-six patients were included in the intention-to-treat analysis. There were 104 pharmacist interventions with a physician acceptance rate of 76%. There was a significant improvement in medication knowledge with regards to indication (P = 0.03) and the composite dose, frequency and indication score (P = 0.06), as well as a decrease in residual adverse drug reactions that persisted at month 2 and cost avoidance of $387.28 over 2 months. There was no significant difference in perception, clinical status or decrease in number of medications. The intervention group showed an improvement in adjusted compliance (odds ration [OR] = 2.52; 90% confidence interval [CI], 1.09 to 5.83) based on the ordered logistic regression model. Perception of severity of illness at baseline (OR = 1.30; 90% CI, 1.04 to 1.62), number of medication remembering methods (OR = 1.87; 90% CI, 1.08 to 3.25) and the use of routine habits (OR = 4.48; 90% CI, 1.51 to 13.28) and medication aids (OR = 3.68; 90% CI, 1.04 to 13.06) significantly affected compliance. Conclusion: The addition of a pharmacist consult clinic to the management of selected geriatric outpatients can improve compliance, with the attendant benefits of improving medication knowledge, cost avoidance and reducing residual adverse drug reactions.

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Key words: Compliance, Health Belief Model, Medication knowledge, Perception, Zelen's design

Introduction

A general philosophy in the care of elderly patients is to use the least drugs possible to achieve the desired clinical outcome.[1] In the United States (US), however, although patients >65 years old represent only 13% of the total population, they consume nearly 30% of all prescription medications.[2]

Elderly patients are of particular concern for non-compliance from polypharmacy because of the number of medications that they are typically prescribed, and the common deficits in physical dexterity, cognitive skills and memory.[3] Estimates of non-compliance among the elderly vary from 21% to 55%.[1] Col et al[4] reported that 11.4% of hospital admissions were attributable to non-compliance.

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There are no published local studies and only a few Asian studies have examined the issue of poor medication compliance in the elderly.[5-8]

The pharmacist is in an ideal position to assist with medication-related problems. The positive impact of a pharmacist service on outcomes for specific diseases has been demonstrated, such as hypertension, heart failure and anticoagulation therapy.[9] Several overseas trials in the US[10-12] have also demonstrated the benefit of a pharmacist as a "physician enhancer", working in collaboration with the treating physician in the outpatient care of elderly patients with multiple medical problems. These included a reduction in the number and costs of medications, fewer adverse drug reactions (ADRs), variable outcomes on knowledge and compliance, and a reduction in inappropriate prescribing without adversely affecting health-related quality of life.[10-12]

This study aimed to evaluate the impact of a pharmacist consult clinic on health-related outcomes of elderly outpatients in a local setting. A literature search was conducted to identify high-risk groups who would benefit most from such intervention. The outcomes studied were linked by a proposed behavioural model (Fig. 1). In line with the Health Belief Model,[13] we postulate that pharmacist intervention can positively impact on medication compliance (the health behaviour under study) by decreasing the attached barriers (cost and number of medications and ADRs) and increasing the perceived benefits of the health action (via improvement in medication knowledge, clinical status and perception).

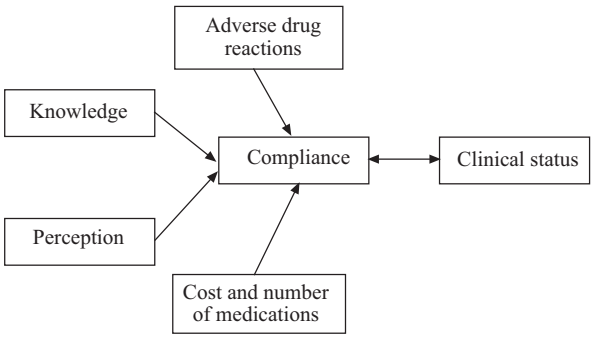

Fig. 1. Outcome variables linked in proposed behavioural model.

Materials and Methods

Study Design and Setting

This prospective randomised controlled trial was conducted in the geriatric medicine outpatient clinic in Tan Tock Seng Hospital from November 2001 to June 2002. Six general clinics ran by geriatricians were designated for the study. Approval was obtained from the hospital ethics committee.

Patients were identified from medical records a day before the scheduled physician clinic visits. They were eligible for the study if they required drug therapy monitoring, had evidence of polypharmacy (operationally defined as taking >3 regularly scheduled medications or >9 doses per day), had documentation of non-compliance, self-administered drugs that require psychomotor skill and co-ordination, were on nasogastric tube feeding, had >1 doctor managing care or were hospitalised within the last 6 months. Patients were excluded if they were stable on follow-up (defined as repeat prescription for $\geq$3 times, each with an interval of at least 2 months), had cognitive impairment but no caregiver to participate in the intervention, had life expectancy of <6 months or if their medications were supervised by other healthcare personnel (including nursing home residents).

All eligible patients were randomly assigned into intervention or control groups using computer-generated numbers and in blocks of 2. As the intervention (and, hence, treatment allocation) cannot be blinded, randomisation was carried out before consent following Zelen's design,[14] as compared to the conventional design of consent-randomisation. This is to minimise the Hawthorne effect in the control group and to reduce disappointment bias, which can significantly affect endpoints such as knowledge, compliance and perception. Consent for interview at month 0 and 2 was obtained by the interviewer (SB or KBK) from all patients, whereas consent for intervention was obtained by the pharmacist (CHN or SL) only from the intervention group participants.

Eligible patients who refused the baseline interview, were deceased or hospitalised at the time of the baseline interview were not enrolled. Enrolled patients and their caregivers were interviewed, prior to the physician consultation, using a structured questionnaire by an independent investigator blinded to the randomisation at the index visit and 2 months later. Those in the intervention arm were then directed by the clinic assistant to the pharmacist consult clinic after the usual physician consultation.

Intervention

The pharmacist consultation was provided by a pharmacist with experience in outpatient care. The duration of each session ranged from 10 to 30 minutes. Each patient was evaluated for medication-related problems by reviewing the medical records, the medication list and by interviewing the patient and caregiver. A medication list review per se was inadequate, as up to 73% of interventions in 1 study[15] required a patient interview to identify the problem. The primary aims were to minimise therapeutic duplications, simplify the regimen, improve the effectiveness of the

regimen and decrease ADRs. A secondary goal was to decrease cost, if this could be accomplished, without adversely affecting the previous goals. The relevant recommendations were then discussed with the patient's primary physician and only those accepted were implemented. In addition, the pharmacist provided counselling on medication knowledge and proper administration (such as inhaler technique and insulin administration) and addressed issues related to disease management, such as ADRs, diet and use of non-prescription medications. Patients identified to be non-compliant were given specific counselling and, where appropriate, non-compliance strategies such as pill boxes, administration tables and labels.

Outcome Measures

The pre-specified primary outcomes were medication knowledge, patient's perception, residual ADRs at month 2, cost avoidance, difference in number of medications and clinical status. The secondary outcome was medication compliance and factors affecting compliance. Medication remembering methods, the number of patient counselling points and interventions, and physician acceptance rate of pharmacist recommendation were also documented. There was training of the interviewers in order to establish standardisation of data collection.

Medication knowledge of dose, frequency and indication was assessed using the composite scores of percentage of correct DFI, dose and frequency (DF) and indication (I) (Table 1). Unlike previous studies that assessed health-related quality of life[16] (such as using the SF-36 questionnaire) or patient satisfaction with the pharmacist service,[10,15] our study examined patient perception instead, as this was felt to have a greater impact on health behaviour as proposed by the Health Belief Model. Perception was assessed by asking patients regarding their perception of severity of their illness, usefulness of treatment and appropriateness of the number of medications, using a Likert scale from 1 to 10 (items 1 and 2a) and by categorised items (items 2b and 3) (see appendix 1).

ADRs were assessed at baseline and month 2 by asking patients if they experience any side effects or unwanted reactions with their medications. Patients who answered "yes" were asked to name the medication involved and to describe the problem that they experienced. Each ADR-drug pair was assessed by the primary physician to ascertain if the patient's symptoms were indeed actual adverse effects of the implicated medication. The reported ADRs at month 2 were also ascertained to see if these were new or residual complaints from baseline.

Cost avoidance was calculated from the accepted recommendations by deducting the cost incurred by pharmacist recommendations from the cost savings of avoided, discontinued or switched medications.[12] The difference in mean number of medications between month 2 and 0 was compared. Clinical status was determined by asking the primary physician to give a global impression of the overall clinical condition of the patients at the end of the second month. Accordingly, the patients were classified as either improved, stable or worsened.

Compliance was assessed by asking if patients forgot to take the medication as directed. This approach was chosen since it replicates the method used in previous medication compliance studies in the elderly.[10] Compliance was then categorised into 3 levels, based on the change in compliance from baseline (Table 2).

Statistical Analysis

Differences in knowledge, compliance and perception (items 1 and 2a) between the intervention and control groups were ascertained using analysis of covariance (ANOVA) models. Items 2b and 3 of perception involving ordinal data were analysed using the H-test.[17] An ordered logistic regression model[18-20] was built to test how intervention, activities of daily living (ADL), recent hospitalisation, person supervising medication, medication remembering methods, baseline knowledge and baseline perception affected the level of compliance. The analysis was repeated using the same covariates, but with a breakdown of the medication remembering methods to determine how they affected compliance.

Table 1. Illustration of Calculation of Knowledge Composite Scores

Drug	Dose (D)	Frequency (F)	Indication (I)
1	Correct	Correct	Correct
2	Correct	Correct	Wrong
3	Correct	Wrong	Wrong
4	Wrong	Correct	Wrong
5	Correct	Correct	Correct

In the above example of a patient on 5 medications,
- % correct DFI = 2/5 x 100 = 40%
- % correct DF = 3/5 x 100 = 60%
- % correct I = 2/5 x 100 = 40%

where DFI: composite dose, frequency and indication score;
DF: composite dose and frequency score

Table 2. Illustration of Derivation of Compliance Categories

Month 0 compliance	Month 2 compliance	Summary
1	2	Least Compliant
2	2	Not Compliant
1	1	} Compliant
2	1	

1: compliant; 2: non-compliant

Chi-square tests were performed to check for differences in categorical data between the intervention and control groups, while *t*-tests or Mann-Whitney *U* tests were used for continuous data, depending on whether the normality assumption was valid.

The data were entered into Excel and exported to Stata 6.0 for analyses. The level of significance was set at 10% a priori. An intention-to-treat approach was utilised and, thus, all enrolled patients were retained in the analysis.

Sample size and power calculations were carried out based on the results of a pilot study.[21] Sixty patients were required in each arm to achieve a power of 80% to detect a 10% difference between the 2 groups in the knowledge outcome of DFI.

Results

Of the 136 eligible patients who were randomised, 10 were excluded because they refused baseline interview, were hospitalised or deceased at the time of the baseline interview (Fig. 2). Of the 126 patients enrolled, 13 patients in each arm did not complete the study due to hospitalisation, refusal of the second-month interview and loss from follow-up, yielding a dropout rate of 20.6%.

At baseline, there was no significant difference between the groups in terms of demographics, medication knowledge and compliance (P >0.1) (Table 3). However, the intervention group was more likely to visit other doctors regularly (P = 0.08). The most common, as well as number of, medication remembering methods were comparable between the 2 groups, although more patients in the intervention group relied on taking medications according to mealtimes (P = 0.06). In addition, a greater percentage of control subjects were totally dependent in ADL,

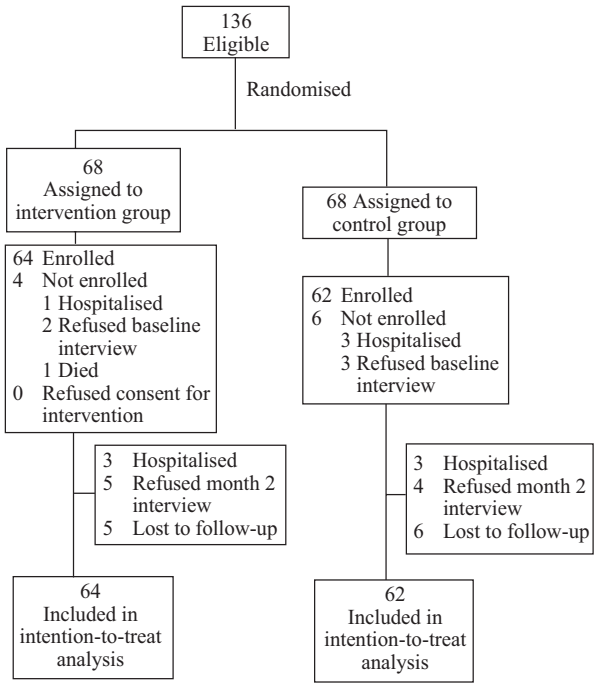

Fig. 2. Study profile.

Table 3. Baseline Characteristics of Enrolled Population

Variable	Control group (n = 62)	Intervention group (n = 64)
Age (mean ± SD)	80.5 ± 8.1	79.6 ± 7.7
Female (%)	69.4	60.9
Race (%)		
Chinese	83.9	73.4
Malay	6.5	6.3
Indian	6.5	12.5
Others	3.2	7.8
Impaired cognition (%)	21.0*	20.3*
ADL status (%)		
Independent	40.3	50.8
Partially dependent	30.6	30.2
Totally dependent	29.0*	19.0*
Visits other doctors regularly (%)	17.7	31.3
Hospitalised in last 6 months (%)	43.5	46.9
Median baseline medications (range)	7 (3-10)	6 (3-16)
Number of medication remembering methods (%)		
0	3.2	6.3
1	43.5	48.4
2	45.2	35.9
3-4	8.1	9.4
Type of medication remembering methods (%)		
Memory	46.8	32.8
Routine habit	30.6	32.8
Reading labels	33.9	28.1
According to mealtimes	6.5	17.2
Memory aids	19.4	18.8
Others	11.3	12.5
Median baseline knowledge (range)		
DFI	72.7 (0-100)	65.1 (0-100)
DF	100.0 (33.3-100)	100.0 (0-100)
I	80.0 (0-100)	76.4 (0-100)
Baseline compliance (%)	82.3	71.9
Ensure medications are taken correctly (%)		
Self	19.7	30.6
Self with supervision	14.8	16.1
Caregiver	65.6	53.2
Caregiver relationship (%)		
Family	53.2	69.0
Maid	46.8	28.6
Others	-	1.1

* These patients required caregivers to ensure that their medications are taken correctly.

ADL: activities of daily living; DFI: dose, frequency and indication; DF: dose and frequency; I: indication

corresponding to the greater proportion of caregivers ensuring correct medication consumption in the control group. The caregivers were mainly domestic helpers in the control group, compared with family members in the intervention group. This highlights the importance of correctly identifying the caregiver supervising medication-taking as the key target for pharmacist intervention.

Altogether, there were 104 patient counselling points and 41 interventions (Table 4). The physician acceptance rate of the interventions was 76%. Physicians were more likely to accept recommendations with regards to discontinuing medication without indication (35.5% versus 10%), addition of indicated medication (12.9% versus 0%) and drug duplication (12.9% versus 0%), and were less likely to accept recommendations of cost considerations (3.2% vs 40%). There was cost avoidance of S$387.28 over 2 months. The reduction in the mean number of medications was not statistically significant ($P = 0.11$).

Using the ANOVA models, the intervention group demonstrated an improvement in medication knowledge compared to the control group. There was a statistically significant improvement in the composite DFI score ($P = 0.06$) and I score ($P = 0.03$), but not the DF score ($P = 0.4$). There was no difference in change in perception from baseline with regards to severity of illness ($P = 0.8$), usefulness of medications (ANOVA, $P = 0.7$; H-test, $P = 0.9$) and number of medications (H-test, $P = 0.7$).

The intervention group had more reported ADRs at baseline and at the second month (Table 5). However, the residual ADR complaints decreased in the intervention group compared to the control group (30.7% vs 50%). Therefore, the higher incidence of reported ADRs in the second month in the intervention group was due to newly reported ADRs (9 vs 2). The seemingly better correlation of reported to actual ADRs in the intervention group (44.4% versus 0%) could be entirely due to chance, owing to the small numbers in the control group.

Although the overall clinical status was not statistically significant ($P = 0.23$), there were more patients with improved clinical status in the intervention group at the second month (Table 6). However, this result should be interpreted judiciously as a greater proportion of the control subjects had poorer premorbid status at baseline.

The unadjusted compliance improved in the intervention group, although this was not statistically significant (odds ratio [OR] = 1.50; 90% confidence interval [CI], 0.73 to 3.08). The proportional-odds model in Table 7 showed that intervention significantly improved compliance (OR = 2.52; 90% CI, 1.09 to 5.83) after adjusting for ADL status, hospitalisation in the last 6 months, person ensuring medications, the number of medication remembering methods, baseline knowledge and baseline perception. As such, one may interpret that the odds of poorer compliance versus good compliance were 60% higher for patients in the control group. An increase in the number of medication remembering methods (OR = 1.87; 90% CI, 1.08 to 3.25) and perception of greater severity of illness (OR = 1.30; 90% CI, 1.04 to 1.62) were significant predictors of good compliance. There was a trend towards increased

Table 4. Summary of Pharmacist Interventions

Variable	No.	(%)
Pharmacist counselling (n = 104)		
Use of medication	51	(49)
Disease state	23	(22)
Reported adverse drug reaction	14	(14)
Diet	9	(9)
Insulin administration	2	(2)
Ryles tube	2	(2)
Inhaler technique	3	(3)
Non-compliance management (n = 36)		
Counselling	16	(44)
Pill box	11	(31)
Administration table	4	(11)
Label	5	(14)
Therapeutic intervention (n = 41)		
Cost consideration	1	(20)
Discontinue medication	11	(92)
Addition of medication	4	(100)
Inappropriate dose/frequency/duration	7	(70)
Nasogastric tube substitution	2	(67)
Duplication	4	(100)
Others	2	(67)
Total number (%)	31	(76)
Cost savings from interventions		
Cost savings	S$427.91	
Cost incurred	S$40.63	
Net cost savings	S$387.28	

Table 5. Reported ADRs

	Month 0	Month 2	
Group		Total (Residual)	Actual to total ADR among newly reported ADRs (%)
Control	8	6 (4)	0/2 (0)
Intervention	13	13 (4)	4/9 (44)

ADRs: adverse drug reactions

Table 6. Clinical Status at Month 2

Group	Worsen	Stable	Improve
Control (%)*	9.6	80.8	9.6
Intervention (%)*	15.1	66.0	18.9

* $P = 0.23$

Table 7. Predictors of Compliance Based on Oredered Logistic Regression Model

Variable	OR	90% CI	*P*
Pharmacist intervention*	2.52	1.09-5.83	0.07
Activities of daily living status	1.41	0.76-2.64	0.36
Not dependent			
Dependent			
Hospitalisation in last 6 months	2.3	0.98-5.37	0.11
No			
Yes			
Medication-taking			
Caregiver	-	-	-
Self	1.87	0.64-5.44	0.34
Self with supervision	0.45	0.13-1.62	0.31
Number of medication remembering methods	1.87	1.08-3.25	0.06
Baseline knowledge, indication	0.99	0.98-1.01	0.42
Baseline perception, illness severity	1.30	1.04-1.62	0.05
Baseline perception, too many medications	0.43	0.17-1.06	0.13

CI: confidence interval; OR: odds ratio

* Pharmacist intervention, unadjusted OR = 1.50 (90% CI, 0.73-3.08); *P* = 0.36

compliance (*P* >0.1) in patients who were dependent in ADL, hospitalised in the last 6 months, perceived that the number of medications was appropriate and taking medications on their own without supervision. A re-run of the analysis with a breakdown of medication remembering methods found routine habits (OR = 4.48; 90% CI, 1.51 to 13.28) and use of medication aids (OR = 3.68; 90% CI, 1.04 to 13.06) to be statistically significant in improving compliance. The assumption of proportional odds was not violated for the above-mentioned models.

Discussion

Previous trials have demonstrated the benefit of a pharmacist working as a "physician enhancer" in the outpatient care of elderly patients with multiple medical problems.[9-12,15] However, the benefit on compliance has been inconsistent. Our pilot study[21] of 40 patients failed to demonstrate a benefit in compliance in the intervention group despite an increase in knowledge, reduction in number of medications and cost savings. In a randomised controlled trial involving elderly patients attending a general non-subspecialised Veteran's Geriatric Clinic,[10] pharmacist intervention reduced inappropriate prescribing and adverse drug effects, but did not improve compliance. Jameson et al[11] also failed to demonstrate a benefit in compliance despite reduction in medication number and cost savings.

The lack of a clear-cut association between medication outcomes and compliance[8,10,11,21] highlights the complex interplay of factors that can result in definitive health actions consistent with compliance. Haynes et al[22] defined compliance as "....the extent to which a person's behaviour (including the taking of medications) coincides with medical advice". This behavioural approach to compliance finds its basis in the Health Belief Model, which states that the likelihood of taking a health action is determined by the perceived vulnerability and susceptibility to disease, as well as the perceived benefits and barriers/costs of such an action.[13] Health Belief Model variables together accounted for 52% of the variance in self-reported medication-taking behaviour among diabetics in one study.[23]

In our study, the pharmacist consult clinic was able to improve compliance in high-risk elderly outpatients with multiple medical problems. This could be attributed to the attendant benefits of improved medication knowledge, cost avoidance and a reduction in residual ADRs predicted in our hypothesis. In addition, the pharmacist interventions could have a positive impact via other factors in the Health Belief Model that were not explicitly measured in our study, such as cues to action, medication aids and other medication remembering methods.

Unlike previous studies which emphasised on reducing medication-related problems,[10-12,15,16] our study included specific strategies targeted at improving compliance and counselling on disease state and medications. As revealed in the logistic regression analysis, an increase in the number of medication remembering methods and perception of greater severity of illness were significant predictors of good compliance in the intervention group. In addition, unlike other large studies involving a diverse group of pharmacists with varied training, practices and intensity of interventions,[24] we were able to provide a standardised and targeted intervention via 2 pharmacists. Also, we took into account baseline compliance by measuring a change in compliance, rather than just comparing the self-reported compliance at month 2 alone.[10,11]

Poor recall of medication regime is significantly associated with poor compliance.[25] Hence, it is crucial that there is specific behavioural intervention aimed at improving medication remembering methods. The logistic regression model revealed that the benefit of intervention on compliance increased in those with more medication remembering methods. Among the different methods, routine habit and use of medication aids were the most significant in improving compliance. The impact of taking medication according to mealtimes was also reported in a Japanese study.[8] Thus, pharmacist intervention should aim to enhance compliance by increasing the number of medication remembering methods and, where appropriate, to focus on the use of medication aids or to link medication-taking to routine habits and mealtimes.

Our study was unable to demonstrate a benefit in the DF score in the intervention group, despite a significant improvement in knowledge with regards to I and composite DFI scores. This observation is interesting as it suggests that many patients in the study population were taking their medications in the prescribed dose/frequency without knowing what the medications were for. This is a potential area for intervention, as an increased understanding of medication indication is likely to enhance the perception of medication usefulness and, in turn, compliance.

We were unable to demonstrate a benefit with regards to perception. This could be due to the high baseline perception score, lack of sensitivity of our simple questionnaire which resulted in a ceiling effect, or the intervention was not targeted enough to influence perception. For example, patient education should seek not just to impart knowledge, but also to favourably improve patient perception of the vulnerability to disease, severity of illness and the benefit of treatment. However, it should be recognised that certain perceptions represent deeply ingrained and long-held views and cultural perspectives that may not be amenable to education alone.

Lamb et al[26] reported that informing patients of potential side effects, prior to starting a new medication, does not lead to an increased incidence in these and should not be a reason for healthcare providers to avoid warning patients of them. In our study, while pharmacist intervention decreased the number of residual ADRs at month 2, there was a greater number of newly reported ADRs at month 2, albeit with a greater correlation of reported to actual ADRs compared to the control group (44.4% versus 0%). This could be due to heightened awareness resulting from patient education.

Although there was an overall improvement in clinical status in the intervention group, this was not statistically significant. This is not unexpected, as the clinical status in elderly patients with multiple comorbidities is subject to other factors such as baseline status and progression of disease. Hence, it may only be partially influenced by medication use. In addition, the short follow-up of 2 months and limitation of the global impression method compared with disease-specific measures may be contributory. Nonetheless, it is noteworthy that the reduction in number and cost of medications was achieved without adversely affecting the clinical status.

The observed difference between the intervention and control groups may have been diminished by the Hawthorne effect, in which physicians may have changed their clinical behaviour as a result of being observed.[11] Some physicians whose patients received a consult may have transferred the principles from the consult to a control patient. In addition, the observed benefits may arguably be augmented in a more homogeneous group of less frail elderly who did not require supervision in their medications. This was suggested by the logistic regression analysis that patients taking medications on their own were more compliant. Lastly, it is conceivable that the choice of a geriatrician-run clinic may also result in an underestimation of the impact of intervention. This is because geriatricians are familiar with polypharmacy, drug interactions and elderly care, and are able to function as a single-attending physician handling multiple medical problems, thus limiting the need for multiple physician involvement.[27]

Our study has its limitations. It lacked an objective method, such as pill count, to confirm the veracity of self-reported compliance. Nonetheless, self-report is a reliable method used in previous trials[10,11] with demonstrated reliability and validity;[28] direct measures of blood, serum and urine specimens are not feasible. Moreover, pill counts overestimate compliance increasingly as compliance with the prescribed regimen decreased,[29] and home visits are often required to ensure the completeness and accuracy of pill count. In addition, it is unclear whether the benefits will persist if followed up over a longer period, and whether there is a dose-response relationship[24] between the number of clinical pharmacist contacts and improvement in the various outcomes. The large number of outcomes investigated limited our ability to explore the findings in greater depth.

Future local studies should involve a more homogeneous study population (such as elderly patients taking medications on their own without supervision by caregivers) and focus on the in-depth study of perception factors affecting compliance and predetermined meaningful patient outcomes, such as health-related quality of life. They could evaluate the effectiveness of such clinical pharmacist interventions for specific conditions that are very sensitive to medication optimisation (such as congestive cardiac failure) and utilise disease-specific measures. Studies specifically examining the impact of pharmacist interventions on the Health Belief Model using condition-specific health belief indices should also be considered. Finally, the economic implications of such pharmaceutical care programmes need to be studied using either formal cost effectiveness or cost-benefit methodology.

In conclusion, our study suggests that the addition of a pharmacist consult clinic to the management of high-risk geriatric outpatients can result in improved compliance, with the attendant benefits of improving medication knowledge, cost avoidance and reducing residual ADRs. It is also important to focus on patient's perception and specific compliance strategies, such as improving medication-remembering methods in the intervention.

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Appendix I: Items For Assessing Patient's Perception

1. In your perception, how severe do you think is your illness?

Not severe									Very severe
1	2	3	4	5	6	7	8	9	10

2. With regards to the medications you are taking, how helpful do you think they are to your illness?
   a. Very helpful
   b. Slightly helpful
   c. Not helpful

Not helpful at all									Very helpful
1	2	3	4	5	6	7	8	9	10

3. In your perception, do you think you are taking too many medicines?
   a. Too many medicines
   b. The number of medicines is just right
   c. Too few medicines

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