

## Polypharmacy and Inappropriate Medication Use in Singapore Nursing Homes

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### Abstract

**Introduction:** At present, 7.2% of the population in Singapore is in the geriatric age group, which will increase to 18.4% in the year 2030. The frailest segment of the geriatric population live in nursing homes. They suffer from multiple co-morbidities requiring multiple medication use. Polypharmacy and inappropriate medication use have been considered as quality indicators for nursing home care. As no data of these indicators are available in Singapore, this study was planned to assess the prevalence of polypharmacy and inappropriate medication use in Singapore nursing homes. **Materials and Methods:** A total of 454 residents in the geriatric age group residing in 3 randomly selected nursing homes were involved in the study. Case notes were reviewed for demographic information, clinical history and medication use. The data were analysed for polypharmacy (5 or more medication orders) and inappropriate medication use (based on established criteria). **Results:** Residents were on an average of 5.32 medications. Polypharmacy and inappropriate medication use were seen in 266 (58.6%) and 318 (70.0%) residents, respectively. There was significant association between polypharmacy and inappropriate medication use [ $P < 0.001$ ,  $\chi^2 = 82.56$  at 95% confidence interval (CI)]. The most common medication-related problems were the use of medication without proper indication (n = 302), significant potential for adverse drug reactions (n = 281) and drug interactions (n = 141). **Conclusion:** The prevalence of polypharmacy and inappropriate medication use is high in Singapore nursing homes. Current practice of medication use in the nursing homes may lead to significant adverse drug reactions and drug interactions. A multidisciplinary approach involving geriatricians, nursing home physicians, nurses and pharmacists may potentially reduce polypharmacy and inappropriate medication use in Singapore nursing homes.

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### Introduction

The elderly usually have multiple medical problems, requiring prescription drugs to treat diseases and to prevent complications arising from them. Currently, in the United States, those who are 65 years and older (geriatric age group) make up 13% of the total population but consume 33% of all prescription drugs. In the year 2040, 25% of the American population are projected to be in the geriatric age group and are expected to consume 50% of all prescription drugs.<sup>1</sup> In the year 2000, 7.2% Singaporeans were in the geriatric age group and is projected to increase to 18.4% in the year 2030.<sup>2</sup> No data on medication use by our elderly population are available but similar trends to those seen in North America can be expected.

The elderly use more medications than any other age group.<sup>3</sup> This high rate of drug use has been attributed in part to the accumulation of disease with ageing.<sup>4</sup> It is not surprising that nursing home residents receive more medications than the community dwelling elderly.<sup>5,6</sup> A study on 1106 residents in 12 nursing homes of a large city in the US showed that residents are on an average of 7.2 medications.<sup>7</sup> An average nursing home resident in the US uses 6 different medications and more than 20% of them use 10 or more different drugs.<sup>8</sup> Consequently, concerns about the quality of medication prescriptions for elderly residents in the nursing homes have been raised in several studies.<sup>9-11</sup>

Polypharmacy and inappropriate medication use lead to

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adverse drug events (ADEs), defined as an injury from a medication. ADEs occur in 14.6% to 35% of the geriatric population, depending on the population setting and measure employed for their identification.<sup>12-14</sup> The annual incidence of ADEs in the United States is 26 per 1000 hospital beds.<sup>15</sup> The incidence of adverse drug reaction (ADR) increases from 10% in those between 40 and 50 years of age to 25% in those above age 80.<sup>16</sup> It has been estimated that in American nursing homes, for every dollar spent on medication, \$1.33 in healthcare resources is utilised for drug-related morbidity and mortality.<sup>17</sup> The nursing home residents are the frailest segment of the geriatric population,<sup>18</sup> using the highest number of medications compared to the non-institutionalised elderly.<sup>5</sup> Not surprisingly, they have the highest risk for an ADE.<sup>19,20</sup>

Due to the widespread concerns raised about the high rate and quality of medication usage in older people, Beers et al<sup>18</sup> developed explicit criteria to determine potentially inappropriate medication use in nursing home residents. The Healthcare Financing Administration (HCFA\*) considers unnecessary drug use as a clinical quality indicator for American nursing homes.<sup>21</sup> Involvement of consultant pharmacists is a federally mandated requirement for all nursing homes in the US to avoid polypharmacy and inappropriate medication use.<sup>22</sup>

No data are currently available about the prevalence of polypharmacy and inappropriate medication in the Singapore nursing home population.

### Objective

This study sets out to investigate the prevalence of polypharmacy and the extent of inappropriate medication use in Singapore nursing homes, and to further explore ways whereby the quality of care provided in these healthcare facilities can be enhanced.

## Materials and Methods

### Study Population

Three nursing homes run by voluntary welfare organisations in various parts of Singapore were randomly selected for the study. There were a total of 512 residents in the 3 homes and 454 of the residents were included in the study. Those aged less than 65 years were excluded (n = 58).

### Data Collection

Casenotes were reviewed for information about each resident's age, sex and functional category\*\* on the basis of the criteria set out in the standard resident assessment form for application to the nursing homes in Singapore. The clinical diagnoses recorded in the casenotes were not further verified.

A pharmacist and a geriatrician reviewed the medication list for routine and as required (PRN) medication orders.

*Polypharmacy and inappropriate medication use:* For the purpose of the study, polypharmacy was defined as an order of 5 or more medications per resident including routine and as required (PRN) orders. Appropriateness of the medications were determined by using the explicit criteria developed by a panel of experts in the US<sup>23</sup> and adopted by HCFA as an indicator for quality of care provided in American nursing homes. Those medications, not specified in the explicit criteria, were further analysed for their appropriateness in the geriatric population on the basis of 8 drug-related problem categories (Table I) developed by Strand et al.<sup>24</sup> The Geriatric Dosage Handbook was used as the standard reference.<sup>25</sup>

### Data Analysis

The SPSS program was used to analyse the data to determine the prevalence of polypharmacy and inappropriate medication use. Pearson's chi-square test was used to assess the association between polypharmacy and inappropriate medication use.

## Results

The mean and median age of the participants was 80 years. Of the 454 residents studied, 303 (66.7%) were female and 151

Table 1. Categories of Drug Related Problems

Problem	Description
Drug use without indication	The resident is taking a drug for no medically valid documented indication
Adverse drug reaction	The resident has a medical problem that is the result of an adverse drug reaction or adverse effect
Drug interactions	The resident has a medical problem that is the result of a drug-drug interaction
Overdose or sub-therapeutic dose	The resident has a medical problem that is treated with too much or too little of the correct drug
Duration of treatment	The resident is receiving drug treatment for longer period of time than clinically indicated, e.g. antibiotics started for acute infection is continued without any indication because there was no stop date written in the prescription
Untreated condition	The resident has a medical problem that requires drug therapy but is not receiving a drug for that condition
Clinical contraindication	Use of a drug which is contraindicated for the resident because of existing medical problems
Therapeutic duplication	Use of multiple drugs with similar pharmacological effect when single drug is adequate

\* Healthcare Financing Administration (HCFA): Presently known as Centre for Medicare and Medicaid Services, is a US federal government agency which runs Medicare programme, a healthcare benefit programme for elderly age  $\geq 65$  years

\*\* Functional Category I-IV: In Singapore, Resident Assessment Form (RAF) for nursing home residents measures the need of care for the resident on the basis of the measurement of their functional and cognitive ability. Those who score  $< 6$  are functional category I, score of 7-24 is functional category II, score of 25-48 is functional category III and score  $> 48$  is functional category IV. Functional category IV residents are completely dependent for all aspects of care.

(33.3%) were male. Sixty (13.2%) residents were in functional category II, 249 (54.8%) residents were in functional category III and 145 (31.9%) residents were in functional category IV. A total of 2408 medications were prescribed for 454 residents; of which, 2102 were routine orders and 306 were as required (PRN) orders. The residents were on an average (mean) of 5.32 medications.

Polypharmacy was found in 266 (58.59%) residents; of which, 189 (71%) were female and 77 (29%) were male. On the basis of functional category, polypharmacy was noted in 34 (13%) residents in functional category II, 149 (56%) residents in functional category III and 83 (31%) residents in functional category IV.

Based on the defined criteria outlined in the methodology section, inappropriate medication use was seen in 318 residents (70.04%); of which, 220 (69%) were female and 98 (31%) were male. Forty (12%) residents were in functional category II, 167 (53%) were in functional category III and 110 (35%) were in functional category IV. For the residents on inappropriate medications, an average of 2.30 inappropriate medications was prescribed per resident (range, 0 to 7). Of all the residents on inappropriate medications, 252 (80%) residents received these medications routinely, 20 (6%) residents received them on an “as required” (PRN) basis and 46 (14%) residents received both routine and PRN medications.

The case records were reviewed in relation to the prescribed medications and a number of common problems were observed. There was no written documentation of the clinical indication for its use in 302 (12.5%) medications. The potential for ADRs was noticed in 281 (11.7%) medications. Risk of drug-drug interaction was observed in 141 (5.8%) medications. Eighty-two (3.4%) medications were given in inappropriate dosage for the geriatric age group. Duration of treatment was longer than what was clinically indicated in 37 (1.5%) medications.

There was a significant association between polypharmacy and inappropriate medication use [ $P < 0.001$ ,  $\chi^2 = 82.56$  at 95% confidence interval (CI), Pearson's  $\chi^2$  test].

The prevalence of commonly prescribed medications was also examined (Table II). Commonly prescribed medications included cardiovascular medicines (19.6% or 473/2408 prescriptions), psychoactive medicines (13.9% or 335/2408 prescriptions) and sedating anti-histamines (4.7% or 112/2408 prescriptions). One hundred and fifty-seven patients (34.5% or 157/454 patients) were on 2 or more of these medications that may be associated with an increased risk of falls. Other commonly prescribed medications included gastrointestinal drugs (14.2% or 343/2408 prescriptions), vitamins or nutritional supplements (15.9% or 382/2408 prescriptions) and analgesics (6.4% or 154/2408 prescriptions).

## Discussion

The prevalence of polypharmacy is high (58.59%) in our study population which is comparable to the findings of several American studies.<sup>7,8</sup> However, compared to these

Table 2. Prevalence of Commonly Observed Medication Use in the Study Population

Class of medications	Subclass	Total use	Inappropriate use	
		n	n	%
Cardiovascular n = 473 (19.6%)	ACE inhibitors	55	4	7
	Beta-blockers	53	19	35.8
	Ca+ channel blockers	108	37	34.2
	Diuretics	50	17	34.0
	Others	207	30	14.4
Psychoactive n = 335 (13.9%)	SSRI	114	6	5.2
	Other antidepressants	4	3	75.0
	Antipsychotics	137	67	48.9
	Sedatives	80	31	38.7
Gastrointestinal n = 343 (14.2%)	Laxatives	221	13	5.8
	H2 blockers	77	40	51.9
	PPI	14	10	71.4
	Antacids	23	5	21.7
	Others	8	5	62.5
Vitamins and supplements n = 382 (15.9%)	Vitamins	332	145	43.6
	Iron	50	19	38.0
Antihistamines n = 112 (4.7%)	Sedating antihistamines	112	96	85.7
Musculo-skeletal symptomatic relief n = 154 (6.4%)	NSAID	55	34	61.8
	Acetaminophen	87	1	1.2
	Codeine	12	12	100

American studies,<sup>7,8</sup> the prevalence of inappropriate medication use was significantly higher (70.04%) in Singapore nursing homes. The use of medications that may cause recurrent falls,<sup>26</sup> e.g. sedating antihistamine, cardiovascular and psychoactive medication, was also high in this study population. Since the majority of the residents on these medications were in functional category III, they would potentially be at risk for hip fractures and other injuries<sup>27,28</sup> which may lead to complete functional dependence and further deterioration in the quality of life.

Significant use of h2 blockers and vitamins without appropriate clinical indications was observed, which may raise the cost of care<sup>17</sup> and contribute towards polypharmacy.

The most common prescription-related problem was the lack of documentation of the clinical indication in the casenotes. Three hundred and two medications were deemed inappropriate for this reason. A number of medications were prescribed on an “as required” (PRN) basis and were served to the residents at the discretion of the non-physician staff of the nursing homes. Documenting the indication for medications, especially those to be served as required (PRN), would further limit unnecessary medication use in nursing home residents.<sup>9</sup> Other common medication-related problems, such as the potential for ADRs and drug-drug interactions, are common dilemmas amongst the complexities of geriatric pharmacology. The unique features of the institutional setting make pharmacotherapy a particular challenge for physicians who

care for the nursing home residents. Adequate training and education programmes for these physicians could reduce ADRs and drug interactions in the nursing homes.<sup>29,30</sup> Inappropriate dosing can also change a safe drug into an unsafe one.<sup>31</sup> In this study, 80 medications were prescribed in dosages that were not considered to be appropriate for the geriatric population. This further illustrates how vigilant one must be in order not to overlook the fact that standard medication doses may be inappropriate for frail older patients with compromised drug elimination abilities. A “start low and go slow” guideline for all medication orders would be potentially useful for the nursing home population.

Several measures may reduce polypharmacy and inappropriate medication use in the nursing homes. A new medication should be prescribed only when it is necessary. An appropriate diagnosis should be recorded for each medication prescribed. There would need to be more vigilance in the selection of medications so as to avoid potential drug-drug and drug-disease interactions. When patients are transferred from acute hospitals, all medications should be reviewed for appropriate clinical indications. Regular medication review by trained physicians to discontinue unnecessary medications could also reduce polypharmacy and inappropriate medication use in the nursing homes.<sup>32</sup> These strategies, however, may require greater specialist input into the medical assessments within the nursing homes and may have resource implications. Other novel strategies adopted in other countries include clinical pharmacists working in collaboration with physicians to ensure appropriateness of the medication orders.<sup>33</sup>

## Conclusion

The study showed a high prevalence of both polypharmacy and inappropriate medication use in the nursing homes studied. There was significant association between polypharmacy and inappropriate medication use. Current prescribing practices resulted in medication use without appropriate clinical indications, increased the potential for ADRs and drug interactions. The use of a multidisciplinary approach involving geriatricians, nursing home physicians, nurses and pharmacists could potentially reduce polypharmacy and inappropriate medication use in Singapore nursing homes.

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