INNOVATIONS TO IMPROVE MEDICATION USE APPROPRIATENESS AMONG ELDERLY NURSING HOME RESIDENTS IN SINGAPORE

YAP KAI ZHEN

(B.Sc.(Pharmacy)(Hons.), NUS)

A THESIS SUBMITTED

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF PHARMACY

FACULTY OF SCIENCE

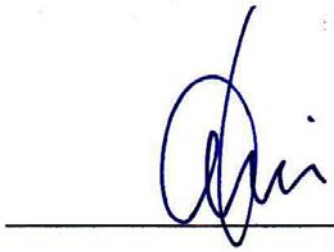
NATIONAL UNIVERSITY OF SINGAPORE

2012

DECLARATION

I hereby declare that this thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.



Yap Kai Zhen

17 September 2012

ACKNOWLEDGEMENTS

This work would not have been possible without the support of many. I would like to express my deepest gratitude to all, with special mention of the following persons.

To my academic supervisor, Assistant Professor Joyce Lee Yu-Chia (Department of Pharmacy, NUS) who provided invaluable guidance in the area of pharmacotherapy among many other areas and whose patience and selflessness had also been more than enough to sustain me throughout the course of this work.

To my academic co-supervisor, Associate Professor Chan Sui Yung (Department of Pharmacy, NUS), for sparking my interest in the work to improve medication use appropriateness among elderly nursing home residents and for providing the opportunity for me to explore new ideas. Her approachability, generosity with time and resources, willingness to share insights, and infectious optimism had been instrumental to the successful completion of the work in this thesis.

To my academic supervisor, Ms. Tan Mui Ling (Department of Pharmacy, NUS) whose wealth of experience in pharmacy practice pointed the way in approaching clinical research and solving logistical problems.

To my external collaborator, Professor Kua Ee Heok (Department of Psychological Medicine, NUHS) who played a pivotal role in the success of the PUM program with his words of wisdom, invaluable time and counsel, sharing of expertise without any reservations, and generous opportunities. His words of encouragement mean a lot to me.

To the executive directors and nursing managers from the various nursing homes, namely Mr. Victor Seng, Ms. Belinda Soo Guat Ling, Mr. Albert Fernandez, Ms. Tan Ai Suan, Mr. Michael Foo, Mr. Raymond Tan, Ms. Lina Ma, Mdm. Low Mui Lang and their staff for their support and participation in the research projects.

To Dr. Feng Lei (Research Fellow, Department of Psychological Medicine, NUHS) who helped with the inter-rater reliability validation of the APP scale.

To research assistants Ms. Kong Chiou Mee and Ms. Melanie Siaw Yee Lee and the students, Jasmeet Singh, Loo Li Wen, Selina Cheong, Edwina Beverly Liew, and Tung Hsui Tzu who took the Undergraduate Research Opportunities Program in Science and Final Year Projects (Department of Pharmacy, NUS) for their meticulous assistance in some parts of the data collection and entry.

Last, but not least, my parents Mr. and Mrs. Yap Ah Eng, spouse Dr. Wilson Chew and daughter Elizabeth, for their understanding and support, and my friends and colleagues who provided cheer and administrative support during my candidature.

I hereby also acknowledge the funding from the NUS Virtual Institute for the Study of Ageing (VISA) Grant, NUS Start-up Grant for Dr. Joyce Lee and the Ministry of Education (MOE) Research Scholarship to support my PhD studies.

TABLE OF CONTENTS

SUMMARY

Prescribing, the first and major decision-making stage in the medication use process, has the greatest potential to produce health benefits or cause harm. However, prescribing for the elderly is challenging, especially for medically frail elderly nursing home residents (NHRs). It was hypothesized that innovations of inter-professional collaborative practice that leverage on the pharmacists' role as an "advocator" of appropriate medication use may improve prescribing appropriateness (PA) and outcomes of NHRs.

In this thesis, two such practices, namely, the Pharmacist-Led Education on Appropriate Drug-use (PLEAD) program and the Psychotropic Use Monitoring (PUM) program were developed, implemented and evaluated (reported in Chapters 3 and 4 respectively) for their impact on reducing inappropriate prescribing/use of laxatives and antipsychotics identified from the retrospective cross-sectional background study conducted in four NHs (reported in Chapter 2) and optimizing related clinical outcomes among elderly NHRs in Singapore.

The PLEAD program, spearheaded by pharmacists, engaged the nursing staff (NS), physicians and key administrators in behavioral changes to improve the appropriateness and outcomes of laxative use by NHRs. A set of recommendations (iPURGE) was thus developed and communicated via a workshop and "Dear Healthcare Professional Letter". The non-randomized controlled study in two NHs to evaluate PLEAD's impact showed significant increases in the number of laxative prescriptions altered and bowel frequencies of residents in the intervention NH. The dosing of laxatives was optimized, with a benefit of reducing the time needed for medication administration by the NS. In addition to PLEAD, the Algorithms for Appropriate Laxative Use (AALU), a new PA instrument that addresses the "under-

prescribing" and "under-use" of laxatives for regular and when-needed use, was developed; validation of AALU using laxative use data of 24 NHRs suggested its potential in facilitating timely retrospective medication use evaluations and prospective use as a guide for prescribing/administering laxatives.

The PUM program synergized the expertise of the pharmacist, nursing staff (NS) and physicians to monitor the use of antipsychotics and other psychotropics to manage behavioral and psychological symptoms of dementia (BPSD). After receiving training from the pharmacist, the NS in one NH dementia ward used the newly developed Assessment for Psychotropic Prescriptions (APP) scale for PUM and provided timely feedback to the psychiatrist, who then adjusted the doses of psychotropics for the residents. From the before-and-after pilot study, the average daily doses of antipsychotics, residents' psychological symptoms, and adverse events decreased after PUM implementation; positive changes in the psychiatrist's antipsychotic-related prescribing decisions and the NS's perceptions towards BPSD management, psychotropic side effects monitoring and caregiving stress were also reported. In addition to PUM, feasibility study of computer games as a diversional therapy to manage BPSD and reduce inefficacious use of antipsychotics (as a secondary effect) was piloted, with encouraging results (Chapter 5); a new criteria (JACLY) was developed and used to select suitable computer games for this purpose.

Future work is needed to evaluate the sustainability, cost-effectiveness and feasibility of these innovative collaborative practices involving pharmacists on the use of these and other medications within NHs/other care settings in Singapore and elsewhere.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AALU	Algorithm for Appropriate Laxative Use
ACOVE	Assessing Care of Vulnerable Elders
ADE	Adverse drug event
ADR	Adverse drug reaction
AE	Adverse event
APP scale	Assessing Psychotropic Prescriptions scale
ATC	Anatomical Therapeutic Chemical
BNF	British National Formulary
BPSD	Behavioral and psychological symptoms of dementia
DRP	Drug-related problem
ECAQ	Elderly Cognitive Assessment Questionnaire
ED	Emergency department
EPSE	Extra-pyramidal side effects
GEQ	Game Experience Questionnaire
GRD	Gastro-oesophageal reflux diseases
iPURGE	Acronym that represents the contents of PLEAD workshop
ICD	International Classification of Diseases
IP	Inappropriate prescribing
JACLY criteria	Jasmeet and Chan Lee Yap criteria
LS	Life Satisfaction
MAI	Medication Appropriateness Index
MUE	Medication Use Evaluation
NAI	Neuroleptic Appropriateness Indicator
NBO	Nil bowel output

NH	Nursing home
NHR	Nursing home resident
NPI	Neuropsychiatric Inventory
NS	Nursing staff
OR	Odds ratio
PA	Prescribing appropriateness
PCNE	Pharmaceutical Care Network Europe
PDRM	Preventable drug-related morbidity
PLEAD program	Pharmacist-Led Education on Appropriate Drug-use program
PUM program	Psychotropic Use Monitoring program
RAF	Resident Assessment Form
RCC	Residents identified with chronic constipation
RnCC	Residents identified with no chronic consipation
SD	Standard deviation
SE	Side effect
STOPP	Screening Tool of Older Persons' Prescriptions
WHO	World Health Organization

Chapter 1

Introduction and Literature Review

1.1 Medication use process in the nursing homes (NHs)

Medication use is a central aspect of medical care for most elderly persons, for the treatment of acute (e.g. antibiotics) or chronic conditions (e.g. blood sugar lowering medications), prophylaxis or secondary prevention (e.g. antiplatelets), and symptom relief or palliation (e.g. painkillers). Based on a medication safety guideline published by the Ministry of Health in Singapore, regardless of the purpose of medication use, the processes involved in medication use can be summarized in general as four inter-related and continuous stages, namely "prescribing", "supply", "administration" and "monitoring" (Figure 1.1).[1]

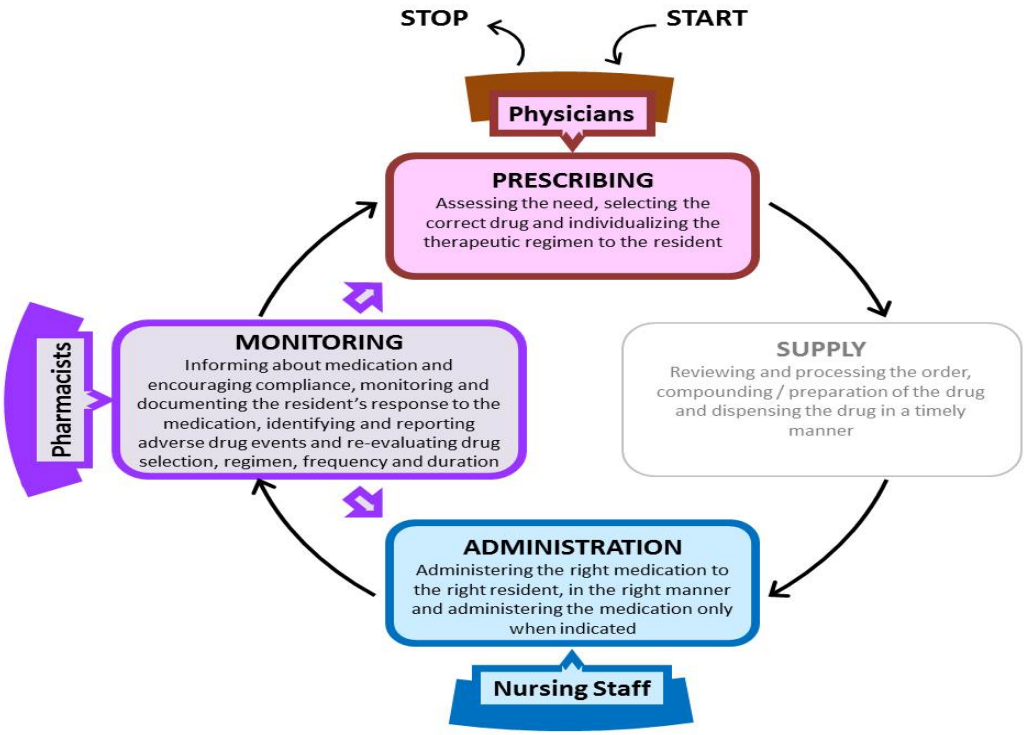


Figure 1.1 Medication use process in the NHs in Singapore
The medication use stages that take place predominantly within the confines of a NH in Singapore are "Prescribing", "Administration" and "Monitoring". "Supply" of medications usually takes place at a pharmacy outside the confines of the NH. A visiting pharmacist's role is to provide "monitoring" at the NHs, [2] which interventions can influence the "administration" (by nurses) and the "prescribing" (by physicians to start, continue, switch or stop the use of medications) stages of the medication use process.

In the NH in Singapore, while the "supply" of medications often take place at a pharmacy outside the confines of the NHs, the responsibility of the visiting pharmacist in "monitoring" is to provide "periodic (at least six monthly) review of the individual resident's (NHR's) medical, medication records and prescriptions to evaluate his/her progress towards achieving therapeutic outcomes and to ensure that his/her drug therapy is appropriately indicated, effective, safe and convenient".[2] The pharmacist's interventions can, therefore, influence medication use at the "administration" stage by the nurses and "prescribing" stage by the physicians (Figure 1.1).

1.2 Caveats of prescribing for the elderly

Prescribing for individuals in this population group are often complex decisions, compounded by issues of age-related pharmacokinetic and pharmacodynamic changes, polypharmacy, increased co-morbidities, aged heterogeneity, and the lack of evidence-based prescribing information due to under-representation of elderly in clinical trials and inadequacies in disease-specific clinical guidelines.[3-5] Hence, the focus on appropriate prescribing has become a cornerstone in the practice of geriatric pharmacotherapy.[6] Clinical and epidemiological research with the aim to improve prescribing appropriateness (PA) among the elderly has also become indispensable,[7] in view of the concerns about increased costs[8] and safety issues[9] related to inappropriate prescribing (IP).

1.3 Defining and measuring PA

In its fundamental pharmacological sense, the term PA implies the attainment of maximum health benefits with minimal risks from a chosen pharmacological

therapy.[10, 11] However, based on this definition, it would be difficult to derive a standard measure of appropriateness as patient outcomes often vary widely; this is due to the complexity of case mix in the elderly and other issues (such as patient's choice, social expectations, ethics, cost and quality of life) that may influence prescribing. Hence, PA has been more comprehensively defined as "the outcome from a process of decision-making that maximizes net individual health gains within society's available resources".[12]

Besides simply being "appropriate" or "inappropriate", inappropriateness in prescribing (or medication use in general) can be categorized as: (1) over-prescribing (overuse of medication), (2) mis-prescribing (misuse of medication), and (3) under-prescribing (underuse of medication). Extending from the definitions of the problem categories in healthcare quality,[13] over-prescribing can be defined as the prescribing of more medications than clinically indicated. Likewise, mis-prescribing can be defined as the incorrect use of a medication (which include incorrect choice of medicine, dose, mode of administration, duration of therapy, or the presence of drug interactions, inadequate monitoring, and unjustified cost) when an indication is present; and under-prescribing can be defined as the omission of medication use when it is indicated, where such an omission would be deleterious to the patient's health. From these definitions, "inappropriate" prescribing implies mistakes in planning actions. Hence, it may also be likened to being part of the knowledge-based and rule-based classification of "medication error".[14]

Tools for assessments of PA can be (1) used to identify gaps in achieving optimal medication use,[15, 16] (2) incorporated as part of interventions that aim to improve medication use and its outcomes,[17-19] or (3) applied as outcome measures in clinical studies.[20] Ideally, comprehensive PA assessment tools should address all

types of IP described above.[21] Over the past two decades, numerous instruments which contain lists of prescribing quality indicators[22] for the assessment/measurement of the PA in the elderly population were developed, modified and updated. Those instruments that were developed for use in any setting or specifically in the NH setting were identified from PUBMED, using a combination of keywords "prescribing", "elderly", "measure", and "appropriateness". Citations in relevant publications identified from the search were also reviewed manually. Instruments that were developed for use specifically in the hospital in-patient[23-26] and community[27, 28] were excluded. The results were summarized in Table 1.1, which was recently updated to include instruments published after year 2008.

Table 1.1 Instruments for assessing PA among elderly NHRs

Country	Year Published	Instrument	Prescribing Inappropriateness Categories Assessed			Indicator Type		Type of Measures	
			Over-	Mis-	Under-	Explicit	Implicit	Process	Outcome
USA	**1991**, 1997, 2003, 2012	Beers Criteria[29-32]	✓	✓		✓		✓	
	1992, 1994	MAI[33, 34]	✓	✓		✓	✓	✓	
	2002	PDRM[35]	✓	✓		✓		✓	✓
	2004, 2007	Medication Quality Indicators *(ACOVE project)*[36, 37]	✓	✓	✓	✓		✓	
UK	**2002**	NAI[38]	✓	✓		✓		✓	
	2003	PDRM[39]	✓	✓		✓		✓	✓
	2003	Nursing Home Prescribing Indicators[40]	✓	✓		✓		✓	
Republic of Ireland	**2008**	STOPP [41, 42]	✓	✓		✓		✓	
Canada	**1997**	IP for Elderly People[43]		✓		✓		✓	

ACOVE = Assessing Care of Vulnerable Elders; MAI = Medication Appropriateness Index; NAI = Neuroleptic Appropriateness Indicator; PDRM = preventable drug-related morbidity; STOPP = Screening Tool of Older Persons' Prescriptions.

PA can be measured by explicit or implicit prescribing quality indicators,[11] from the perspective of the prescribing "process", or its "outcomes". Among the

instruments listed in Table 1.1, those which contain "explicit" indicators are usually drug or disease-oriented and are derived from published literature and expert opinions. Although these can be easily applied in settings where little patient information is available, they do not allow for situational flexibility as they may not be able to address all pharmacological issues and clinical scenarios, nor do they account for non-pharmacological factors such as the patient's and surrogate's wishes.[44, 45] In addition, these instruments may become quickly obsolete and irrelevant if not updated periodically with new clinical evidence.[46] Hence, these may also be time-consuming and costly to maintain.

Conversely, "implicit" indicators allow the assessor to employ his/her clinical judgment on available patient information and clinical recommendations to measure PA. These indicators usually focus on the individual elderly person rather than on a specific drug or disease, and thus, may account for complex mix of patient factors and external factors that may influence prescribing. However, the use of "implicit" indicators such as the Medication Appropriateness Index (MAI)[33, 34] is time-consuming, and may have low inter-rater reliability as its use depends on the users' knowledge and attitudes.[47] For example, differences in users' attitudes towards prescribing of analgesics for patients who are not able to verbally communicate pain,[48] deciding on the dose and duration of long-term active treatment for chronic illness in frail elderly,[49] and determining the need for pharmacological agent to manage behavioral problems among institutionalized elderly with dementia[50] may give rise to different "appropriateness", and hence influence the reliability of MAI among different users.

"Process" indicators refer to elements/rationale to be considered during the decision-making process of prescribing. "Outcome" indicators refer to the effect of

the prescribing decision on the patient (i.e. NHR). Assessments of PA based solely on "process" measures would not be able to link the process's impact to patient outcomes. On the other hand, assessments based on "outcomes" measures alone would not elucidate the underlying causes of IP or process areas for improvement. Hence, evaluations of PA should include both "process" and the "outcomes" measurements.[51-53] To date, only MacKinnon *et al*.[35] and Morris *et al*.[39] attempted to marry both "process" and "outcomes" measurements in an instrument. However, the two teams' disagreement on a single explicit criteria set emphasized the lack of a consensus on what was considered a drug-related morbidity[54] and its preventability.[55]

Further to this, a review of original publications that reported the prevalence of IP measured using PA instruments (published from 1998 to 2008) in the NH setting was performed in PUBMED using MeSH terms "inappropriate prescribing" and "nursing home". The reference lists of review articles of this topic identified from the search were also reviewed manually to identify additional publications. Among the nine studies identified (Table 1.2), only two evaluated the relationship between the use of Beers criteria medications[30] and adverse events (AEs) of all-cause hospitalization, emergency department (ED) visit and/or death.[56-58] Although significant associations were reported by Lau *et al*. and Perri *et al.*, the predictability of actual adverse drug events (ADE) from the use of inappropriate medications remain elusive,[59] as numerous others,[60-65] did not find significant associations between AEs and IP in the NH and other care settings.

Table 1.2 Prevalence of IP and adverse outcomes among NHRs in the NH setting (1998 – 2008)

PA Instru-ment Used	Country	Study Site (Sample Size)	Data Period (Year)	Prevalence of IP		Prevalence of Adverse Outcomes	
				(%)	Associated NHR Factors	(%)	Association with IP
Beers Criteria (1997)	Singapore[66]	3 NHs **(454)**	PP	70.0	**Presence of polypharmacy** ($p < 0.001$)[a]	-	**Not assessed**
	USA[56, 57]	NH data from 1996 Medical Expenditure Panel Survey **(3,372)**	1 yr (1996)	50.3	**Medicaid coverage** [OR = 1.39 (1.09 to 1.59)[b]]		
					Non-dementia mental disorders [OR = 1.40 (1.07 to 1.82)[b]]	31.6[c]	[OR = 1.27 (1.09 to 1.47)[b]]
					Communicative problems [OR = 0.69 (0.57 to 0.84)[b]]	18.8[d]	[OR = 1.28 (1.05 to 1.55)[b]]
					< 5 medications [OR = 0.23 (0.19, 0.29)[b]]		
					5-8 medications [OR = 0.46 (0.37, 0.56)[b]]		
	USA[58] *Georgia*	15 NHs **(1,117)**	3 mths (2002)	46.5	**Dementia** [OR = 0.75 (0.56 to 0.99)[b]]	46.5[e]	[OR = 2.34 (1.61 to 3.40)[b]]
					Total number of medications [OR = 1.14 (1.11 to 1.17)[b]]		
	USA[67] *Kansas*	Medicaid recipients in NHs **(1,164)**	1 yr (2000-2001)	38.0	**not reported**	-	**Not assessed**
	USA [68] *Kentucky*	Medicaid recipients in NHs **(20,573)**	1 yr (1996)	33.2	**not reported**	-	**Not assessed**
	USA[69] *Kansas, Maine, Mississippi, New York, South Dakota*	1,492 NHs **(44,565)**	1 yr (1995-1996)	31.0	**Female gender** [OR = 1.0 (1.1 to 1.2)[b]]	-	**Not assessed**
					4 to 5 medications [OR = 1.7 (1.6 to 1.9)[b]]		
					6-8 medications [OR = 2.4 (2.2 to 2.6)[b]]		
					≥ 9 medications [OR = 3.5 (3.2 to 3.8)[b]]		
					Admitted from hospital [OR = 1.2 (1.1 to 1.3)[b]]		
					Moderate cognitive impairment [OR = 0.7 (0.6 to 0.7) [b]]		
					Severe cognitive impairment [OR = 0.6 (0.5 to 0.6)[b]]		
	Canada[70] *Ontario*	National Databases **(58,719)**	1 yr (2001)	2.26	**not reported**	-	**Not assessed**
Beers Criteria (2003)	Finland[71] *Helsinki*	All NH **(1,987)**	1 mth (2003)	34.9	**No dementia** ($p = 0.001$)[a]	-	**Not assessed**
					Taking psychotripics ($p < 0.001$)[a]		
					Taking ≥ 9 medications ($p < 0.001$)[a]		
Beers Criteria (2003) and STOPP	Ireland[72]	1 NH **(87)**	PP	24.1	**not reported**	-	**Not assessed**
				43.7	**not reported**		

mth = month; yr = year; PP = point prevalence; yo = years' old.
Only statistics that were significant with $p < 0.05$ were reflected.
[a] chi-square test.

[b] 95% confidence interval.
[c] adverse outcome = hospitalizations.
[d] adverse outcome = death.
[e] Adverse outcomes include hospitalizations, ED visits, and death.

Among the studies which directly examined incidents of probable adverse drug reactions (ADRs) and/or events among elderly NHR,[73-77] antipsychotics (8.3% to 22.8%), diuretics (7.5% to 20.8%) and warfarin (7.5% to 15%) were repeatedly reported as the top medications implicated. In addition to identifying the commonly implicated medications, inappropriateness in the prescribing and monitoring stages of the medication use process were also identified by Gurwitz *et al*. to be the major contributory factors towards ADEs in this elderly population, over medication errors in the supply, storage and administration stages.[76, 77] Hence, not only is prescribing the first and major decision-making step in the medication use process, it has been shown to have the greatest potential to produce health benefits or to cause harm.[78]

In another study by Budnitz *et al.*, which evaluated the incidents of ADEs-related ED visits among older adults in general, Beers criteria-defined inappropriate medications were found to be implicated in only 8.8% of the total 4492 incidents.[79] This is a far cry compared to the top single medications implicated, namely warfarin (17.3%) and insulin (13.0%). Interestingly, antipsychotics were not among the top medications implicated in ADRs among the elderly in general. This could be related to antipsychotics' common use among elderly NHR, to manage behavioral and psychological symptoms of dementia (BPSD).[73, 80, 81]

In summary, to achieve optimal pharmacotherapy outcomes, it is imperative to ensure PA. Although instruments for measuring PA are available, each has their limitations and inadequacies in predicting clinically significant adverse outcomes. In addition, interventions that aim to improve clinical outcomes among the elderly NHRs

may be more effective from targeting issues related to all aspects of inappropriate drug use (i.e. overuse, misuse, and underuse) in specific drug groups or diseases/conditions, instead of the focus on the general reduction of IP spelled out in these instruments. However, the use of these instruments in medication use evaluation (MUE) studies[82] may highlight gaps in achieving optimal medication use and issues related to specific drug groups or diseases/conditions for interventions.

1.4 Improving PA – the role and potential impact of pharmacists in medication management in Singapore NHs

The main role of the pharmacist is providing pharmaceutical care, which is defined as "the responsible provision of drug therapy to achieve definite outcomes that are intended to improve a patient's quality of life".[83] Having a professional education that focuses on pharmaceutical expertise and development of pharmacists' clinical roles in various healthcare settings, pharmacists are, therefore, in the prime position to promote and support the safe, effective and rational use of medications, to improve PA and its outcomes.[84-86] Furthermore, long-term care facilities such as NHs presents ideal opportunities for timely and comprehensive drug regimen reviews.[7] The physical confines of an institution may also bring the prescriber, nursing staff (NS), other health care providers and the pharmacist into close proximity of each other, and allow greater communications and support for each other to achieve optimal pharmacotherapy and continuity of pharmaceutical care for the elderly NHRs. In countries such as the USA and Australia, pharmacist-led medication reviews for the elderly residing in long-term care facilities have been mandated,[87, 88] and have undergone rigorous federal-funded research to evaluate its impact.[89, 90]

A literature search was conducted (during January 2009) in PUBMED using the keywords "intervention studies", "intervention", "medication", "prescribing", and "nursing homes" (entered as a MeSH term) to identify interventions published during 1998 to 2008 that aimed to reduce IP in the NHs. The publications included for discussion were those that reported changes in medication use/prescribing or prescribing appropriateness as the primary outcome measure of the intervention, with comparisons to a control or baseline estimates. The reference lists of review articles (that described nursing home interventions) identified from the search were also reviewed manually for additional publications. As various study designs may be employed to evaluate interventions of different nature, no attempts were made to judge the quality of the studies. All publications that met the inclusion were reported and compared descriptively. Table 1.3 summarized the interventions that aimed to reduce inappropriate prescribing in general while Table 1.4 summarized those that aimed to reduce inappropriate prescribing of specific pharmacological group/agent.

It was interesting that nationally mandated drug use reviews by pharmacists/surveyors for inappropriate prescribing in NHs did not show significant differences in inappropriate prescribing compared to assisted living facilities without the mandatory "audit".[91] Specifically, although the presence of guidelines may promote safe, rational, and effective medication use, its impact on actualizing reductions in inappropriate prescribing may be limited.[92, 93] Among the other interventions aimed to reduce inappropriate prescribing in general (Table 1.3), six out of nine were pharmacist-led medication reviews.[94-99] Of these, four studies measured and reported high prescribers' acceptance (59.8 to 91.6%) to the recommendations made on NHRs' medication regimen.[94-96, 99] Pharmacists' reliability and performance in medication review were also highly valued by the physicians and nurses as reported

by Schmidt *et al.*[100] and Lapane *et al.*[101] In addition, pharmacists were also shown to be a valuable asset in multi-discipline case-conferencing, contributing 42.3% of all 92 recommendations implemented.[102] By comparison, the use of a clinical decision support system during computerized physician order entry reported only a modest increase in likelihood among the prescribers (relative risk = 1.11, 95% CI = 1.00 to 1.22) to take appropriate actions when prompted by an electronic alert.[103] The same intervention was further reported in another study to have no effect on reducing ADE rate or preventable ADE rate, possibly related to alert burden.[104] In summary, pharmacists improve PA. Although the use of technology may improve operational efficiency, the presence of pharmacists seemed to engender a greater effect in prescribing behavior change, and may be indispensable.[105]

Table 1.3 Interventions that aimed to reduce IP in the NHs (1998 – 2008)

Intervention Type	Health Profession Involved	Study Design	Dura-tion	PA Instru-ment Used	Outcomes Measured (results)		
					Prescriber's Response	Medication	Clinical
Drug use review[91] *Nationally mandated "audit" (CMS's 1999 policy for explicit criteria drug reviews)*	**Pharmacist**	CT	4 yrs	Beers Criteria [a]	Not assessed	- Changes of inappropriate drug use	Not assessed
Medication review[99] *(North Carolina Long-Term Care Polypharmacy Initiative) Review potential drug therapy problem alerts, provide recommendation (using Toolkit developed) and provided follow-up*	**Pharmacist**	CT	6 mths	Beers Criteria [a]	- Accepted 59.8% of 6,360 recommenda-tions	- Alert persistence (reduced in 2 of 5 alert categories compared to control) - Relative cost-reduction ($57.12 per resident)	Not assessed
Medication review[94] *Review conducted within 28 days + consultation with the patient and carer*	**Pharmacist**	RCT	6 mths	nil	- Accepted 75.6% of 747 pharmacist recommenda-tions - Implemented 58% of 747	- Medication changes (more in intervention group) - Number of medication	- Falls (fewer in intervention group) - GP consults - Hospital stay - Deaths

Intervention Type	Health Profession Involved	Study Design	Dura-tion	PA Instru-ment Used	Outcomes Measured (results)		
					Prescriber's Response	Medication	Clinical
					pharmacist recommenda-tions	- Cost of medication	- Barthel score - MMSE score
Medication review[95, 106] *Review conducted at the beginning of intervention phase, with follow-up at 3 weeks*	**Pharmacist**	CRCT	4 mths	nil	- Accepted 91.6% of 261 pharmacist recommendati ons - Implemented 55.2% of 261 pharmacist recommenda-tions	- Medication changes - Drug and non-drug costs (decreased from baseline in intervention group)	- MMSE score - GDS score - BASDEC score - CRBRS score (increased from baseline in intervention group) - Accidents and falls - Deaths (fewer in intervention group)
Medication review[107] *One-off review by NH physicians for systematic review of repeat prescriptions + discussion with senior member of staff (nursing)*	**Inter-professional collaborative practice**	Before-and-after study	1 visit *(3-hr)* per NH	nil	- 65% residents had prescriptions altered	- Number of repeat prescriptions per resident (reduced compared to before) - Projected saving	Not assessed
Case conferencing[108] *2 case conferences held 6-12 weeks apart, attended by the NHR's GP, geriatrician, NS, pharmacist*	**Inter-professional collaborative practice**	CRCT	3 mths	MAI[b]	- All 27 GP attended the first case conference - 26 GP attended the second case conference	- MAI score (lower in intervention group) - Drug cost (higher in intervention group)	- Deaths - NHBPS score
Case conferencing[102] *Case conference attended by GP, clinical pharmacist, senior NS, and other health professionals*	**Inter-professional collaborative practice**	CT	1 mth	nil	- 70% of participating GP gave positive comments - 42.4% of 92 implemented recommenda-tions were from pharmacists	- Changes in number and cost of medications prescribed/ad ministered (lesser in intervention group)	Not assessed
Medication review + case conferencing[96] *Medication review, followed by case conference with GP and NS*	**Pharmacist**	Before-and-after study	12 mths	MAI[b]	- Accepted 67.8% of 115 pharmacist recommenda-tions	- MAI score (reduced after intervention)	Not assessed
Multifaceted pharmacist intervention[97] *Medication review, education, communications,*	**Pharmacist**	CRCT	12 mths	nil	Not assessed	- Medication use (lesser in intervention group)	- Deaths

Intervention Type	Health Profession Involved	Study Design	Dura-tion	PA Instru-ment Used	Outcomes Measured (results)		
					Prescriber's Response	Medication	Clinical
and case conference with NS							
Transfer coordination from hospital[98] *Medication reconciliation and review within 10 to 14 days of transfer, followed by case conference with physicians within 14 to 28 days of transfer*	**Pharmacist**	RCT	8 wks	MAI[b]	Not assessed	- MAI score (worsened in control group)	- ADE - Falls - Worsening mobility - Worsening behavior - Increased confusion - Hospital stay - Worsening pain (less in intervention group)
CPOE system with CDSS[103] *Alerts of inappropriate orders during entry of medication order*	**Not applicable**	CRCT	1 yr	nil	- Prescribers were 1.11 times more likely to take appropriate action upon receiving alerts	Not assessed	Not assessed

Only significant results were included in the table.
CT = non-randomized controlled trial; BASDEC = Brief Assessment Schedule Depression Cards; CDSS = clinical decision support system; CPOE = computerized physician order entry; CRCT = cluster-randomized controlled trial; CRBRS = Crichton-Royal Behaviour Rating Scale; GDS = Geriatric Depression Scale; GP = general physician; MMSE = Mini-Mental State Examination; mth = month; RCT = randomized controlled trial; SMPA = Swedish Medical Product Agency; wk = week; yr = year.
[a] Used as part of intervention.
[b] Used as outcome measure.

The identified interventions summarized in Table 1.4 included those that targeted changes in the prescribing/use of antibiotics,[109-111] drugs for fracture prevention,[112] calcium and vitamin D supplements,[113] non-steroidal anti-inflammatories,[114] drugs for treatment of cardiovascular conditions,[115] psychotropics,[116-121] hypnotics,[122] benzodiazepines,[92, 123] and antipsychotics.[124-126] Most of these interventions involved educational interventions[109-114, 121, 122, 124, 125] and were multi-disciplinary in nature.[109, 110, 112-114, 116, 118, 120, 122, 124, 125] Similar to the interventions listed in Table 1.3, most of these reported minimal change in clinical

outcomes measured.[109-112, 114, 115, 117] By contrast, fewer interventions had pharmacists' involvement,[113, 116, 118, 120-122, 124] none involved the use of any PA instruments listed in Table 1.1, and five interventions did not elicit positive changes on medication use.[92, 112, 117, 121, 126] Furthermore, the only medication review by external physician specialists[115] with a reported acceptance rate of 47.5% of the recommendations on NHRs' medication regimen was lower compared to those reported in Table 1.3. In contrast with the use of federal medication use guidelines,[92] the presence of a triplicate prescribing policy resulted in lower amounts of benzodiazepines used in NHs;[123] however, no clinical outcomes in relation to this change in benzodiazepine use was assessed. Pharmacists are therefore needed to improve PA,[86] and to engage other healthcare professionals in the active sharing of knowledge and development of specific approaches to prevent or minimize IP of specific drug groups for certain diseases/conditions which cannot be addressed adequately by the use of general PA instruments[127] or general guidelines aimed at reducing inappropriate prescribing.[92, 93]

Table 1.4 Interventions in the NHs that targeted specific drug group or disease / condition with outcomes that measure changes in medication use (1998 – 2008)

Target Drug Groups / Condition	Year Publish-ed	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	Clinical
Antibiotics[111]	2007	**Education** *Distribution of antibiotic guide via mail*	CRCT	**Physicians**	Larger decrease in non-adherence of prescribing to antibiotic guide	No change
Antibiotics[109]	2005	**Education** *Small group + academic detailing*	CRCT	**Inter-professional collaborative practice** *P + NS*	Fewer antimicrobial prescribed for suspected UTI	No change
Antibiotics[110]	2001	**Education** *Small-group*	RCT	**Inter-professional collaborative practice** *P + NS*	Higher prevalence of prescribing antibiotics according to guidelines	No change
Anti-epileptic & anti-parkinsonian	2002	**Medication Review** *Pharmacist conducted*	RCT	**Inter-professional**	44.4% *(epilepsy cohort)* & 30.3%	Decrease in ADL

Target Drug Groups / Condition	Year Publish-ed	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	Clinical
medication[120]		*medication review to identify problems, recommendations were then made after discussion in a multi-speciality group and communicated to residents' physicians through a letter*		**collaborative practice** *P + Ph + Pharmacolo-gist + Neurologist*	*(parkinson's cohort)* of recommendations were implemented. No changes in number of regular medications.	score in interventi on group *(parkinso n's cohort)*
Antipsychotics[124]	2008	**Education + Clinical follow-up**	Single group prospective study	**Inter-professional collaborative practice** *P + NS + Ph*	Reduced antipsychotic use	Reduced behavior scores
Antipsychotics[126]	2007	**Structured non-pharmacological intervention**	Single group prospective study	**Nurses**	**No change in antipsychotic use**	Reduced behavior scores
Antipsychotics[125]	2006	**Education + Clinical follow-up**	CRCT	**Inter-professional collaborative practice** *P + NS*	Reduced antipsychotic use	Reduced behavior scores
Benzodiazepines [92]	2001	**Federal guidelines**	Before-and-after study	**Not specified**	**No change in benzodiazepine prescribing and chronic use**	Not assessed
Benzodiazepines [123]	2001	**Triplicate Prescription Policy**	Cross-sectional comparison	**Not specified**	Reduced benzodiazepine use	Not assessed
Calcium and Vitamin D Supplements[113]	2006	**Education + Clinical follow-up**	Before-and-after study	**Inter-professional collaborative practice** *Medical director + Ph*	Significant increase in multivitamin, calcium and Vitamin D supplementation	2 of 11 residents achieved goal of 25-OHD > 30ηg/ml.
Cardiovascular drugs[115]	2003	**Medication review**	RCT	**Physician specialists**	47.5% of recommended drug therapy changes were accepted by physicians	No change
Hypnotics[122]	2001	**Audit-feedback education** *Distribution of hardcopy education materials*	Before-and-after study	**Inter-professional collaborative practice** *P + NS + administrator*	Reduced benzodiazepine use	Not assessed
NSAIDs[114]	2001	**Education** *30-minute training sessions for nurses, teleconferencing and letters to physicians, distribution of hardcopy algorithm, and active inquiry to discontinue NSAIDs*	CRCT	**Inter-professional collaborative practice** *P + NS + administrator*	Decreased NSAIDs use, increased paracetamol use	No change
Psychotropics[118]	2008	**Improving documentation and inter-disciplinary communication**	Before-and-after study	**Inter-professional collaborative practice**	25% of residents had recommendations to adjust	Not assessed

Target Drug Groups / Condition	Year Published	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	**Clinical**
		A questionnaire is completed biyearly and as-needed for all residents at family conference meetings (attended by family member, nurse, and social worker), for subsequently discussion with interdisciplinary team on recommendations for psychotropic use		*P + NS + Ph + administrator + social worker*	psychotropics; lower prevalence of antipsychotic, anxiolytic, and cholinesterase inhibitors used; higher prevalence of hypnotics and memantine used; no changes in antidepressant use	
Psychotropics[117]	2005	**Screening program**	RCT	**Not applicable**	**No change in psychotropic use**	No change
Psychotropics[121]	2005	**Education** *Provided (1) academic detailing to P, (2) education session to facility PH & NS, (3) distributed copies of algorithm on non-pharmacological approaches for managing agitation and appropriate guidelines for psychotropic drug use in long-term care*	CT	**Pharmacist**	Increase in prevalence of antipsychotic use after intervention; Prevalence of antipsychotic use in control was higher at all time points measured	Not assessed
Psychotropics[119]	2003	**Audit-feedback** *Mailing of individually generated reports on outcomes (with comparison to average NHs) of 6 quality care measures (incl. psychotropic use) to NH administrators*	CT	**Not applicable**	Reduced psychotropic use	Not assessed
Psychotropics[116]	1998	**Case conferencing** *Monthly meeting on NHRs' drug use*	CRCT	**Inter-professional collaborative practice** *P + NS + Ph*	Reduced prescribing of psychotropics	Not assessed
Fracture prevention[112]	2007	**Audit-feedback education** *Using teleconferences, academic detailing, and distribution of hardcopy educational materials*	CRCT	**Inter-professional collaborative practice** *P + NS*	**No significant increase in bisphosphonate prescribing and use of hip protectors**	No change

UTI = urinary tract infection; CRCT = cluster-randomized controlled trial; CT = non-randomized controlled trial; P = physicians; Ph = pharmacists; RCT = randomized controlled trial.

The same literature search was also re-visited recently to identify articles published after 2008; these are summarized in Tables 1.5 and 1.6. Comparing the interventions aimed to reduce IP published before (Table 1.3) and after 2008 (Table 1.5), there seemed to be an increase in physicians' and nursing staff's involvement in recent publications. Conversely, comparing the publications identified before (Table 1.4) and after 2008 (Table 1.6), pharmacists' involvement as part of an inter-professional team or as the primary profession was more apparent in more recently published interventions that targeted specific drug groups or disease / condition. However, the clinical outcomes of many of these interventions remain to be modest or under-evaluated.

Table 1.5 Interventions that aimed to reduce IP in the NHs (2009 - current)

Intervention Type	Health Profession Involved	Study Design	Dura-tion	PA Instru-ment Used	Outcomes Measured (results)		
					Prescriber's Response	Medication	Clinical
IP tool[128] *NS identified IP using a modified Beers criteria, notified physicians verbally, and provided f/u in 2 mths when necessary*	**Nursing staff**	Before-and-after study	4 mths ; 1 yr f/u	Beers Criteria [a]	Not assessed	- IP post intervention (reduced, RR = 0.2 [0.06, 0.5][c]) - IP at f/u from baseline (reduced, RR = 0.3 [0.1, 0.7][c])	Not assessed
Medication review[129] *(North Carolina Long-Term Care Polypharmacy Initiative) reported in earlier publication*[99]	**Pharmacist**	CT	9 mths	Beers Criteria [a]	Reported in earlier publication[99]	- Number of clinical initiative alerts per resident (reduced) - Drug-cost savings	- Relative risk for hospitalization (reduced in matched cohort with retrospective review only)
Medication review[130] *(Fleetwood Model) Prospective medication review, direct communication with prescriber, patient assessment, document care*	**Pharmacist**	CT	2 yrs	Beers Criteria [a,b]	Reported in earlier publication[101]	- Rates of inappropriate medication use	- Rates of hospitalization and mortality

Intervention Type	Health Profession Involved	Study Design	Dura-tion	PA Instru-ment Used	Outcomes Measured (results)		
					Prescriber's Response	Medication	Clinical
plan							
Medication Review[131] *Recommendations were made by P fellows (based on Beers Criteria & Epocrates online program) & communicated to NH P for action*	**Physicians**	Before-and-after study	3 yrs baseline; 3 yrs intervention	Beers Criteria [a]	Not assessed	No. of medications (reduced) - Overall/ regular/ as-needed - Beers Criteria - Contraindications - DDI - No indications	Not assessed
Case-conferencing[132] *Ph-led monthly multidisciplinary meetings (1 hr) held for reviewing residents' medications; attended by P and NS*	**Inter-professional collaborative practice**	Before-and-after study; CT for economic out-come	3 yrs	Nil	- 1228 interventions derived from 1225 pharmacist-identified DRPs - 93% of interventions implemented	- Mean number of total medications per resident (12.8 → 11.8; $p < 0.01$) - Global drug cost (decreased more in intervention group)	Not assessed
Drug surveillance[133] *NS monitored residents' health status & well-being, conducted care-planning, and went on rounds with NH P; OT assessed functional status*	**Inter-professional collaborative practice**	CT	6 mths; 1 yr f/u	nil	Not applicable	No. of medications in intervention group (reduced) - Overall - Regular; Proportion of medication changes (higher in intervention group post-intervention)	Not assessed

CT = non-randomized controlled trial; DRP = drug related problem; DDI = drug-drug interaction; f/u = follow-up; mth = month; NS = nursing staff; OT = occupation therapist; P = physician; Ph = pharmacist; RR = risk ratio; yr = year

[a] Used as part of intervention.

[b] Used as outcome measure.

[c] 95% confidence interval.

Table 1.6 Interventions in the NHs that targeted specific drug group or disease / condition with outcomes that measure changes in medication use (2009 - current)

Target Drug Groups / Condition	Year Publish-ed	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	Clinical
Antibiotics[134]	2011	**Education** *Educational materials and 2 CME sessions were provided for NS and P of NH; content included (1) feedback on performance, (2) guidelines on antibiotic prescribing, and (3) local pattern of antibiotic resisnance*	CRCT	**Inter-professional collaborative practice** *P + NS +Ph*	Reduced proportion of infections treated with antibiotics (in intervention group); increased proportion of "wait and see" management (in intervention group); No difference in trends of nitrofurantoin used	No change in no. of hospitalized cases
Antibiotics[135]	2011	**Education** *Academic detailing of NH-acquired pneumonia care pathway was provided for directors of nursing (1 group) and medical director/physicians/mid-level care providers (1 group) by a multidisciplinary team.*	CT	**Inter-professional collaborative practice** *P + NS + Ph*	% (of cases) adherence to recommended care pathway - timing of antibiotic delivery (increased in intervention) - antibiotic choice (no difference) - antibiotic duration (low, no difference)	Mortality (no difference)
Adverse drug events[136] (*Delirium & falls)*	2011	**Clinical informatics tool** *(Geriatric Risk Assessment Med. [GRAM] Guide) Resident-specific reports on use of medications, indicators/ADE for delirium & falls were generated and conveyed by Ph to NS for monitoring & documentation & action*	CRCT	**Inter-professional collaborative practice** *Ph + NS*	No difference in total no. of medicines used; Absolute decrease in use of tranquilizers (4%), opiate & miscellaneous anticonvulsants (3%) in intervention homes	Reduced rate of potential delirium in intervention home; No change in fall and hospitalization rates
Clinical problems[137] *(falls, fever evaluation, pneumonia, urinary tract infection, osteoporosis)*	2009	**Computerized order entry algorithms** *Facilitated interdisciplinary communication on care requiring interdisciplinary coordination*	Before-and-after study	**Prescribers** *P + NS*	No changes in quality indicators of target medications (psychotropics, antibiotics, osteoporosis medication, calcium and 25(OH) vitamin D	No changes in quality indicators of target conditions
Methotrexate[138]	2012	**Medication review** *Reviewed methotrexate orders for indication, dosing, & alerts for drug interactions, allergies or*	Before-and-after study	**Pharmacist**	Increased variances from preestablished appropriateness criteria detected	Not assessed

Target Drug Groups / Condition	Year Publish-ed	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	**Clinical**
		duplications; second review to ascertain completion of review process; monthly f/u reviews			(497 [1.1%] vs. 693 [1.6%] of all orders)	
Warfarin[139]	2011	**Communication protocol** *(SBAR-based approach) NS tracked and communicated IBR results using printed message templates*	RCT	**Inter-professional collaborative practice** *P + NS*	% rate of appropriate response to subtherapeutic range (64.6% in intervention group vs. 71.7% in control)	Increased % time in therapeutic range (53.1% in intervention group vs. 51% in control); Reduced prevent-able adverse events (NS)
Warfarin[140]	2010	**Electronic decision support system** *(MEDeINR) Ph provided training, NS carried out warfarin monitoring and use of MEDeINR support system, and P reviewed and endorsed recommendations.*	Before-and-after study	**Inter-professional collaborative practice** *P + NS + Ph*	Reduced average number of INR test/30 days per resident	-
Palliative care[141]	2009	**Geriatric primary care team** *The team provided palliative care consistent with the resident's wishes given the disease process and prognosis, including: clarify goals of care, develop advanced directives, preserve functional status, reduce sensory impairment, treat end-of-life symptoms, reduce polypharmacy*	Before-and-after study	**Inter-professional collaborative practice** *P + NS + Ph + other allied health professionals*	Reduced unnecessary drug use - Overall (74.2 → 39.3%) - Effectiveness criterion (57.3 → 23.6%) - Indication criterion (40.5 → 20.2%)	Not assessed
Psychotropics [142, 143] *(Antipsychotics & benzodiazepines)*	2011	**Education** *(RedUSe project) On: (1) risks and modest benefits associated with antipsychotic and benzodiazepine use via 2 medication audit & feedback cycles; (2) non-pharmacological approaches to manage BPSD & sleep disturbance via guidelines developed*	CT	**Inter-professional collaborative practice** *P + NS + Ph*	At 6 mths (intervention group) - More dose reductions/cessations of benzodiazepine & antipsychotic - Reduced prevalence of drug use Delayed (12 mths) reduction in benzodiazepine	Not assessed

Target Drug Groups / Condition	Year Publish-ed	Intervention Type	Study Design	Health Professional Involved	Outcomes	
					Medication	**Clinical**
					and antipsychotic use in control group	
Psychotropics [144, 145]	2010	**Medication review** *(Fleetwood Northern Ireland Study) Assessed residents' needs through interviews, identified problems, made recommendations, discussion with other care professionals*	CRCT	**Pharmacist**	Prevalence of inappropriate psychotropic/s reduced in intervention group (OR = 0.26 [0.14 – 0.49][a]); Average number of inappropriate psychotropic/s reduced by 0.4 in intervention group; High probability of intervention being cost-effective	Falls rate (increase in interventi on group; NS)
Renal insufficiency [146, 147]	2009	**Computerized clinical decision (prescribing) support** *Recommendation alerts triggered during physician prescribing entry; alert types included (1) max. total daily dose, (2) max. administration freq., (3) avoid medication, and (4) missing creatinine clearance for appropriate dosing*	RCT	**Not applicable**	Reduced orders for type 3 alerts (NS); Increased appropriate orders of types (1) and (2) (NS); modest immediate and direct financial impact	Not assessed

CRCT = cluster-randomized controlled trial; CT = non-randomized controlled trial; mth = month; NS = not significant; P = physicians; Ph = pharmacists; RCT = randomized controlled trial; UTI = urinary tract infection.
[a] 95% confidence interval

In Singapore, national guidelines on the role of physicians, nurses and pharmacists in the NHs are available.[2, 148] A summary of this is provided in the Brief Factsheet on NHs in Singapore (Appendix 1.1). Although the guidelines specified pharmacists' role to provide "pharmaceutical care to residents" and "quality assurance of medication management", there is no data on the impact of pharmacists' medication review on PA. In addition, the pharmacist's on-site presence, standard of

pharmacy services and level of involvement in the NHs differ across NHs. Furthermore, it was observed that the "monitoring" services provided by the visiting pharmacists to the NHs were mainly focused on overcoming skill-based medication errors (such as slips and lapses[14]); examples included conducting audits and providing reminders on NS's compliance in proper storage, packing and preparation of medicines for administration, and timely documentation on residents' medication notes, and making interventions in retrospect of physicians' oversight in noting existing drug allergies, potential interactions or duplications with residents' current medication regimen when prescribing. Pharmacist interventions on improving PA or appropriateness of medication administration (which may be likened to overcoming knowledge-based errors and rule-based errors[14]) were lacking or limited; these were often left to physicians who conduct routine medical reviews of NHRs. However, IP or "mistakes" may not be picked up as these physicians as they could be the same prescribers who initiated the orders. With the advent of a "silver tsunami",[149] and the high prevalence of potentially IP reported by Mamun *et al*.,[66] there is a need for pharmacists to assume the role of "advocator" and less as "police" or "auditor" to improve PA and patient outcomes.

1.5 Objective and scope of work

The objective is to develop innovative approaches to improve PA and direct patient outcomes from the use of one or more medication groups for specified diseases among the elderly NHRs in Singapore in the following steps (Figure 1.2). Firstly, the prevalence of medication use, IP, and clinically significant AEs were determined using PA instruments and pharmacoepidemiology study methods. From the results of this study, the most compelling IP practices and/or clinically significant

AEs were identified. Next, the gaps in achieving appropriate prescribing of the targeted pharmacological groups and/or health conditions were further identified through qualitative and quantitative survey methods where necessary. Lastly, innovative inter-professional collaborative practice that leverages on the pharmacists' role as the "advocator" of appropriate medication use and prescribing at the NHs were developed. These were tested at the NH setting using suitable clinical study designs to evaluate the (1) feasibility of implementation, (2) feedback from the other healthcare professionals, and (3) impact on prescribing, medication use, cost, and relevant patient outcomes.[51, 150]

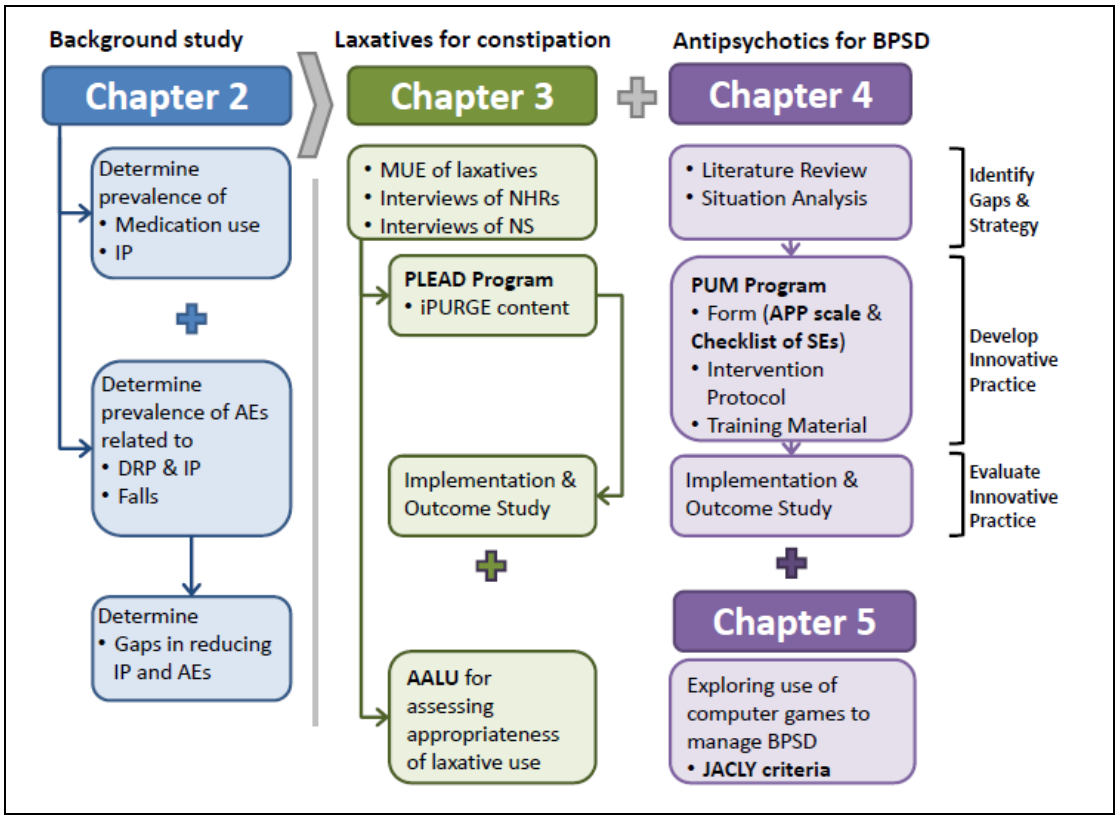


Figure 1.2 Thesis workflow

Chapter 2

Prevalence of Inappropriate Prescribing (IP) and Adverse Events (AEs) among Elderly Nursing Home Residents (NHRs) in Singapore

2.1 Introduction

In Singapore, published information on prescribing appropriateness, adverse events, and gaps relating to these among the elderly NHRs was lacking. Identification of the most compelling IP practices and/or clinically significant AEs was crucial in directing the limited research and future resources to tackle IP of the relevant medication group / disease management and improve specific patient outcomes. Understanding the common gaps in the appropriateness of prescribing was also imperative for the development of feasible interventions that can be successfully implemented at the NHs. For these purposes, a background study was conducted from February 2009 to July 2010, which is reported in this chapter.

2.2 Methodology

Hence, a retrospective cross-sectional study was conducted to determine (1) the prevalence and associated factors of medication use and IP, (2) the impact of medication use and IP on AEs, and (3) the gaps in reducing IP and AEs among elderly NHRs. For this study, and all other work in the subsequent chapters, ethics approval was obtained from the Institutional Review Board of the National University of Singapore, and were was carried out in NHs that are run by Volunteer Welfare Organizations (VWOs). A description of the NHs in Singapore is provided in Appendix 1.1.

The NHRs' data sets for this study was obtained from four VWO NHs which gave consent to participate in this study and approval to access the original archived hardcopy of the NHRs' administrative, medical and medication records in the NHs. These NHs have a capacity of 200-300 beds each and were randomly selected from the northern, central, western and eastern parts of Singapore. The recruitment of four NHs was estimated to be able to provide more than the minimum number of data sets required for this study.

The prevalence medication use and IP along with the postulated associated factors were determined from the 1-month resident data in December 2008. The prevalence of medication use of all NHRs aged 65 years and above during the month of December 2008 was determined using the data from the original hardcopy of the NHRs' medication use records. Data of the NHRs who had passed away or were transferred out of the institution before 31st December 2008 were excluded, as they did not yield a full 1-month resident data. The medication use prevalence was reported in Section 2.3.1 according to the World Health Organization (WHO) Anatomical Therapeutic Chemical (ATC) classification system.[151] Medications that were discontinued after taking for less than two weeks and those that were prescribed for use on a when-needed basis or a pre-specified short-term basis were considered as "short-term medications". Conversely, medications that were used regularly for more than two weeks were considered as "regular medications". These definitions were based on the common consensus among pharmacists and physicians who provide care at the NHs. Polypharmacy[152] was defined as the use of five or more "regular medications".

The prevalence of IP for all medications used in December 2008 of the included data sets, except for those classified as dermatologicals under the ATC

classification system, was determined by reviewing medications using PA instruments listed in Table 1.1. Multiple PA instruments were used to overcome the limitations of each individual instrument (discussed in Section 1.3) for determining the true prevalence of IP. These instruments included the Beers criteria,[31] Medication Quality Indicators derived from the ACOVE project,[36] and instruments developed by Oborne *et al*.,[40] McLeod *et al.*,[43] and the MAI,[33, 34] which had previously been used in an unpublished study conducted among local NHs. The Neuroleptic Appropriateness Indicator (NAI)[38] was also included in the study, where its use during data collection and analysis was included as part of the instrument developed by Oborne *et al*.[40] The PDRM was not selected due to the presence of conflicting consensus between MacKinnon *et al*.[35] and Morris *et al*.[39] on what should be included in the PA instrument. The STOPP criteria[41, 42] was also not included as it was identified after the study was underway.

Documentation of the reviews was made directly on the data collection form (Section B of Appendix 2.1). Additional information required for the medication review was obtained from the NHRs' medical notes and transcribed onto the same form. Clarification with the NS and/or drug references was made when required. The references used for the reviews of IP included the Geriatric Dosage Handbook (14th Edition), British National Formulary (BNF, 2009 Editions), the online version of MIMS Drug Information System, and online resources from the Health Science Authority of Singapore. These references were also used for the other studies reported in this thesis.

NHRs' demographic and clinical factors that were deemed to be associated with inappropriate prescribing (based on the studies reported in Table 1.2) were also listed on the data collection form (Section A of Appendix 2.1) and obtained from the

NHRs' medical records. These factors, which included age, gender, race, length of stay in the NH, functional status, and cognitive status were then evaluated for their association with IP observed among this sample population during the data analysis. The most recent category rating on the Resident Assessment Form (RAF)[148] of each NHR, which was reviewed by the nurses every 3-6 months across all NHs, was used to represent the NHRs' functional status. The RAF categorized the NHRs into four categories of increasing physical and mental dependency (Figure 2.1). NHRs had impaired cognitive status if a diagnosis of "mild cognitive impairment", "dementia", "Alzheimer's disease" or other forms of dementia were documented on the main problem list in the NHRs' medical records.

RAF	Description
Category I	Physically and mentally independent; may or may not use walking aids; do not need or need minimal assistance in activities of daily living
Category II	Semi-ambulant; require some physical assistance and supervision in activities of daily living; may have mild dementia, psychiatric/behavioral problems
Category III	Wheelchair/bed bound; may have dementia or psychiatric behavioral problems; need help in activities of daily living and supervision most of the time
Category IV	Highly dependent; may have dementia, psychiatric and behavioral problems; require total assistance and supervision for every aspect of activities of daily living

Figure 2.1 Descriptions of RAF functional categories

The 1-month prevalence of IP identified by explicit and implicit instruments from the data obtained in December 2008 were reported and described separately in Sections 2.3.1.1 and 2.3.1.2. In order to prevent an over-estimated reporting of IP identified by multiple use of explicit PA instruments, the individual IP identified was not used as the unit of analysis; simple summation of the total number of IP identified from the combined use of all criteria per resident was also not performed. Instead, both (1) individual NHRs and (2) individual medications were used as the units of

analysis in reporting of the prevalence and statistical analysis of IP identified using explicit PA instruments. Although these units of analysis were also used in the reporting of the MAI index and prevalence of IP identified using the implicit PA instrument (MAI), the total number of IP identified by the individual domains of the MAI was also reported. In addition, the concordance between IP identified by explicit PA instruments used and the overall prevalence of IP among NHRs during December 2008 was evaluated.

For the determination of the impact of medication use and IP on AEs among NHRs, data was collected using the same data collection form (Appendix 2.1), to obtain the incidence and the details of AEs that occurred among elderly NHR who were 65 years and older residing in the NHs from 1st July 2007 to 30th June 2008. Due to constraints in research resources and limited duration (imposed by the NH) for accessing the archived records of residents imposed at one NH, data collection for this purpose was conducted in three of the four NHs located in the northern, central and western parts of Singapore. AEs included unplanned hospitalizations and ED visits identified from the NHR transfer records.[57] The details of these incidents (Section C of Appendix 2.1) were transcribed directly from filed copies of the discharge summaries in the NHRs' medical records. Incidents were defined as rehospitalizations if the referral was for the same primary or secondary diagnoses, within a 30-day period after a previous discharge from hospital stay or ED visit.[153] Rehospitalizations were non-independent and were excluded from data analysis. The independent incident was used as the unit of analysis and were reported in Sedtion 2.3.2 based on the International Classification of Diseases (ICD-10)[154] that is available online. Medication use during the 3-month period prior to each independent incident was also noted from the NHRs' medication use records and assessed for

presence of IP as described above. The prevalence of IP identified from medication use during the 3-month period prior to all AEs identified during this 1-year period was reported in Section 2.3.2, and compared descriptively to the prevalence of IP identified among the general elderly NHRs in December 2008.

From this, the impact of medication use and IP on AEs that were caused by drug-related and falls-related reasons were evaluated further. These AEs were described as "drug-related AEs" and "fall-related AEs" in the rest of this chapter. In order to identify drug-related AEs, the discharge summaries of all the incidents (including rehospitalizations) were reviewed for explicit documentations of (1) drug-related problems (DRPs) as the primary diagnoses, (2) DRPs leading to the primary diagnoses, or (3) documentation of changes to the NHRs' medication regimens at discharge, which including dose alterations, discontinuations, or new additions of medications, as an outcome of the documented primary diagnoses. Incidents that carry these documentations were then discussed with a US board certified pharmacotherapy expert for confirmation as drug-related AEs. The DRPs related to these incidents were reported in Section 2.3.2.1 according to the classification (Appendix 2.2) by the Pharmaceutical Care Network Europe (PCNE);[155] the medications implicated in these drug-related AEs and their identified IP using explicit and implicit instruments were also reported. The significance of these findings on the gaps that needed to be addressed in interventions to reduce IP and drug-related AEs is discussed in Section 2.4.

The identification of fall-related AEs was based on explicit documentations of "fall" or any unintentional movements to the floor in the discharge summaries of the unplanned hospitalizations and ED visits under "reason for referral" to the hospital. These documentations were verified against records of fall incidents and instructions

for referral to a tertiary care institution by the physician or staff nurse in the NHR's medical records kept in the NHs. Associations of these fall-related AEs with NHR's demographic and clinical factors, and the use of medications widely reported to increase falls[156-158] and fall-complications[159] were evaluated. The results from this evaluation are reported in Section 2.3.2.2. From the results, the implications of IP (among the medications associated with falls), the significance of the factors associated with falls and the corresponding gaps to be addressed in interventions to reduce IP and fall-related AEs were discussed in Section 2.4.

In this thesis, while all other statistical tests were performed on the SPSS Statistics version 19.0, the Kappa's test was performed using online calculators available at http://vassarstats.net/. In this study, the minimum sample of data sets required was 368 data sets; this was derived from an online sample size calculator,[160] based on the total patient population in the year 2008 (8600 beds),[161] "worst-case-scenario" prevalence of IP and AEs at 50%, α value of 0.05 and confidence interval of 95%. The sample size was calculated based on the total number of beds, and not on the number of NHs as VWO NHs are likely to have similar patient demographics since admissions into VWO NHs are randomly assigned by a government agency unless the resident has specific preferences for the location of a NH and meal plan. Comparisons of means were performed using Mann-Whitney U test or Kruskal-Wallis One-Way ANOVA where applicable, and adjusted for co-variables using General Linear Model with Bonferroni post hoc tests. Comparisons of proportions were performed using χ^2 test. Multiple logistic regressions were used to evaluate associations between factors. In the evaluation of factors associated with 1-month prevalence of IP in December 2008, univariate logistic regressions were performed using factors (which included age, race, gender, length of stay, functional dependency

status, presence of dementia and polypharmacy) individually to obtain the unadjusted odds ratios, while the adjusted odds ratios were obtained by keeping all the reported factors as they were deemed to be important as reported in the studies in Table 1.2. In addition, the NH study-site was included to adjust for potential clustering due to site-related factors such as prescribing preferences and care culture. Both the unadjusted and adjusted odds ratios of factors associated with IP were reported in Table 2.3. The evaluation of the factors associated with fall-related AEs was also performed similarly using univariate and multiple logistic regression; the results of their unadjusted and adjusted odds ratios were reported in Table 2.14. Concordance in this study was evaluated using Kappa statistics, where the strength of concordance was based on the following: 0.1 – 0.2 = slight, 0.21 – 0.40 = fair, 0.41 – 0.60 = moderate, 03.61 – 0.80 = substantial, and 0.81 – 1 = almost perfect.[162] This reference was also used to interpret the use of Kappa statistics throughout the rest of the thesis.

2.3 Results

2.3.1 Medication use trends

There were 712 elderly NHRs residing at the four NHs during December 2008. The data sets for all NHRs were obtained and included in the analyses. The demographic, medical and medication factors of these elderly NHRs were summarized in Table 2.1. The mean age of the NHRs was 80.7 (± 8.76) years' old. There were slightly more females than males (57.2% and 42.8% respectively) in the sample population. The majority of the NHRs resided in the respective institutions for more than 2 years (69.4%), were Chinese (86.9%), had functional status of RAF Categories 3 and 4 (92.3%), and had dementia (62.6%).

Table 2.1 NHRs' demographic, clinical and medication factors (n = 712)

Factors	n	%
NH Site		
A	172	24.2
B	136	19.1
C	104	14.6
D	300	42.1
Length of Stay		
0-6 months	66	9.3
7-24 months	152	21.3
>24 months	494	69.4
Gender		
Male	305	42.8
Female	407	57.2
Age		
65-79 years old	324	45.5
≥80 years old	388	54.5
Race		
Chinese	619	86.9
Non-Chinese	93	13.1
Functional Status		
RAF Category 1 & 2	55	7.7
RAF Category 3	266	37.4
RAF Category 4	391	54.9
Cognitive Status		
No Dementia	266	37.4
Has Dementia	446	62.6
Polypharmacy		
Absent	266	37.4
Present	446	62.6

Among the 712 NHRs, only one did not use any medication and polypharmacy was present among 62.6% of the NHRs, where the majority took five to nine "regular medications" (see Figure 2.2). The total number of medications prescribed was 5922 (mean = 8.3 ± 3.3, range 0 to 25); of which 4019 (mean = 5.6 ± 2.8, range 0 to 15) were "regular medications" and 1903 (mean = 2.7 ± 1.9, range 0 to 12) were "short-term medications".

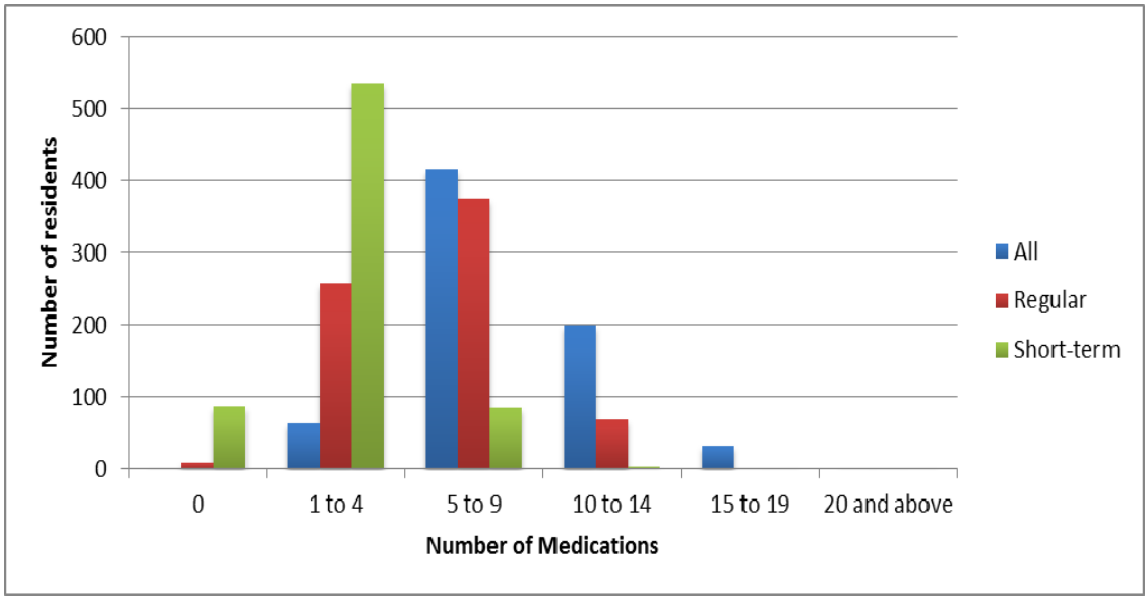


Figure 2.2 Number of medications taken by 712 elderly NHRs during December 2008 (n = 5922)

The prevalence of these medications were reported according to their anatomical main groups and pharmacological subgroups of the ATC classification system. Among the anatomical main groups shown in Figure 2.3, medications of the alimentary tract and metabolism [ATC code = A] were the most commonly prescribed, contributing to 44% of the 5922 medications, and given to 95% of the 712 NHRs. This was attributed to the frequent use of laxatives [A06A]; which made up 25% of 5922 medications prescribed, and was prevalent among 87% of the NHRs. More than two thirds of all laxatives prescribed were meant for use on a when-needed basis. Medications of the nervous system [N] were the next most commonly prescribed. These medications made up 25% of the medications prescribed, and were prevalent among 88% of NHRs.

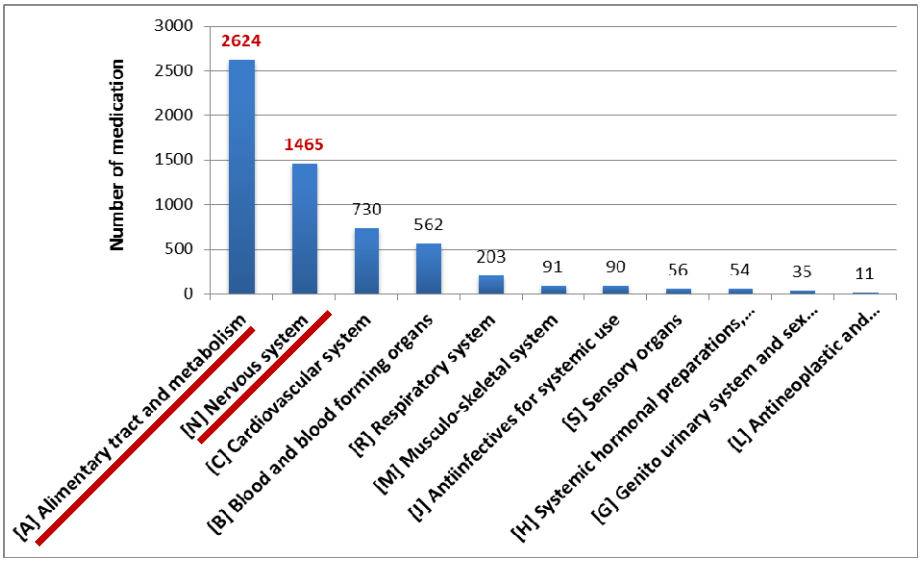


Figure 2.3 Number of medications taken by 712 NHRs, classified by anatomical main group of ATC (n = 5922)

Of the 99 pharmacological subgroups identified, the 10 most prevalently prescribed were laxatives [A06A], antidepressants [N06A], other analgesics and antipyretics [N02B], drugs for peptic ulcer and gastro-oesophageal reflux diseases [A02B], calcium [A12A], antithrombotic agents [B01A], antipsychotics [N05A], antiepileptics [N03A], plain lipid modifying agents [C10A], and anxiolytics [N05B]; these contributed to 66% of the 5922 medications used (Figure 2.4).

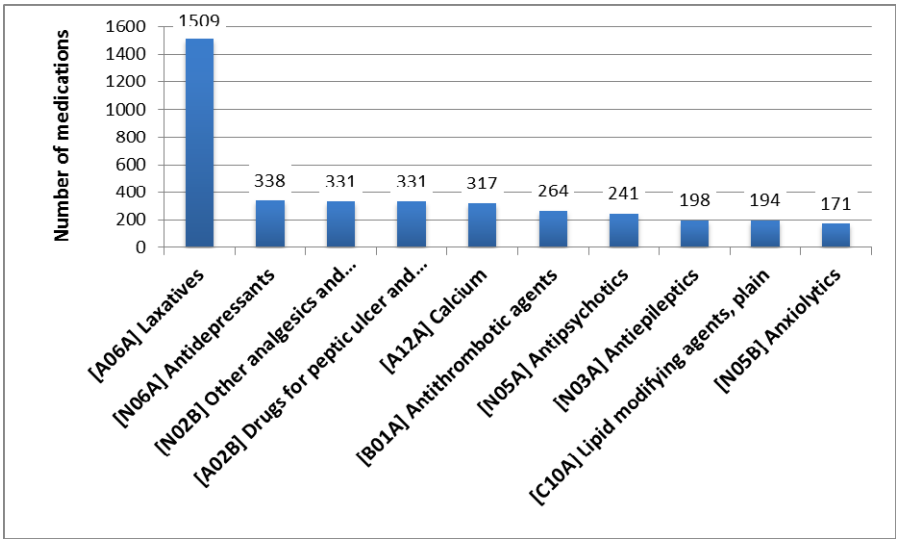


Figure 2.4 Ten most prevalently used medications, classified by pharmacological subgroups of ATC

2.3.1.1 Types of IP defined by explicit instruments

Explicitly defined IP was prevalent among 664 NHRs (93%). Among these NHRs, 32 had inappropriately prescribed medications defined by at least one indicator from each of the four explicit instruments used (Table 2.2).

Table 2.2 Number of elderly NHRs in December 2008 with IP measured by N number of explicit PA instruments

Number of explicit PA instruments	Number of NHRs	
	n	%
0	48	6.7
1	161	22.6
2	270	37.9
3	201	28.2
4	32	4.5

From Table 2.3, the presence of IP was widely prevalent among the NHRs of the four NHs. However, the IP seemed to be more prevalent in some homes, compared to the others. In addition, NHRs who were more likely to have IP were noted to be of the male gender, have polypharmacy and higher functional dependency characteristics.

Table 2.3 NHRs' demographic, clinical and medication factors associated with presence of IP identified by explicit PA instruments in December 2008 (n = 712)

NHRs' Factor	Prevalence of IP		Unadjusted OR (95% CI)		Adjusted[a] OR (95% CI)	
	n	%				
NH Site						
A	160	24.1	-		-	
B	135	20.3	10.1[b]	(1.3, 78.9)	15.1[b]	(1.8, 125.5)
C	103	15.5	7.7	(1.0, 60.3)	10.2[b]	(1.3, 83.2)
D	266	40.1	0.6	(0.3, 1.17)	1.0	(0.45, 2.2)
Length of Stay						
0 - 6 months	63	9.5	-		-	
7 - 24 months	132	19.9	0.3	(0.1, 1.1)	0.4	(0.1, 1.5)
> 24 months	469	70.6	0.9	(0.3, 3.0)	1.2	(0.3, 4.6)
Gender						
Female	371	55.9	-		-	
Male	293	44.1	2.4[b]	(1.2, 4.6)	2.3[b]	(1.1, 5.1)
Age						
65-79 years old	301	45.3	-		-	
> 80 years old	363	54.7	1.1	(0.6, 2.0)	1.0	(0.5, 2.1)
Race						
Chinese	575	86.6	-		-	
Non-Chinese	89	13.4	1.7	(0.6, 4.9)	0.8	(0.3, 2.5)

Functional Dependency Status						
RAF Category 1 & 2	44	6.6	-		-	
RAF Category 3	250	37.7	3.9[b]	(1.7, 9.0)	4.0[b]	(1.5, 10.7)
RAF Category 4	370	55.7	4.4[c]	(2.0, 9.7)	5.3[b]	(2.0, 14.0)
Cognitive Status						
No Dementia	248	37.3	-		-	
Has Dementia	416	62.7	1.0	(0.6, 1.8)	1.5	(0.7, 3.2)
Polypharmacy						
Not present	231	34.8	-		-	
Present	433	65.2	5.0[c]	(2.6, 9.7)	5.7[c]	(2.7, 11.8)

OR = odds ratio.
[a] Adjustment was performed for all NHRs' factors listed in this table.
[b] *p*-value < 0.05.
[c] *p*-value < 0.001.

Among the four explicit PA instruments, IP measured by the instrument from Oborne *et al*. was the most prevalent (76% of 712 NHRs; Figure 2.5), and had the highest concordance with the overall prevalence of IP observed among the 712 NHRs (Kappa = 0.37, *p*-value < 0.05; Table 2.4).

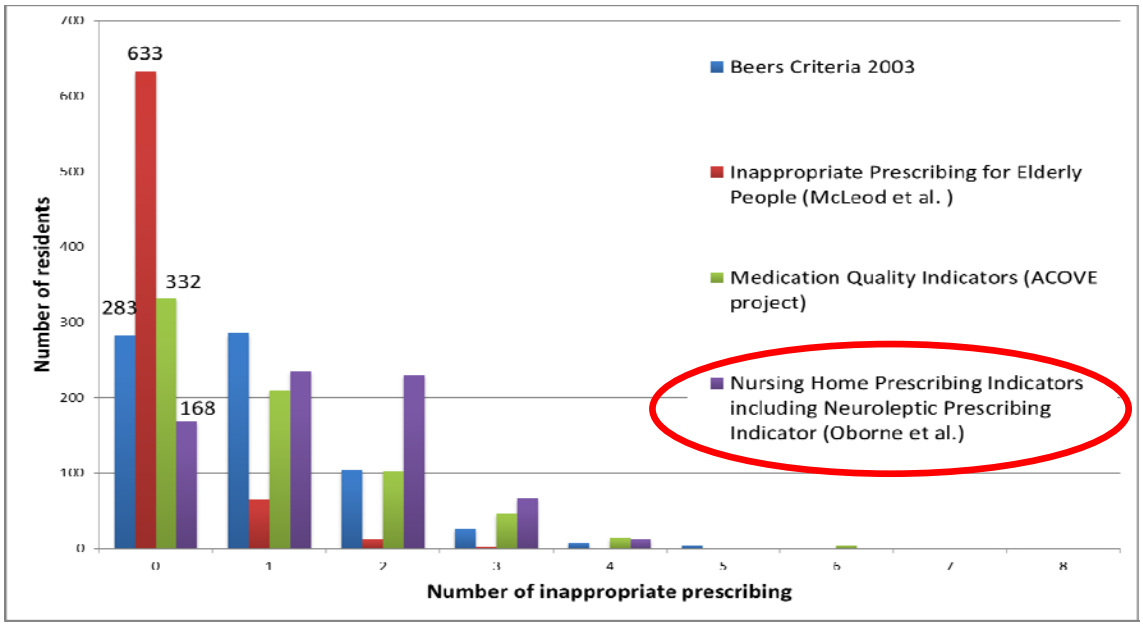


Figure 2.5 Number of IP among 712 NHRs measured by each explicit PA instruments

Table 2.4 Agreement between the presence of IP identified by each explicit PA instrument and the overall prevalence of IP among 712 elderly NHRs in December 2008

Explicit PA Instruments	Kappa	95% CI
IP for Elderly People (McLeod *et al*.)	0.017	0 to 0.05
Medication Quality Indicators (ACOVE project)	0.157	0.08 to 0.23
Beers Criteria 2003	0.194	0.11 to 0.28
Nursing Home Prescribing Indicators including NAI (Oborne *et al*.)	0.372	0.27 to 0.47

All reported Kappa statistics had *p*-value > 0.05.

From Table 2.5, the most prevalent IP identified by the individual explicit indicators were those from the explicit PA instrument by Oborne et al. Specifically, these were the failure to use generic name in the drug orders (52.1% of 712 NHRs) and the failure in documenting the maximum frequency of administration (39.6% of 712 NHRs). The medication most commonly implicated with these indicators of IP was bisacodyl suppository [A06AB02].

Table 2.5 Ten most prevalent IP described by explicit PA indicators among elderly NHRs in December 2008 (n = 712)

Explicit PA Instrument	Indicator Description	n	%
C	Use of generic drug name	371	52.1
C	Documentation of maximum frequency of administration	282	39.6
A	Long-term use of stimulant laxatives	258	36.2
C	Appropriate Neuroleptic prescribing	142	19.9
C	Appropriate Benzodiazepine prescribing	117	16.4
B	Daily aspirin therapy for patient with diabetes	110	15.5
B	Medication for hypertension if no nonpharmacologic therapy response	100	14.0
A	Daily Fluoxetine	92	12.9
B	Aspirin for patient with coronary artery disease	89	12.5
A	Anticholinergics and antihistamines	78	11.0

A = Beers Criteria 2003; B = Medication Quality Indicators (ACOVE project); C = Nursing Home Prescribing Indicators including NAI (Oborne *et al*.).

Of the 5922 medications, 31% of them were deemed to be inappropriately prescribed by one or more explicit instruments. A breakdown of the prevalence of inappropriately prescribed medications according to the anatomical main groups and pharmacological subgroups of the ATC are shown in Figures 2.6 and 2.7.

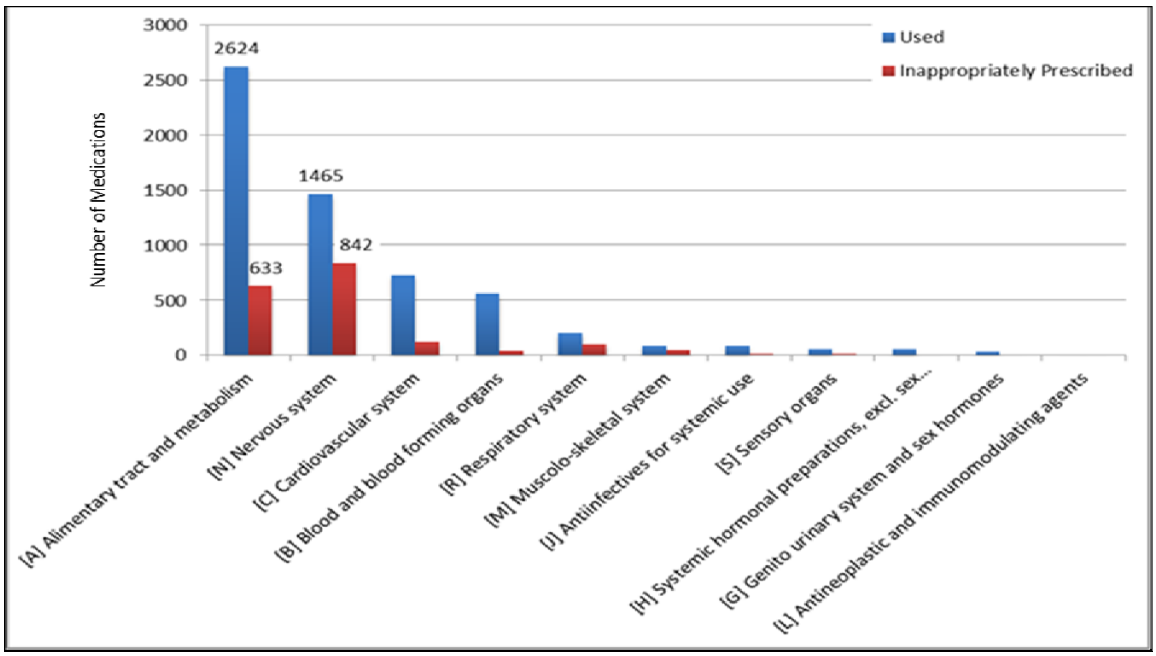


Figure 2.6 Number of inappropriately prescribed medications measured by explicit PA instruments among 712 elderly NHRs in December 2008 (n = 5922)

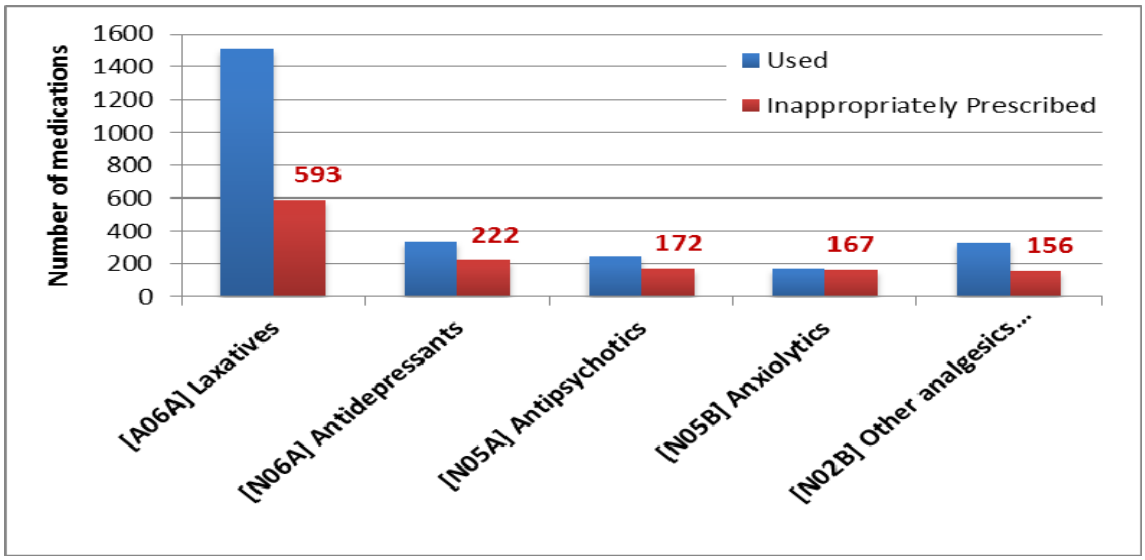


Figure 2.7 Five most prevalent inappropriately prescribed medications measured by explicit PA instruments in December 2008

Besides being the most widely prescribed medications among the elderly NHRs (Figure 2.4), laxatives [A06A] also topped the chart as the most common (10% of the 5922 medications) and widely prevalent inappropriately prescribed medications among 443 (62%) NHRs. Inappropriateness of laxatives were mostly related to the

prescribing of stimulant laxatives for long-term use, and failure to document the maximum frequency of administration (Table 2.6).

The four other most prevalent inappropriately prescribed medications were antidepressants [N06A], antipsychotics [N05A], anxiolytics [N05B], other analgesics and antipyretics [N02B], each contributing 3.7%, 2.9%, 2.8% and 2.6% of all prescribed medications respectively (Figure 2.7). Among the PA indicators that were applicable for these pharmacological subgroups, the NAI[38] produced the highest count of IP (Table 2.6). Among the 156 counts of inappropriately prescribed antipsychotics identified by this indicator, 26 were related to the absence of documented indications, 39 were due to inappropriate indications of unspecified symptoms of agitation, restlessness and uncooperativeness related to dementia, 24 did not have objective documentations regarding the frequency of behavioral indications, and 67 were prescribed prior to June 2008 with no records of attempted dose reduction during the six-month period leading to December 2008.

Table 2.6 Explicit PA indicators that measure the five most prevalent inappropriately prescribed pharmacological subgroups

Pharmacological Subgroup [ATC Code]	Explicit PA Instrument	Indicator Description	Prevalence of IP (n = 5922)	
			n	%
Laxatives [A06A]	A	Long-term use of stimulant laxatives	265	4.5
	D	Documenting maximum frequency of administration	263	4.4
	D	Use of generic drug name	214	3.6
	C	Bowel regimen to prevent constipation for patient taking opiate	3	NA
Antidepressants [N06A]	D	Use of generic drug name	121	2.0
	A	Fluoxetine	92	1.6
	A	Antidepressants with bladder outflow obstruction	30	0.5
	C	Avoid tertiary amine tricyclic, monoamine oxidase inhibitor, benzodiazepine, or stimulant as first-line antidepressant	12	0.2
	A	Selective serotonin receptor inhibitor with syndrome of inappropriate antidiuretic hormones/hyponatremia	11	0.2
	A	Amitriptyline	7	0.1
	B	Tricyclic antidepressant with active metabolites	7	0.1
	C	Avoid strongly anticholinergic medications if alternatives exist	5	0.1
	B	Tricyclic antidepressant with glaucoma, benign prostatic hypertrophy or heart block	1	0.02
Antipsychotics [N05A]	D	NAI	156	2.6
	C	Avoid strongly anticholinergic medications if alternatives exist	17	0.3
	D	Use of generic drug name	12	0.2

Pharmacological Subgroup [ATC Code]	Explicit PA Instrument	Indicator Description	Prevalence of IP (n = 5922)	
			n	%
	A	Conventional antipsychotics with Parkinson disease	6	0.1
	D	Documenting maximum frequency of administration	4	0.1
Anxiolytics [N05B]	D	Use of generic drug name	154	2.6
	D	Benzodiazepine Prescribing Indicator (algorithm)	114	1.9
	A	Anticholinergics and antihistamines	49	0.8
	D	Use of generic drug name	41	0.7
	A	Benzodiazepines with syncope or falls	26	0.4
	A	Benzodiazepines with depression	13	0.2
	C	Avoid strongly anticholinergic medications if alternatives exist	10	0.2
	A	Long-acting benzodiazepines	10	0.2
	A	Anticholinergics and antihistamines with bladder outflow obstruction	6	0.1
	D	Documenting maximum frequency of administration	5	0.1
	B	Long-term prescription of long-half-life benzodiazepine to treat agitation in dementia	3	0.1
	D	Allowing paracetamol doses >4g/24 hours	2	0.03
	D	Documenting maximum frequency of administration	2	0.03
Anxiolytics [N05B]	B	Long-term prescription of long-half-life benzodiazepine to treat anxiety	1	0.02
	B	Long-term prescription of long-half-life benzodiazepine to treat insomnia	1	0.02

A = Beers Criteria 2003; B = IP for Elderly People (McLeod *et al*.); C = Medication Quality Indicators. (ACOVE project); D = Nursing Home Prescribing Indicators including NAI (Oborne *et al*.); NA = not applicable (inappropriateness in under-prescribing.

At least 50% of NHRs of these 4 NHs who were prescribed antipsychotics had one or more IP measured by the NAI (Table 2.7). These showed a legitimate concern for the lack of proper assessment, monitoring, and/or documentation with regards to the indication and outcomes of antipsychotic use across the NHs.

Table 2.7 Prevalence of inappropriate antipsychotic prescribing due to lack of monitoring, assessment and/or documentation of indication and outcomes of use at the NHs

NH Site	Number of NHRs Prescribed with Antipsychotics	NHRs with Inappropriately Prescribed Antipsychotics Identified by NAI		% of IP among NHRs Prescribed with Antipsychotics in the respective homes
		No	Yes	
A	78	10	68	87.2
B	28	7	21	75.0
C	15	7	8	53.3
D	91	46	45	49.5

2.3.1.2 Types of IP defined by the implicit instrument – MAI

Of the 712 NHRs, 96% had IP measured by one or more domains of the MAI. The mean MAI index scores for prescribing inappropriateness per NHR was 1.4 (± 0.82, range 0 to 4.7), 1.8 (± 1.08, range 0 to 6.0) and 0.5 (± 1.16, range 0 to 8.0) for all medications, "regular medications" and "short-term medications" respectively. The average index scores for IP of all medications for NHRs were significantly varied across the four NHs, with the exception of NHs B and D (Table 2.8). After adjusting for the NHRs' demographic, clinical and medication factors (that were reported earlier in Table 2.1) using General Linear Model, this result remained significant.

Table 2.8 Mean MAI index score for PA of elderly NHRs across the NHs

NH Site	MAI Index Score (± SD, Range)[a]	Compared with NH Site	*p*-value[b]
A	1.7 (± 0.96, 1.5 to 1.8))	B	0.018
		C	< 0.001
		D	0.002
B	1.4 (± 0.63, 1.3 to 1.5)	C	< 0.001
		D	0.424
C	1.0 (± 0.68, 0.8 to 1.1)	D	< 0.001
D	1.4 (± 0.80, 1.3 to 1.5)	NA	

NA = not applicable; SD = standard deviation.
[a] Kruskal-Wallis one-way ANOVA test (α = 0.05), *p*-value = < 0.001.
[b] Mann-Whitney *U* test, using α = 0.008.

From the analysis, several NHRs' factors were also found to be associated with higher MAI index scores for PA. Similar to that reported for explicit instruments, higher burden of IP measured by the MAI implicit PA instrument was also associated with the male gender (compared to females, *p*-value = 0.001) and with polypharmacy (compared to no polypharmacy, *p*-value < 0.001). Other associated NHRs' factors included being 80 years and older (compared to younger than 80 years old, *p*-value = 0.023) and with dementia (compared to without dementia, *p*-value = 0.017).

Of the 5922 medications, the ten pharmacological groups most commonly implicated with IP identified by MAI were laxatives [A06A], anxiolytics [N05B], drugs for peptic ulcer and gastro-oesophageal reflux diseases [A02B], calcium [A12A], antidepressants [N06A], iron preparations [B03A], lipid modifying agents [C10A], vitamin B12 and folic acid [B03B], blood glucose lowering drugs excluding insulin [A10B], and antipsychotics [N05A] (Table 2.9). These made up 73% of the 4468 counts of IP identified by the 10 domains of MAI; and contributed to 86%, 83%, 75%, and 52% of the IP identified within their respective anatomical main groups for the alimentary tract and metabolism [A], blood and blood forming organs [B], nervous system [N], and cardiovascular system [C].

Table 2.9 Ten pharmacological subgroups with the most number of IP measured by MAI domains (total IP count = 4468)

Medication	Number of IP Measured by MAI Domain…										Total IP counts
	1	2	3	4	5	6	7	8	9	10	
	n	n	n	n	n	n	n	n	n	n	n
[A06A] Laxatives	248	261	1	4	1	0	0	3	235	229	982
[N05B] Anxiolytics	41	115	1	12	1	1	72	5	132	40	420
[A12A] Calcium	0	0	0	311	0	0	0	0	1	0	312
[A02B] Drugs for peptic ulcer and gastro-oesophageal reflux diseases	76	0	1	84	0	4	0	2	67	127	361
[N06A] Antidepressants	17	103	1	1	0	29	52	13	15	60	291
[B03A] Iron preparations	23	0	0	150	0	0	0	1	20	55	249
[C10A] Lipid modifying agents, plain	16	0	1	192	0	2	0	0	10	12	233
[B03B] Vitamin B12 and folic acid	53	2	1	0	0	0	0	11	49	48	164
[A10B] Blood glucose lowering drugs, excluding insulins	0	0	0	127	0	2	0	1	1	0	131
[N05A] Antipsychotics	6	11	1	0	0	4	9	7	40	34	112

MAI Domain 1 = indication; 2 = effective; 3 = correct dosage; 4 = correct direction; 5 = practical direction; 6 = drug-drug interaction; 7 = drug-disease interaction; 8 = duplication; 9 = acceptable duration; 10 = least expensive.

As observed in Figure 2.8, the most common types of IP identified among these four anatomical main groups were issues related to indication, effectiveness, direction of use, duration of use, and cost. Specifically, IP related to duration of use and cost were most prevalent among laxatives, which were prescribed as part of the

post-discharge medications from the hospitals or at admission to the NH for short-term management of acute constipation related to transfers and medical stress but were commonly left on the medication charts without proper documentation of indications for long-term use. In addition, IP related to inappropriately long duration of use was also commonly reported for anxiolytics, and was the most pertaining IP issue for antipsychotics. The lack of indication was most prevalent with the pharmacological groups of vitamin B12, folic acid, drugs for peptic ulcer and gastro-esophageal reflux diseases as well as laxatives. IP related to effectiveness was most prevalent for laxatives, specifically, the long-term use of senna was deemed to be inappropriate under the domain for effectiveness defined by MAI, where according to the 2003 Beers Criteria, the potential risks from its use outweighed its potential benefits. Besides laxatives, large numbers of IP related to the issue of effectiveness was also found among the pharmacological subgroups of anxiolytics and antidepressants, specifically with the long-term use of long-acting benzodiazepines and fluoxetine. Lastly, the issue related to inappropriate directions of use was mostly due to the lack of documenting proper instructions on the timing of administration with regards to food and other interacting medications; this was common among many pharmacological groups including calcium, iron preparations, lipid modifying agents, and blood glucose lowering drugs excluding insulin.

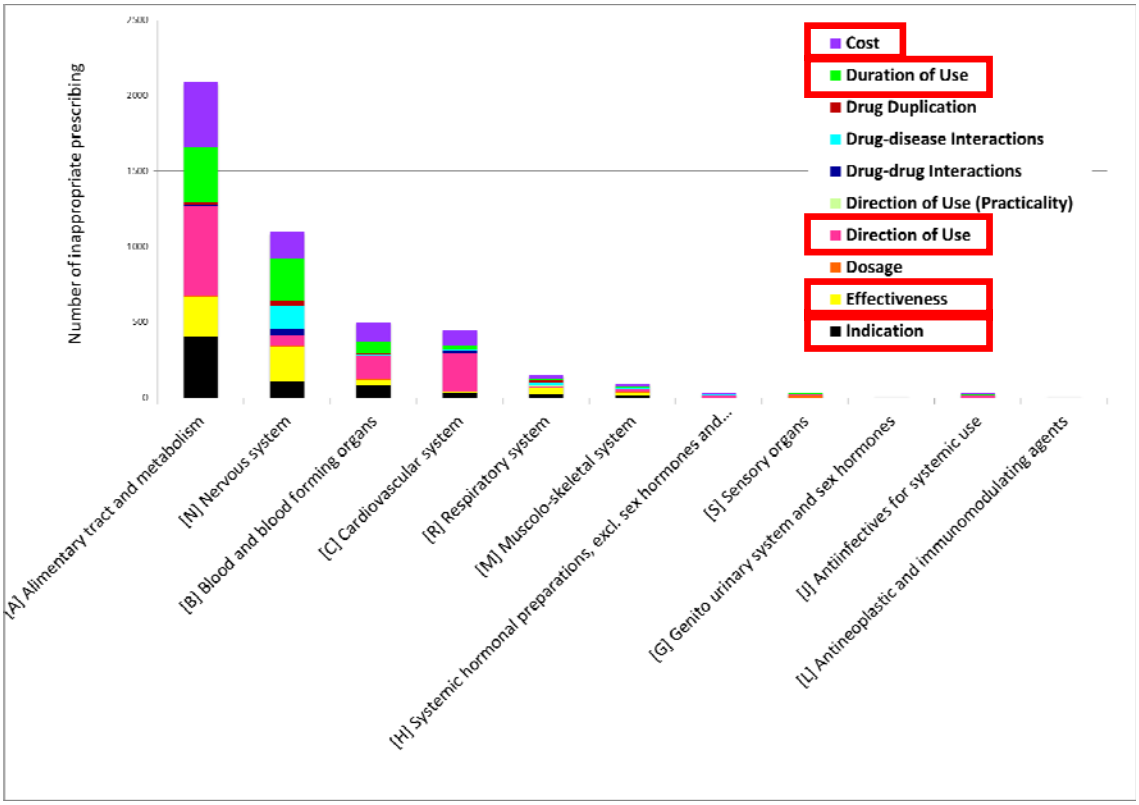


Figure 2.8 Number of IP measured by MAI domains among 712 elderly NHRs in December 2008

2.3.2 Prevalence and types of AEs, prior medication use and IP

Of three of the NHs included in this retrospective study, the 504 NHRs present from 1st July 2007 to 30th June 2008, and aged 65 years old and above, were screened. Of these, 196 NHRs had one or more incidents of unplanned hospitalizations and ED visits, leading to a total number of 345 recorded incidents, and 36 of these identified as rehospitalizations, were excluded from the subsequent analysis.

Of these 309 independent AEs, 275 were hospitalizations, and 34 were ED visits. The average length of stay for the 275 hospitalizations was 8.19 ± 7.16 (range 2 to 53) days. From the summary of the NHRs' demographic, clinical and medication factors of the 309 independent incidents (Table 2.10), the majority of these unplanned hospitalizations or ED visits seemed to occur among NHRS' who were Chinese, older, had functional dependency of Category 3 and above, had cognitive impairment,

resided in the homes longer than 2 years, and had polypharmacy. When compared against the distribution of these factors among the general elderly NHRs staying at the NHs during December 2008 (reported in Table 2.1), it was noted that AEs occurred more significantly among NHRs who were male, older, had polypharmacy, and had been NHR longer than six months but shorter than two years (χ^2 test for goodness of fit, *p*-value < 0.05). When compared to the proportion of non-Chinese (versus Chinese) present in the general elderly NH population, the proportion of AEs occurring among non-Chinese was also significantly larger (χ^2 test for goodness of fit, *p*-value < 0.05).

Table 2.10 NHRs' demographic, clinical and medication factors of the unplanned hospitalizations and/or ED visits between 1st July 2007 to 30th June 2008 (n = 309)

Factors	n	%
NH Site		
A	127	41.1
B	107	34.6
C	75	24.3
Length of Stay[a]		
0-6 months	28	9.1
7-24 months	87	28.2
>24 months	194	62.8
Gender[a]		
Male	163	52.8
Female	146	47.2
Age[a]		
65-79 years old	112	36.2
≥80 years old	197	63.8
Race[a]		
Chinese	237	76.7
Non-Chinese	72	23.3
Functional Status		
RAF Category 1 & 2	16	5.2
RAF Category 3	111	35.9
RAF Category 4	182	58.9
Cognitive Status		
No Dementia	109	35.3
Has Dementia	200	64.7
Polypharmacy[a]		
Absent	51	16.5
Present	258	83.5

[a] χ^2 test for goodness of fit against the proportion of factors reported in Table 2.1, *p*-value < 0.05.

The most common diagnoses documented in the discharge summaries were related to diseases of the respiratory system [ICD-10 Code = X]. Of these diagnoses, 90% were chest infections and pneumonia, which contributed close to a quarter of the 309 independent AEs recorded. The number of diagnoses related to injury, poisoning and other consequences of external causes [XIX] were a distant second. Among these 48 diagnoses, 15 were fractures of the femur, forearm, pelvis, and spine, which contributed about 5% of 309 independent AEs. The other 33 were related to complications of genitourinary prosthetic devices, implants and grafts, and injuries and open wounds involving various body parts, including the head. The types and prevalence of all other diagnoses documented in these hospital and ED discharge summaries were summarized in Table 2.11.

Table 2.11 The types and prevalence of diagnoses at hospital and ED discharges (total discharges = 309)

WHO ICD-10	n	%
[X] Diseases of the respiratory system	81	26.2
[XIX] Injury, poisoning and certain other consequences of external causes	48	15.5
[I] Certain infectious and parasitic diseases	41	13.3
[XVIII] Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	30	9.7
[XI] Diseases of the digestive system	29	9.4
[XIV] Diseases of the genitourinary system	25	8.1
[IX] Diseases of the circulatory system	18	5.8
[XII] Diseases of the skin and subcutaneous tissue	15	4.9
[IV] Endocrine, nutritional and metabolic diseases	5	1.6
[II] Neoplasms	5	1.6
[V] Mental and behavioural disorders	4	1.3
[XXI] Factors influencing health status and contact with health services	4	1.3
[III] Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	1	0.3
[VI] Diseases of the nervous system	1	0.3
[XIII] Diseases of the musculoskeletal system and connective tissue	1	0.3
[XX] External causes of morbidity and mortality	1	0.3

WHO = World Health Organization; ICD-10 = International Classification of Diseases (10^{th} Revision).

The average number of total medications used by the NHRs during the 3-month prior to each of the 309 AEs was 12.0 (± 4.9, range 2 to 29); the average

number of "regular medications" and "short-term medications" were 7.3 (± 3.0, range 1 to 20) and 4.6 (± 3.4, range 0 to 19) respectively. Among the pharmacological subgroups identified, the 10 most prevalently used prior to unplanned hospitalizations and/or ED visits were laxatives [A06A], drugs for peptic ulcer and gastro-oesophageal reflux diseases [A02B], other analgesics and antipyretics [N02B], beta-lactam antibacterials, penicillins [J01C], antidepressants [N06A], calcium [A12A], antithrombotic agents [B01A], iron preparations [B03A], antiepileptics [N03A], and anxiolytics [N05B] (Figure 2.9). Compared with the medication use trends among all elderly NHRs in December 2008, the most observable difference was the higher prevalence of antiinfectives for systemic use [J] during the 3-month prior to the 309 AEs.

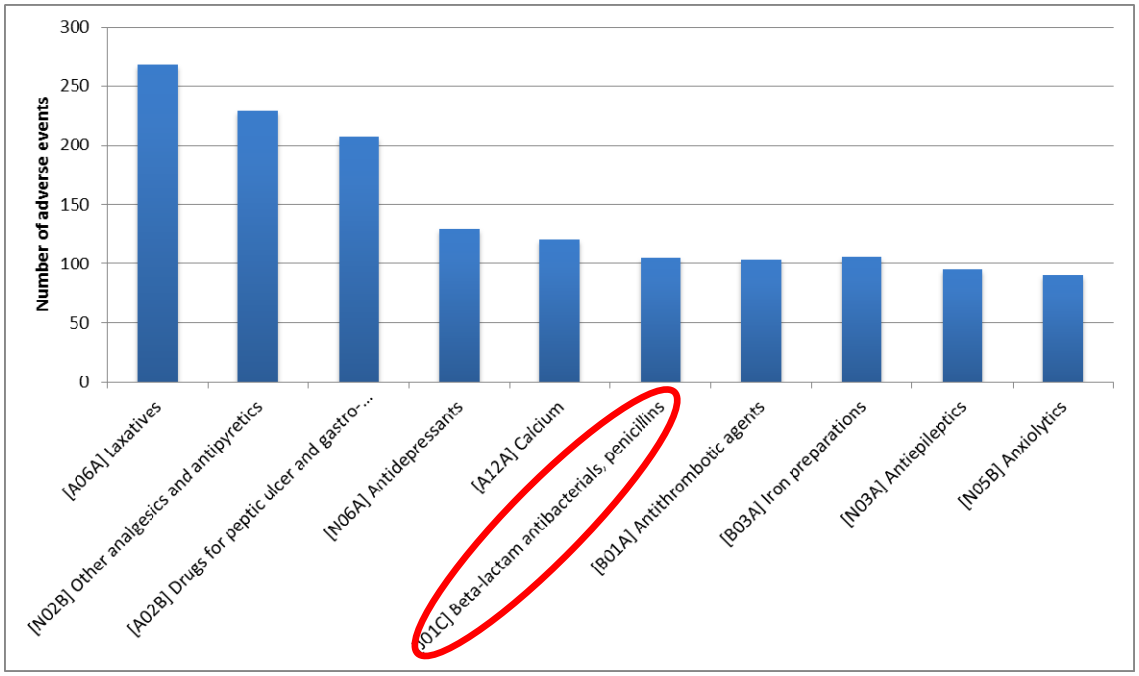


Figure 2.9 Ten most prevalently used medications during 3-month prior to AEs, classified by pharmacological subgroups of ATC

IP defined by explicit PA instruments was present during the 3-month prior to 306 (99%) of these AEs. The total number of medications implicated with IP was

1329 (35.9%). The five pharmacological subgroups which contributed to the most number of IP shown in Figure 2.10 were the same as those for the general elderly NHRs during December 2008.

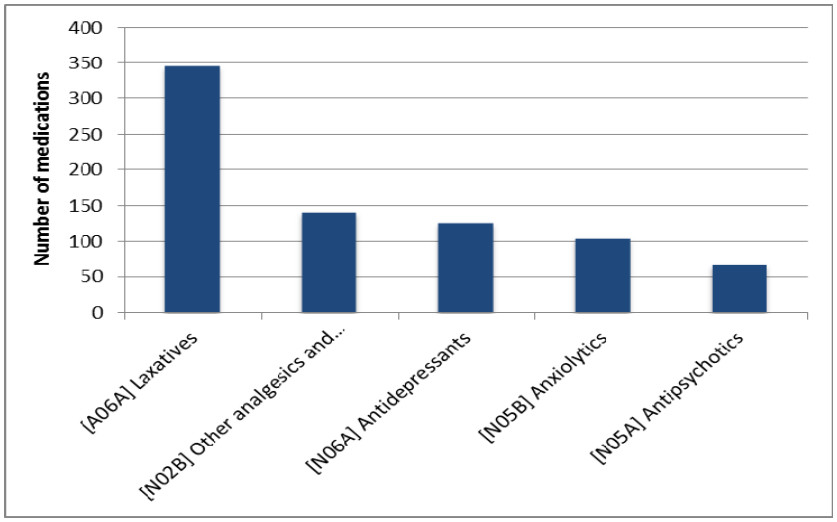


Figure 2.10 Five most prevalent inappropriately prescribed medications measured by explicit PA instruments during 3-month prior to AEs

Of the independent AEs, almost all (n = 305, 99%) were accompanied with IP measured by one or more domains of the MAI during the 3-month prior to the incidents. IP for "regular medications" and "short-term medications" was present during the 3-month prior, among 99% and 81% of the cases respectively. The mean MAI index score for IP for all medications was 1.6 (± 0.84, range 0 to 8.0), and that for "regular medications" and "short-term medications" only 2.1 (± 1.08, range 0 to 8.0) and 0.88 (± 1.15, range 0 to 8.0). By comparison, the prevalence and MAI index score of IP for "short-term medications" was visibly higher than that observed among the general elderly NHRs during December 2008.

Among all the medications used during the 3-month prior to the incidents, the 10 pharmacological subgroup with the largest total counts of IP were laxatives [A06A], drugs for peptic ulcer and gastro-oesophageal reflux diseases [A02B],

anxiolytics [N05B], antidepressants [N06A], iron preparations [B03A], antiepileptics [N03A], antihistamines for systemic use [R06A], antipsychotics [N05A], calcium [A12A], and beta-lactam antibacterials, penicillins [J01C] (Table 2.12). Compared to that reported among the general elderly NHRs during December 2008, IP was more common among medications of the respiratory system [R] and antiinfectives for systemic use [J]. This was probably attributable to the increased "when needed" use of antihistamines and antibacterials for managing acute conditions, some of which led to unplanned hospitalizations and ED visits.

Table 2.12 Ten pharmacological subgroups with the most number of IP measured by MAI domains during 3-month prior to AEs (total IP count = 3402)

Medication	Number of IP Measured by MAI Domain…										Total counts
	1	2	3	4	5	6	7	8	9	10	
[A06A] Laxatives	131	1	2	1	0	0	0	5	164	148	452
[A02B] Drugs for peptic ulcer and GRD	76	0	9	71	3	0	0	2	77	101	339
[N05B] Anxiolytics	50	94	1	0	0	2	64	2	48	46	307
[N06A] Antidepressants	33	56	2	0	0	8	33	14	39	49	234
[B03A] Iron preparations	7	0	2	98	1	0	0	0	28	37	173
[N03A] Antiepileptics	47	6	5	8	0	2	0	0	51	42	161
[R06A] Anstihistamines for systemic use	11	54	5	2	1	1	44	5	17	9	149
[N05A] Antipsychotics	50	0	0	0	1	2	1	5	45	40	144
[A12A] Calcium	0	0	0	117	0	1	0	0	0	0	118
[J01C] Beta-lactam antibacterials, penicillins	8	0	3	4	0	0	0	0	10	79	104

GRD = gastro-oesophageal reflux diseases.

2.3.2.1 Prevalence of drug-related AEs and types of medications implicated

Of the 345 AEs (including rehospitalizations), the discharge summaries of three unplanned hospitalizations carried documentations of DRPs suspected to be linked to the primary diagnoses, 23 carried documentations of changes in medication regimen at discharge. Of the latter, 15 incidents were excluded as the NHRs' medication regimens at discharge were not deemed to be directly resulting from the primary diagnosis documented, nor did the DRPs (which prompted the changes in medication regimens) appear to have contributed towards the primary diagnosis.

In total, 10 (2.9%) drug-related AEs were identified; of which, nine were hospitalizations (mean duration of stay = 7.2 ± 8.7, range 2 to 30 days) and one was a visit to the ED. The details of these incidents were reported in Table 2.13.

Table 2.13 Prevalence of possible drug-related AEs during 1st July 2007 to 30th June 2008 (total independent AEs = 309)

AE Type / Duration (days)	ICD-10 code	Description of Primary Diagnosis (in discharge summary)	Possible DRP and Causes [PCNE code]		Medication Implicated	IP of Medication Implicated
			Problem	Cause		
Hospital stay / 30	[V]	**Cognitive impairment with delusion** *increased quetiapine dose*	[P3.1]	[C1.2]	**Quetiapine**	nil
Hospital stay / 11	[V]	**Dementia with frontal lobe features** *decreased fluoxetine dose, initiated valproate*	[P2.1]	[C1.2] / [C1.5]	**Fluoxetine**	**Beers Criteria** **MAI** *effectiveness*
Hospital stay / 10	[V]	**Dementia - advanced** *previously hospitalized within 30 days prior to current incident with a diagnosis of "poor oral intake secondary to dementia", however was referred again for the same reason. Haloperidol was initiated at discharge for managing agitation symptoms i.e. refusal of food*	[P2.6]	[C1.7]	**Haloperidol** *under-prescribed*	nil
Hospital stay / 5	[XVIII]	**Haemoptysis secondary to bronchiectasis** *precipitated by aspirin*	[P1.1]	[C1.8]	**Aspirin**	nil
Hospital stay / 4	[IX]	**Hypotension** *likely secondary to lorazepam*	[P1.1]	[C1.1] / [C1.8]	**Lorazepam**	**Oborne *et al*.** *non-generic drug name* **MAI** *duration of use* **MAI** *cost*
Hospital stay / 4	[IV]	**Hyperkalaemia** *lowered enalapril dose*	[P3.2]	[C1.2]	**Enalapril**	nil
Hospital stay / 3	[XI]	**Constipation** *initiated lactulose*	[P2.6]	[C1.7]	**Laxatives** *under-prescribed*	nil
Hospital stay / 2	**[IV]**	**Hypoglycemia secondary to poor oral intake and vomiting** *adjusted diabetic medications*	[P3.2]	[C1.7] / [C1.8] / [C3.5]	**Glipizide, Metformin**	**MAI** *direction of use*
Hospital stay / 2	[VI]	**Epilepsy** *sub-therapeutic antiepileptic drug given (sub-therapeutic due to impaired drug availability as staff served phenytoin with NG feeds, when supposed to give on empty stomach*	[P5.1]	[C3.5] / [C2.4]	**Phenytoin**	**MAI** *dosage* **MAI** *direction of use*
ED visit	[XI]	**Constipation** *initiated lactulose*	[P2.6]	[C1.7]	**Laxatives** *under-prescribed*	nil

Among these drug-related unplanned hospitalizations and ED visits, four observations were made. Firstly, medications implicated were mostly from the anatomical main groups of alimentary tract and metabolism [A] and nervous system [N]. Secondly, all the related DRPs were attributed to IP. Specifically, inappropriate drug/dose selection [C1] was implicated in nine drug-related AEs and the lack of proper instructions for drug administration [C3.5] was implicated in two of the 10 drug-related AEs. Thirdly, the use of MAI identified IP in four medications, while explicit PA instruments identified IP in two medications that were implicated with drug-related AEs; however these were not relevant to the DRP reported. Lastly, lack of monitoring/recognition of and continued evaluation for new indications, pharmacotherapeutic responses and adverse drug use outcomes were noted to possibly contribute towards these adverse drug-related events. The limitation and detailed discussion of the implications of these findings are reported in Section 2.4.

2.3.2.2 Prevalence of fall-related AE and the associated medication use and IP

Of the 309 independent unplanned hospitalizations and ED visits, 27 (9%) were referred due to fall-related reasons of 23 NHRs, and four of these NHRs were referred more than once during the 1-year period of our study. Of these 27 fall-related AEs, 14 were hospitalizations (mean duration of stay = 9.9 ± 7.2, range 3 to 25 days) and 13 were visits to the ED. The majority of these fall-related AEs resulted in diagnoses of fractures (Figure 2.11), which contributed to 5% of all 309 AEs.

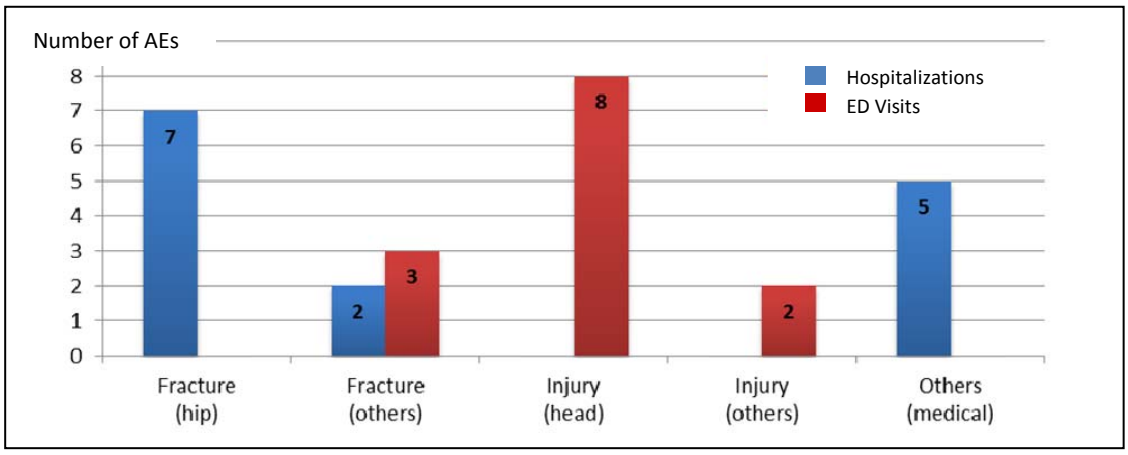


Figure 2.11 Diagnoses resulting from the fall-related AEs

From Table 2.14, it was observed that the NHRs' factors such as female gender, absence of dementia, lower functional dependence, fall history, absence of polypharmacy, and regular use of antidepressants, selective serotonin reuptake inhibitors (SSRI) and hydroxyzine were more likely to lead to an AE related to falls. Particularly, the presence of fall history and lower functional dependency status were singled out as independent risk factors for fall-related AEs. The prevalence of fall-related AEs also appeared to be independently associated with a particular NH. The plausible explanations and implications of these associations are discussed in details in Section 2.4.

Table 2.14 Factors associated with AEs related to falls (total fall-related incidents = 27)

NHRs' Factors	n	%	OR			
			Unadjusted (95% CI)		Adjusted[a] (95% CI)	
Demographic and Clinical Factors						
NH Site						
A	21	77.8	1.0	-	1.0	-
B	5	18.5	0.3	(0.09, 0.68)[f]	0.1	(0.02, 0.36)[f]
C	1	3.7	0.1	(0.01, 0.52)[f]	0.1	(0.01, 0.50)[e]
Length of Stay						
0-6 months	3	11.1	1.0	-	1.0	-
7-24 months	7	25.9	0.7	(0.18, 3.03)	2.3	(0.43, 12.12)
>24 months	17	63.0	0.8	(0.22, 2.93)	1.4	(0.31, 6.59)
Gender						
Male	11	40.7	1.0	-	1.0	-
Female	16	59.3	1.7	(0.76, 3.80)	4.4	(1.30, 14.85)[e]

NHRs' Factors	n	%	OR			
			Unadjusted (95% CI)		Adjusted[a] (95% CI)	
Age						
≥80 years old	14	51.9	1.0	-	1.0	-
65-79 years old	13	48.1	1.7	(0.78, 3.80)	3.1	(1.00, 9.75)
Race						
Chinese	23	85.2	1.0	-	1.0	-
Non-Chinese	4	14.8	0.6	(0.18, 1.64)	0.6	(0.13, 2.39)
Functional Status						
RAF Category 1 & 2	7	25.9	1.0	-	1.0	-
RAF Category 3	17	63.0	0.2	(0.08, 0.71)[e]	0.2	(0.04, 0.83)[e]
RAF Category 4	3	11.1	0.02	(0.01, 0.10)[f]	0.01	(0.00, 0.06)[f]
Cognitive Status						
Has Dementia	11	40.7	1.0	-	1.0	-
No Dementia	16	59.3	3.0	(1.32, 6.62)[f]	1.85	(0.62, 5.57)
History of falls						
No	17	63.0	1.0	-	1.0	-
Yes	10	37.0	2.3	(1.01, 5.34)[e]	9.2	(2.45, 34.94)[e]
Polypharmacy						
Absent	7	25.9	1.0	-	1.0	-
Present	20	74.1	0.5	(0.21, 1.32)	0.2	(0.03, 0.69)[e]
"Regular Medications" Used						
Antipsychotics	8	29.6	1.23	(0.52, 2.93)	2.46	(0.73, 8.30)
Typical antipsychotics	7	25.9	1.38	(0.56, 3.43)	2.33	(0.69, 7.86)
Atypical antipsychotics	1	3.7	0.64	(0.08, 5.02)	1.63	(0.10, 27.41)
Antidepressants[b]	17	63.0	2.70	(1.19, 6.11)[e]	2.11	(0.70, 6.36)
Selective serotonin re-uptake inhibitors	17	63.0	2.78	(1.23, 6.30)[e]	2.34	(0.78, 7.00)
Sedatives and hypnotics	1	3.7	0.43	(0.06, 3.34)	0.70	(0.06, 7.69)
Short-acting benzodiazepines	1	3.7	0.60	(0.08, 4.69)	0.79	(0.07, 8.91)
Levo-dopa	3	11.1	1.29	(0.36, 4.56)	2.70	(0.37, 19.90)
Antiepileptics	7	25.9	0.77	(0.32, 1.89)	1.58	(0.45, 5.47)
Hydroxyzine	4	14.8	3.60	(1.09, 11.93)[e]	1.53	(0.31, 7.48)
Diuretics[c]	5	18.5	1.03	(0.37, 2.85	0.40	(0.10, 1.68)
Hydrochlorothiazide	1	3.7	0.95	(0.12, 7.63)	0.52	(0.05, 4.92)
Furosemide	4	14.8	1.05	0.35, 3.20)	0.41	(0.08, 2.23)
Beta-adrenergic blockers	3	11.1	0.85	(0.25, 2.98)	0.28	(0.06, 1.39)
Calcium channel blockers	4	14.8	0.99	(0.33, 3.02)	0.69	(0.18, 2.67)
Angiotensin II converting enzyme inhibitors	6	22.2	1.36	(0.52, 3.54)	1.36	(0.38, 4.86)
Digoxin	1	3.7	0.36	(0.05, 2.78)	0.29	(0.03, 3.43)
Nitrates	3	11.1	0.57	(0.16, 1.95)	0.43	(0.09, 1.98)
Narcotic analgesics	1	3.7	2.67	(0.29, 24.81)	2.73	(0.10, 72.98)
Non-narcotic analgesics[d]	2	7.4	2.18	(0.45, 10.49)	1.57	(0.23, 10.66)
Alpha-receptor blockers	3	11.1	1.73	(0.48, 6.27)	1.44	(0.27, 7.67)
"Short Term Medications" Used						
Short-acting benzodiazepines	3	11.1	1.34	(0.38, 4.79)	1.98	(0.34, 11.68)
Narcotic analgesics	3	11.1	1.41	(0.39, 5.03)	1.40	(0.18, 10.86)
Non-narcotic analgesics[d]	1	3.7	0.48	(0.06, 3.70)	0.15	(0.01, 2.65)
Hydroxyzine	4	14.8	1.58	(0.51, 4.89)	1.94	(0.37, 10.22)
Drowsy antihistamine- / codeine-based cough and cold preparations	4	14.8	0.99	(0.33, 3.02)	2.76	(0.48, 15.82)

Warfarin, benzodiazepines related hypnotics, long-acting benzodiazepines, and tricyclic antidepressants were not used during the prior 3-months, among NHRs who had fall-related AEs.

[a] OR was adjusted for all demographic and clinical factors reported in the table.

[b] Antidepressants included tricyclic antidepressants and selective serotonin re-uptake inhibitors only.

[c] Diuretics include hydrochlorothiazide and furosemide only.

[d] Non-narcotic analgesics include paracetamol, systemic and topical non-steroidal anti-inflammatory drugs prescribed for pain relief.

[e] Logistic regression, p-value < 0.05.

[f] Logistic regression, *p*-value < 0.001.

2.4 Discussion

In Section 2.3.1.1, the differences in IP prevalence observed between the participating NHs could be attributed to the varied prescribing habits and documentation styles of the different physicians who cared for the NHRs. The association reported between polypharmacy and the presence of IP identified by explicit PA instruments in December 2008 was in keeping with the findings of other studies.[58, 163] This association may be related to the presence of higher number of NHRs' co-morbidities and more complex medication regimens, hence resulting in a greater propensity for IP. Although the association of the male gender with IP was also reported in this study, the author could find no reasonable explanation for this trend. Unlike Ma *et al*.[164] who reported a similar association due to the wide use of doxazosin, a medication predominantly prescribed among males for its indication in benign prostatic hyperplasia, there were little use of such gender-biased medications in our study cohort.

Among the explicit PA instruments used, IP measured by the instrument from Oborne *et al*. had the highest concordance with the overall IP observed among the 712 NHRs. Although the kappa statistics of 0.372 reported in Table 2.4 seemed low, this value was the highest compared to that obtained from the other instruments, and could be due to the high prevalence of the failure to use generic name in the drug orders and the failure in documenting the maximum frequency of administration reported from the use of this PA instrument. Although the failure to use generic drug name of prescribed medications was commonly implicated among the five most prevalent inappropriately prescribed pharmacological subgroups as seen in Table 2.6, this was

not regarded as a "misuse of medication" and hence was not an IP within the definition used in this thesis. Yet, the failure to use generic names during prescribing could lead to potential medication errors, specifically skill-based medication errors,[14] during the medication supply and administration processes. As this thesis did not set out to address medication errors, this gap was not considered in interventions (reported in subsequent chapters) aimed at reducing IP.

In Section 2.3.1.2, the significant differences of mean MAI index scores found between the four NHs suggested that site-related factors such as physicians' prescribing habits, documentation systems and even the organization and treatment culture of the NH[165-168] may influence PA. In addition, the reported associations of higher MAI index scores with age and cognitive impairment may be related to clinicians' inertia to actively review and change the medication regimens of these NHRs, especially if these were prescribed from a hospital. Such prescribing attitudes may be similar to that observed for NHRs who do not require acute considerations,[169] who are more advanced in age,[170] or who lack the ability to make decisions.[171]

From Sections 2.3.1.1 and 2.3.1.2, laxatives were identified as the top most prevalent inappropriately prescribed medication. This prevalence was contributed by the Beers Criteria,[31] which defined the long-term use of stimulant laxatives to be inappropriate at all times among the elderly. Although this criterion had been removed in the recent 2012 update of the Beers Criteria[32] due to the lack of evidence in supporting the concerns on the exacerbation of bowel dysfunction with long-term use of stimulant laxatives,[172] the uncertain risks versus benefits of their long-term use, high prevalence of laxative use in the NHs, prescribing of multiple laxatives per NHR (mean number of laxatives per NHR = 2.1), and the large number of laxatives prescribed for use on a when-necessary basis with a lack of proper instructions to

guide their administration by the NS continue to be pertinent concerns with regards to the appropriateness of laxative use among elderly NHRs. In addition, the lack of documenting and/or reviewing indications for its long-term use, identified using the MAI, added to this list of inappropriate prescribing concerns for laxatives in the NHs.

Among the other top prevalent inappropriately prescribed medications reported in Sections 2.3.1.1 and 2.3.1.2, the nature of inappropriate prescribing of antipsychotic identified were deemed to have more worrying implications compared to that of antidepressants, anxiolytics and analgesics and antipyretics. Specifically, inappropriate antipsychotic prescribing was related to the lack of proper assessment, monitoring and documentation of the use indication and outcomes in more than two-thirds of all NHRs prescribed with antipsychotics, resulting in concerns of inappropriately long duration of antipsychotic use and the unnecessary exposure to SEs and adverse NHR outcomes.

In Section 2.3.2.1, 10 drug-related AEs were reported. This was probably an underestimate of the true prevalence in view of the retrospective nature of this study. As such, the identification of drug-related AEs was based on the presence of explicit documentation in the discharge summary at best, despite limitations in missing documentation and potential under-identification of cases during hospital stays or ED visits. Although attempts were also made to identify drug-related AEs through retrospective evaluation of the medications used and the presence of IP during the 3-month prior to the incidents, the absence of documented details in the NHRs' medical notes posed uncertainties in (1) establishing the causes of the DRPs, (2) ascertaining the causal relationship of the DRP and actual AE, and (3) specifying the medication implicated, especially when multiple medications were potential causes, as in the case of a fall-related AE. Nevertheless, four points to be considered in interventions aimed

at improving PA and medication use outcomes among elderly NHRs were derived from the drug-related AEs reported. Firstly, six drug-related AEs involved laxatives, antidepressants, antipsychotics and benzodiazepines, which had been consistently highlighted in the previous sections as having the highest numbers of IP. This echoed the need to ensure the appropriate prescribing of these medications. Secondly, the nature of the DRPs implicated in these AEs were similar to that reported by Gurwitz *et al*.,[76, 77] where inappropriate drug/dose selection was the main (72%) prescribing errors contributing to preventable adverse events in NHs. Like a repeated refrain, the finding from our background study offered evidence for the significant impact of inappropriateness in the prescribing process (compared to problems in other medication use processes) on negative outcomes of drug use. Hence, it appeared that reducing IP may reduce the incident of drug-related AEs. Thirdly, the general mismatch between the identified IPs and the DRPs implicated in the AEs suggested that the use of generic PA instruments that cover all types of medications may not be adequate for capturing IP that may be clinically significant. Furthermore, the conduct of medication reviews to identify IP, such as that conducted for this study, was a time- and labor-intensive task accomplished by a pharmacist; the use of such interventions to capture and prevent IP with the aim of reducing adverse outcomes may thus be costly, inefficient, and ineffective. More specific, sustainable, and practical interventions/strategies are thus needed, to (1) target the gaps in achieving PA of specific therapeutic or pharmacological subgroups, (2) involve other core clinical team members such as nurses and physicians, (3) be readily applied and systemically incorporated at long-term care institutions and (4) achieve timeliness in minimizing or correcting IP, so as to avoid drug-related AEs, and optimize medication therapy outcomes. Lastly, a lack of monitoring for new indications, pharmacotherapeutic

responses and adverse reactions were deemed to possibly contribute towards these drug-related AEs; this led to the hypothesis that proper monitoring and documentations may serve as an integral part of an intervention to improve PA, avoid drug-related AEs, and optimize medication therapy outcomes.

In Section 2.3.2.2, large confidence intervals for the odds ratios of factors associated with fall-related AEs were observed; this was possibly due to the small number of incidents included in the analysis. Nonetheless, several resident factors were found to be associated with fall-related AEs. The higher likelihood of elderly female NHRs to have fall-related incidents could be related to the physiological effects of accelerated bone loss in post-menopausal women compared to men of similar age;[173] thus, women have higher risk for osteoporosis and are more prone to fractures from falls that may require tertiary medical care. The decreased likelihood of elderly NHRs with dementia to have fall-related incidents could be due to the use of specialized dementia wards at the participating homes; such arrangements may have highlighted the NHRs' decreased safety awareness (due to dementia) and increased fall-prevention measures in these wards. In addition, similar to NHRs with higher functional dependence (RAF categories 3 and 4), NHRs with advanced dementia are likely to be bed-bound, less ambulant and less likely to engage in physical activities, and hence have lesser opportunities for falls due to the lack of mobility. The lower prevalence of fall-related incidents among NHRs with polypharmacy was, however, contrary to that reported in other studies.[174] This may be due to the increased attention given to NHRs with polypharmacy in the NHs, arising from the awareness of the potential association between popypharmacy and falls. Similarly, the author postulated that interventions to improve PA may also

induce a ripple effect in reducing fall-related AEs by increased NS awareness of and attention to the NHRs.

Among the medications evaluated in this study, benzodiazepines and antipsychotics were not significantly associated with falls that led to referrals for hospitalizations and ED visits although they were widely reported risk factors for falls. A possible explanation included limitations of the small number of fall-related AEs and the resulting large confidence intervals. Therefore, this lack of statistical significance should not undermine the potential of these medications for causing falls, and other SEs and the importance of ensuring appropriate prescribing of these medications. Similar to reports of other studies,[157, 175, 176] regular use of SSRI (unadjusted OR = 2.78, 95% CI = 1.23, 6.30) and hydroxyzine (unadjusted OR = 3.60, 95% CI = 1.09, 11.93) appeared to be associated with fall-related AEs. Although the adjusted ORs for these were not statistically significant, the evaluation of these medications revealed concerns about their potentially inappropriate use. Specifically, no documentation of mood disorders was found among 30% of the 17 incidents that recorded prior use of SSRI. This was also observed for 37% of the 124 independent hospitalizations and ED visits (of all causes) that had prior use of SSRI. Hence, not only did this imply that the association of fall-related AE may be unlikely due to the underlying reason of clinical depression, it also highlighted the potential issues related to IP that could have culminated to the increased odds for these AEs. In the case of SSRI, the issue of inappropriateness was poor documentation (similar to the conclusions drawn by Mamun *et al*.[177] on problems in prescribing of psychoactive medications), while for hydroxyzine, it was inadequate monitoring for medication use outcomes, leading to the failure to discontinue medications used for symptomatic

relief when it was no longer indicated. Hence, these fundamental issues should be addressed in interventions to improve PA of psychoactive medications.

Finally, although the prevalence of fall-related AEs appeared to be independently associated with a particular NH, this comparison could be limited by the data being collected from only three of the four NHs recruited. Despite this limitation, strategies to target at-risk NHRs and overcome site-related factors such as environment and level of staffing should be considered when devising strategies to reduce IP and adverse outcomes, as suggested by many publications.[174, 175]

2.5 Summary

In the first part of this background work, laxatives [A06A], antidepressants [N06A], antipsychotics [N05A], anxiolytics [N05B], other analgesics and antipyretics [N02B], drugs for peptic ulcer and gastro-oesophageal reflux diseases [A02B], calcium [A12A], iron preparation [B03A], lipid modifying agents [C10A], and vitamin B12 and folic acid [B03B] were identified as the top five and 10 most prevalent medications with IP measured by the various explicit PA instruments and the implicit PA instrument MAI. Among these, IP among laxatives and antipsychotics appeared to be the most prevalent and with the most worrying clinical issues of IP and concerns in terms of the potential adverse outcomes. Therefore, the subsequent work was focused on these medications, beginning with evaluations of the challenges and other specific external factors that may influence the PA of laxatives and antipsychotics, followed by the development and testing of innovative strategies and interventions at the actual settings to improve their PA and therapeutic outcomes, and reduce AEs. These are reported in chapters 3 and 4 of this thesis.

In the second part of this background work, IP were identified as the main causes of DRPs that had culminated directly to AEs of unplanned hospitalizations and ED visits. AEs related to falls also appeared to be influenced in part by the use and IP of SSRI and hydroxyzine, which are potentially avoidable. Successful interventions at the NHs may reduce the incidents of total unplanned hospitalizations and ED visits by up to 12%. From the evaluations, the issues in PA and suggestions for new inter-professional collaborative practices were summarized in Table 2.15.

Table 2.15 Considerations for interventions that aim to improve PA, NHR outcomes and reduce AEs

Identified Gaps/Issues	Considerations for Interventions
Inappropriate Laxative Prescribing	
• Lack of indication for drug use	• Improve objective assessment and documentation of constipation symptoms
• Uncertain effectiveness of laxative choice	• Improve objective assessment and documentation of constipation symptoms • Improve objective monitoring and documentation of laxative use outcomes
• Lack of administration instructions	• Improve communications and documentation • Increase knowledge of appropriate medication use for prescriber / NS
• Inappropriate duration of drug use	• Improve objective monitoring and documentation of laxative use outcomes • Active review of medication use appropriateness
• Unplanned hospitalizations and ED visits related unrecognized constipation symptoms and under-prescribing of laxatives	• Reduce under-prescribing of laxatives by improving identification of indication for laxative use • Increase knowledge of appropriate medication use for prescriber / NS
Inappropriate Antipsychotic Prescribing	
• Inappropriate indication for drug use	• Improve objective assessment and documentation of BPSD
• Inappropriate duration of drug use	• Improve objective monitoring and documentation of medication use outcomes • Active review of medication use appropriateness
• Risk for falls and other SEs	• Increase awareness and attentiveness of NS • Increase drug knowledge on SEs of prescriber / NS • Target at risk NHRs • Overcome site-related factors

Chapter 3

Improving the Appropriateness of Laxative Use among Elderly Nursing Home Residents (NHRs)

3.1 Identifying gaps in achieving appropriate laxative use

In general, constipation is a term that encompasses symptoms which describe irregular, infrequent or difficult evacuation of the bowels. Despite the presence of a standardized diagnostic definition for chronic constipation such as the Rome III diagnostic criteria for functional gastrointestinal disorders[178], many clinicians maintained the use of less than three bowel movements per week as a quick indicator for constipation.[179] Many report constipation as subjective symptoms, which may include hard/lumpy stools, straining, bloating, and feeling of incomplete evacuation after a bowel movement, regardless of a reduced stool frequency.[180] Hence, it was no wonder that the prevalence of self-reported constipation was observed to increase with age although reduced bowel frequency may not increase with age.[181] Specifically, the prevalence of constipation was known to be higher among the elderly residing in long-term care institutions compared to those who are community-dwelling. The difference in prevalence between the two settings reported in the United States was 74% versus 50%,[182] and that in the Netherlands was 53% versus 16-41%.[183] In Singapore, the prevalence of constipation among those aged 60 years and above was estimated to be 12%; no data was available for the elderly NHRs. The high prevalence of constipation at NHs was associated with NHR factors such as decreased mobility, poor fluid intake, poor dentition, co-morbidities such as Parkinson's disease, dementia, hypothyroidism, arthritis and stroke, polypharmacy, and the use of constipating medications.[184, 185] These NHR factors may also influence

the management of constipation; while improving access to toileting[186] and increasing physical activity,[187] fiber and fluid intake[188, 189] may be effective nonpharmacological interventions to prevent constipation and decrease laxative use. Restrictions in fluid intake due to renal/heart failure and a decrease in mobility status may also render these interventions infeasible for the majority of the frail elderly NHRs. It is therefore not surprising that laxatives are one of the most commonly prescribed medications among the elderly NHRs.

However, the high prevalence of laxative use (which refer to both the prescribing and administration processes of laxatives in this chapter) in the NHs is of concern in view of the lack of evidence on the appropriate duration of using senna to manage chronic constipation,[172] the absence of elderly-specific pharmacotherapeutic guidelines for appropriate laxative use[190] and the highly variable symptoms of constipation between individuals.[191] From the previous chapter, the identified IP of laxatives included the lack of assessment of indications for laxative use, documentation of administration instructions (especially for two-thirds of the laxatives prescribed for use on a when-needed basis), and review of continual prescription of laxatives upon hospital discharge. Moreover, under-prescribing of laxatives also caused two drug-related AEs. To overcome these challenges in a concerted fashion, a communication program, Pharmacist Led Education on Appropriate Drug-use (PLEAD) program for laxative use, was developed to improve communication and the appropriateness of laxative use by engaging the prescribers (physicians), NS, key administrators and NHRs in specific desirable behavioral changes. The details of which are reported in Section 3.2.1. To the author's knowledge, no interventions aimed at improving the appropriateness of laxative use had been attempted or published to date.

Before the development of the PLEAD program, it was essential to first identify the underlying factors, beliefs and attitudes that may influence inappropriate laxative use as well as possible motivators of behavioral change towards laxative use appropriateness. These were the basis for identifying specific gaps and desirable behavioral changes towards appropriate laxative use, which in turn formed the content and contributed to the design of the message and structural framework of the PLEAD program.[192] Several factors that may influence inappropriate laxative use and/or serve as motivators for behavioral change were postulated.

Firstly, the prevalence of chronic constipation was generally thought to be correlated with the amount of laxatives prescribed. However, this assumption in the NH setting where the majority of laxatives are used without documented indications is debatable. This could be due to the omission of proper documentation or the lack of motivation/attention arising from the recurrent NHRs' complaints and the simple routine treatment modes in providing assessment and hence documentation of constipation.[193] However, the appropriateness of laxative choice and use should be one that is suited for the type of constipation symptom manifested and the intended pharmacotherapeutic outcomes.[194] Hence, it would be important to uncover the prevalence of symptoms underlying the NHRs' complaints of constipation. Providing specific knowledge of these in comparison to the laxative prescribing/use trends may serve as a motivation to induce changes in the clinical team to be more attentive in ascertaining proper indications and prescribing/use according to actual needs.

Secondly, it was observed that the prescribers would often add laxatives to the NHRs' medication regimens when suggested by the NS and frequently at the NHRs' first admission to the NH. As laxatives are easily available over-the-counter medications for symptomatic treatment, the prescribers may not pay much attention to

its actual use after prescribing it as a when-needed medication for administration at the NS's discretion (as otherwise, no medications could be served unless ordered by a physician). Hence, discrepancies in laxative administration from its prescribed use may contribute towards inappropriate duration of laxative use.

Lastly, the NHRs' beliefs about constipation, the impact of constipation on their quality of life, their attitudes towards managing constipation and expectations of laxative use, may potentially create pressure for prescribing and use of laxatives.[195] In addition, the NHRs' feedback, negative or positive, after the administration of laxatives, may also influence continual laxative use by the same or other NHRs. Although allowing laxatives to be used according to the NHRs' requests may be deemed appropriate,[10, 196] such laxative use practice would clearly be inappropriate if the requests were driven by incorrect understanding of bowel movements and laxative use by the health care team and the NHRs themselves.[197]

3.1.1 Description of the gap-finding studies

Thus, three separate gap-finding studies were first conducted to evaluate the appropriateness of laxative use, the prevalence of chronic constipation and symptoms among elderly NHR, the perceived impact of constipation, laxative use, satisfaction with the laxatives prescribed, and the NS's perception on constipation management and laxative use (Figure 3.1).

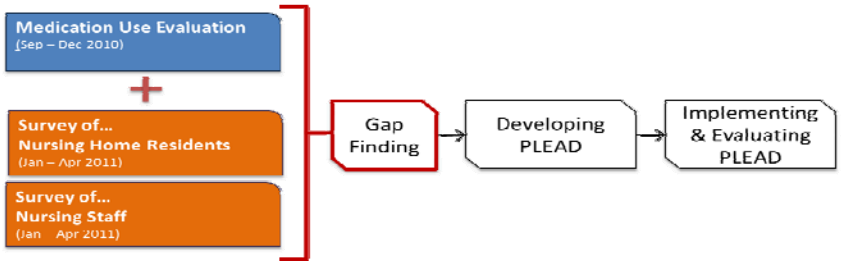


Figure 3.1 Studies conducted to identify gaps in achieving appropriate laxative use

3.1.1.1 MUE of Laxatives

Firstly, MUE to assess the appropriateness of laxative use, was conducted from September to December 2010. The study was conducted at two VWO-run homes (200-300 beds each), which had been estimated to provide an adequate sample size for the MUE study, as well as the resident interviews (Section 3.1.1.2), and pilot study (Section 3.2.2) on the outcomes of the PLEAD program (using a non-randomized controlled before-and-after design). These NHs were selected at random, and were not previously included in the background study.

Retrospective data on laxative use and bowel movements over a 4-week period in October or November 2010 were collected at both NHs using the custom-designed data collection form (Appendix 3.1). Information was collected from the original hardcopy medication records, medical notes and bowel elimination charts of the elderly NHRs held in the respective homes, except those with medical conditions and co-morbidities that would influence bowel movements and require special management, such as the presence of colostomy, cancer of the gastrointestinal tract, neurogenic bowel, megacolon, intestinal volvulus, diverticular diseases, ulcerative colitis (including Crohn's disease), rectal prolapse, intestinal obstruction (of various causes) and irritable bowel syndrome. NHRs with incomplete 1-month data due to hospitalization or death were also excluded.

Evaluation of laxative use appropriateness was defined generally as conforming to any recommendations provided in the original product inserts, drug references, and published literature in terms of several domains, including indication, contraindication, precaution, SEs, dosage, dosing frequency, duration of use, storage, and monitoring requirements. The actual administration of the laxatives was also

assessed for compliance to the prescribed frequency and duration of laxative use. Figure 3.2 shows the guide that was developed and used for this purpose.

The minimum data sets required for this MUE was estimated to be 369 based on a worst-case scenario of 50% prevalence of inappropriate laxative use among the population of 9265 NHRs[198] with 95% confidence level.[160] The prevalence of inappropriate laxative use are reported descriptively in Section 3.1.2.1.

Laxative Use Processes	Appropriate
PRESCRIBING PROCESSES	
Indication	• Documentation of chronic constipation • Bowel opening < 3x weekly • Use of opioids / codeine-containing medications
Contraindication	• Absence of contraindication for use
Precaution	• Absence of precaution for use
SEs	• Absence of SEs (documented)
Dosage (per day)	• Per recommendation of product insert / drug references / published literature
Dosing Frequency	• Per recommendation of product insert / drug references / published literature
Duration of Use	• All PRN laxatives • Regular lactulose / maltodextrin (Fibrosol) in the presence of CC or bowel opening <3x weekly • Regular senna / lactulose in the presence of opioids / codeine-containing medications
POST-PRESCRIBING PROCESSES	
Storage	• Per recommendation of product insert / drug references / published literature
Monitoring	• Monitor for efficacy & side-effects
Administration	• Per prescribed dose & duration

Figure 3.2 Summarized guide used for assessing appropriateness of laxative use

3.1.1.2 Interviews of NHRs

Next, surveys were conducted between January to April 2010 among NHRs and NS separately, to determine the prevalence of self-reported chronic constipation and related symptoms, perceived impact of constipation, laxative use, satisfaction with the laxatives prescribed, and the NS's perception on bowel management. Elderly NHRs with adequate cognitive capacities to provide responses were first identified with the help of the staff nurse-in-charge of each ward. Consent was then sought from these NHRs and all NS at the two homes to participate in the study.

Available validated structured questionnaires were used for this study in order to provide quantitative measures of NHRs' perception on constipation, its impact, laxative use, and satisfaction with the laxatives prescribed. Specifically, The questions for assessing chronic constipation and symptom severity were derived from the Chinese constipation questionnaire.[199] This was chosen as it was relatively short and quick to complete, well-validated and had been tested for use among Chinese, who were the major race at NHs in Singapore. NHRs were identified to have chronic constipation if (1) the total score for the six questions under the "Chronic Constipation & Symptom Severity" section was above 4 or (2) the non-zero response was obtained for Question 1 under the "Perception of Constipation" section. The questions for surveying the perception of constipation were derived in part from a survey published by Cheng *et al*.[200] and the PAC-QOL[201] questionnaire; these questions were worded in order to be understood by both residents with and without chronic constipation to be a survey of their general perception, without the intention to assess their current quality of life. The survey questions administered to the NHRs and NS are shown in Figure 3.3. Responses to all the questions were provided on a 5-point Likert scale consisting of a range of zero to four scores, corresponding to 'not at all', 'rarely/a little bit', 'some of the time/moderately', 'most of the time/quite a bit', and 'always/extremely', where appropriate. The survey questions were pre-tested by three NHRs and two NS prior to their use on the study subjects.

Questions for NHR	Questions for NS
Chronic Constipation & Symptom Severity	
In the past 3 months, have you had any of the following symptoms? 1) Bloating in your abdomen? 2) Feeling like you had to pass a bowel movement but you couldn't? 3) Incomplete bowel movement, like you didn't "finish"? 4) Lumpy or hard stools? 5) <3 defecations/week? *In the past 3 months...* 6) what is the number of laxatives you have taken?	
Perception of Constipation	
1) Do you think you have constipation? 2) Do you think constipation symptoms can be controlled? 3) Does constipation bother you? 4) Does constipation affect your life? 5) Does constipation affect your health physically? 6) Does constipation affect your mood? 7) Are you satisfied with how often you open your bowels? 8) Are you satisfied with the regularity with which you open your bowels?	*Do you think...* 1) your residents have constipation? 2) the residents' constipation symptoms can be controlled? 3) the residents' constipation bothers them? 4) the residents' constipation affects their life? 5) the residents' constipation affects their health physically? 6) the residents' constipation affects their mood? 7) the residents are satisfied with how often they open their bowels? 8) the residents are satisfied with the regularity with which they open their bowels?
Perception of Laxative Use	
1) How often do you think you need to take laxatives? 2) Are laxatives effective in relieving constipation? 3) Are you satisfied with the laxatives you are currently using? Why? 4) How often do you use other methods to relieve your constipation? Specify methods. 5) Are the other methods to relieve constipation effective? 6) Are you satisfied with the other methods used to relieve your constipation? Why?	1) How often do you think your residents need to take laxatives? 2) Are laxatives effective in relieving your residents' constipation? 3) Are you satisfied with the laxatives currently taken by your residents? 4) How often do you think your residents need to use other methods to relieve constipation? 5) Are the other methods effective in relieving your residents' constipation? 6) How often do you think your residents need to use acute methods to relieve constipation? 7) Are the acute methods effective in relieving your residents' constipation?
Perception of Bowel Management	
	1) How important is managing residents' bowels? 2) Does your unit have a written bowel management guideline/protocol? 3) How useful is it to have a written bowel management guideline/protocol? 4) Do you think bowel management is a neglected area of care in nursing homes?

Figure 3.3 Comparison of the YKZ Questionnaire on constipation and laxative use for elderly NHRs and NS

The surveys of NHRs were administered using face-to-face interviews to ensure good response rate and reliability of quantitative responses provided by the older residents[202] as many older residents may require assistance in reading and writing due to physical impairments and illiteracy. In addition, the face-to-face contact also provided opportunities to respond to the participants if help was needed in understanding the questionnaire items. To minimize potential biases imposed by the interviewer, the interviews were carried out in a consistent manner as detailed below. The interviewer also refrained from answering and commenting on questions

other than those related to the questionnaire items. All the interviews were conducted by the same interviewer, in English, Mandarin, or in Chinese dialects namely, Hokkien and Teochew, at a quiet and private location of the NHR's choice. Prior to the start of each interview, five to ten minutes were set aside to introduce the interviewer and the survey objectives, ensure anonymity, obtain the NHR's consent to participate, and engage in casual chat. The interviewer also emphasized the NHR's right to refuse participation or discontinue the interview if he/she wished at any time, and that their action and responses will not affect future treatment. These steps were essential in overcoming the potential reporting bias that may arise from the participant's perception of the interviewer. During the interview, the survey form was shown to each NHR while all the questions were read aloud in the same sequence. After each question, the response options were repeated, while pointing to the corresponding check boxes on the survey form as a visual cue. Efforts were taken to read the questions during the interview slowly and in a low tone according to each NHR's preferences as assessed during the casual chat. Pauses were also made after each question to allow time for the participant to respond in an unhurried manner. Questions were repeated/explained when asked, or when the interviewer sensed the need to do so. Each participant was also encouraged to speak freely, think aloud, and ask questions if he/she wished. Each response was noted down on the survey form immediately and then shown to the participant. Qualitative responses were recorded in the same manner; these served to supplement the residents' quantitative responses, to allow quick assessments of the reliability and convergence of participants' quantitative and qualitative responses during the interview, and to draw deeper understanding of the quantitative findings.[203] Throughout the survey, simple gestures

by the interviewer such as addressing the participant by name and responding to his/her responses with nods and smiles were also made.

For the interviews, a minimum of 119 NHRs were required (based on the recommendations of Bartlett *et al*.)[204] using margin of error = 0.03 and $\alpha = 0.05$. The demographic, clinical and medication factors of the participants were obtained from their medical and medication records and reported. The estimated prevalence of chronic constipation was reported and compared with that in the physician-documented medical summary for each NHR. Discrepancies in the reported laxative use from that recorded in the medication administration charts were reported. The relationships between the perceived constipation, its symptoms, impact, laxative use, and other treatment modes were evaluated. Responses between residents identified with and without chronic constipation were also compared. Comparisons of categorical data were made using χ^2 test while comparisons of continuous data and survey responses (ordinal data) were performed using Mann-Whitney *U* test. Correlation and association of domains and factors were tested using Spearman's correlation test and logistic regression, while agreement was tested using Kappa statistics. Factors associated with In addition, qualitative data was encoded using Microsoft Word and analyzed for emergent themes of NHRs' concerns for the relevant individual questionnaire items using an inductive content analysis.[205]

3.1.1.3 Self-administered survey of NS

In view of the busy workload and changing shift hours of the NS, the use of a self-completed paper-and-pen survey questionnaire was postulated to overcome the potential limitation of a poor response rate as it can be readily completed per the participants' convenience without the need to schedule for face-to-face contact with

the interviewer. As such, personal invitations[168] were made to all the NS of both NHs to fill out a 1-page self-administered form together with the consent form independently in January – April 2012. The participants were given up to one week to return the completed forms to the interviewer, who provided clarifications on the survey questions if necessary, to minimize biased reporting and to ensure reliability of the data. No names were required on the forms and the participants were assured of their anonymity. However, the designations of the participants were obtained.

The perceptions about constipation, its impact, laxative use, other treatment modes, and bowel management at the NH between the NS of different designations were compared. These responses were also compared to those of the NHRs. Testing of relationship between the different questionnaire domains were performed using the Cohen's Kappa test of concordance, Spearman's correlation test and Chi-square test. Kruskal-Wallis one-way ANOVA was used to compare the responses among the NS, and Mann-Whitney *U* test was used to compare responses between those of the NS and the NHRs. The results and discussion of the NHR interviews and NS survey are reported in Sections 3.1.2.2 and 3.1.2.3.

3.1.2 Outcomes of the gap-finding studies

3.1.2.1 MUE of laxatives

At the two NHs, 412 NHRs were screened; among whom, 69 did not meet the inclusion criteria for age, 21 had co-morbidities that may influence bowel management, and 12 had incomplete data. Of the remaining 310 NHRs, laxatives were prescribed for 215 (69%). Multiple laxatives (up to five) were prescribed for 109 (35%) NHRs. The demographic, clinical and medication information of the 310 NHRs are summarized in Table 3.1. The total number of laxatives evaluated was 359,

where 222 were "regular medications" and 137 were for use on a when-needed basis. Senna was the most commonly used laxative on a regular basis, while lactulose was most commonly used on a when-needed basis (Figure 3.4).

Table 3.1 NHRs' demographic, clinical and medication factors of elderly NHRs included in MUE (n = 310)

Factors		Total		Used Laxatives	
		n	%	n	%
NH Site	A	138	44.5	105	33.9
	B	172	55.5	110	35.5
Length of Stay	0-6 months	28	9.0	24	7.7
	7-12 months	11	3.5	9	2.9
	13-24 months	27	8.7	20	6.5
	>24 months	244	78.7	162	52.3
Gender	Male	145	46.8	102	32.9
	Female	165	53.2	113	36.5
Age	65-79 yo	131	42.3	95	30.6
	>80 yo	179	57.7	120	38.7
Race	Chinese	253	81.6	178	57.4
	Others	57	18.4	37	11.9
RAF	Cat 1 & 2	20	6.4	8	2.6
	Cat 3	79	25.5	55	17.7
	Cat 4	211	68.1	152	49.0
Mobility (RAF)	Independent	16	5.2	5	1.6
	Some assistance	102	32.9	71	22.9
	Frequent assistance	101	32.6	62	20.0
	Total assistance	91	29.4	77	24.8
Polypharmacy	Absent	126	40.6	72	23.2
	Present	184	59.4	143	46.1
Dementia (Documented)	Absent	209	67.4	145	46.8
	Present	101	32.6	70	22.6
Chronic Constipation (Documented)	Absent	281	90.6	189	61.0
	Present	29	9.4	26	8.4

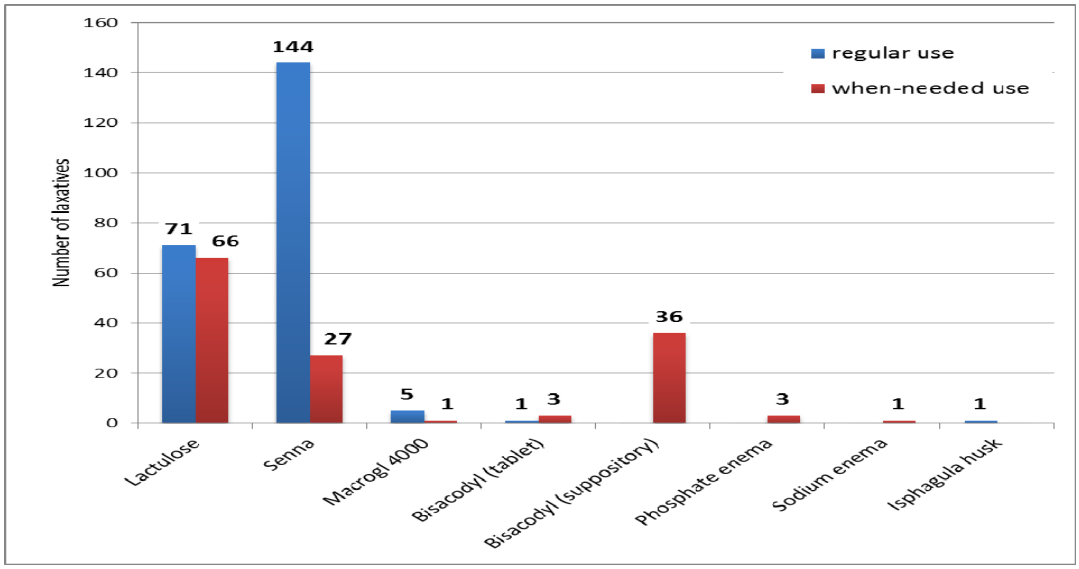


Figure 3.4 Types of laxatives prescribed among 310 NHRs (n = 359)

As reported in Table 3.2, the identified inappropriate laxative use were absence of documented monitoring outcomes of laxative use (100%), absence of indication for use (67.4%), inappropriate duration of use (51.8%), presence of precaution for use (38.2%), inappropriate dosing frequency (32.9%), discrepancy between actual laxative administration and the prescribed directions for use (24.8%), and inappropriate total daily dose (1.1%).

Table 3.2 Prevalence of inappropriate laxative use processes

Domains of Laxative Use Process Assessed	Number of Inappropriate Use					
	All (n = 359)		Laxatives for regular use (n = 222)		Laxatives for when-needed use (n = 137)	
	n	%	n	%	n	%
Prescribing						
Indication	242	67.4	151	68.0	91	28.5
Duration of Use	186	51.8	186	83.8	0	-
Precaution	137	38.2	71	32.0	66	48.2
Dosing Frequency	118	32.9	44	19.8	74	54.0
Dosage (per day)	4	1.1	2	0.9	2	1.5
Post-prescribing						
Monitoring	359	100.0	222	100.0	137	100.0
Administration	89	24.8	7	3.2	82	56.9

SEs, contraindication, inappropriate route of administration and storage were not observed and hence not reported.

Specifically, 151 of the 186 regular laxatives with inappropriately long duration of use were related to absence of documented indication for regular laxative use, while 35 were related to insufficient evidence to support the benefits of prescribing senna and bisacodyl tablets for use on a regular basis. Among the 137 laxatives prescribed for "short-term" use, 82 were administered on a regular basis, deviating from the prescribed intention of use. Of the 118 laxatives with inappropriate prescribed dosing frequency, lactulose was implicated 94 times, for administration "three times daily" instead of the recommended dosing frequency of "one or two divided doses" for total daily doses of up to 30 milliliters. Of the four counts of inappropriate prescribed total daily dose of laxatives, three involved under-dose of senna; NHRs' outcomes were not monitored in two cases, while bowel frequency outcome was clinically unsatisfactory (less than three per week) in the third case. In the fourth case, the dosing frequency of lactulose was unspecified, with a potential for over-use. In addition, it was observed that 17 of the 95 NHRs who were not prescribed with laxatives had indications for laxative use (bowel frequency < 3 per week and/or use of opioid medications), while the other 64 NHRs were not actively monitored for their bowel movements nor assessed periodically for constipation symptoms. The gaps and recommendations from these results are discussed in detail in Section 3.1.3.

3.1.2.2 Interviews of NHRs

Among the 110 NHRs identified as potential participants for the survey by the staff nurses-in-charge, 95 of them expressed interest and provided verbal consent to be interviewed when approached by the interviewer. However, 10 NHRs were subsequently excluded due to language barrier and another two due to inability to

hold prolonged conversations. The remaining 83 NHRs provided written consent and were interviewed. Of these, three were excluded from the analysis as they had difficulty in answering more than half of the questions. Another three NHRs opted to discontinue the interview citing reasons that they did not have any useful information to offer. The number of interviews completed and included in the analysis was 77.

Compared to that of the general cohort of elderly NHRs (Tables 2.1 and 3.1), the interviewees were made up of more males, younger (65 to 79 years old), had higher mobility (independent or require some assistance), and presented with polypharmacy. The proportion of these NHRs with diagnosed and documented chronic constipation (7.8%) was similar to that determined in the MUE (9.4%, reported in Table 3.1). The average time taken for the interviews was 14.4 (± 5.6, range 5 to 30) minutes.

Table 3.3 Demographic, clinical and medication factors of NHRs interviewed (n = 77)

Factors		n	%
NH Site	A	47	61.0
	B	30	39.0
Length of Stay	0-6 months	5	6.5
	7-12 months	4	5.2
	13-24 months	4	5.2
	>24 months	64	83.1
Gender	Male	47	61.0
	Female	30	39.0
Age	65-79 yo	45	58.4
	>80 yo	32	41.6
Race	Chinese	64	83.1
	Others	13	16.9
RAF	Cat 1 & 2	11	14.3
	Cat 3	34	44.2
	Cat 4	32	41.6
Mobility (RAF)	Independent	9	11.7
	Some assistance	37	48.1
	Frequent assistance	16	20.8
	Total assistance	15	19.5
Polypharmacy	Absent	22	28.6
	Present	55	71.4
Chronic Constipation (Documented)	Absent	71	92.2
	Present	6	7.8

Of the 77 NHRs, 33 (42.9%) were identified as having chronic constipation; 28 of them were identified using the questions under the "Chronic Constipation & Symptom Severity" section of the questionnaire, and 27 NHRs gave a non-zero response for Question 1 under the "Perception of Constipation" section. This reported prevalence was higher than that diagnosed and documented in the NHRs' medical records. In addition, good agreement was observed between these two methods of identifying chronic constipation (Kappa = 0.7, 95% CI = 0.52 to 0.86; r_s = 0.7, *p*-value < 0.001), suggesting that the responses provided by the interviewed NHRs were reliable. These 33 NHRs will be referred to as "residents identified with chronic constipation" (RCC), and the other 44 will be referred to as "residents identified with no chronic constipation" (RnCC).

From Figure 3.5, the number of constipation symptoms reported by RCC was significantly higher compared to RnCC (Mann-Whitney *U* test, *p*-value < 0.001). Each of the six symptoms was also more prevalent among RCC (χ^2 test, *p*-value < 0.05), where the most commonly reported symptom was "difficulty in passing motion"; followed closely by the use of laxatives (Table 3.4).

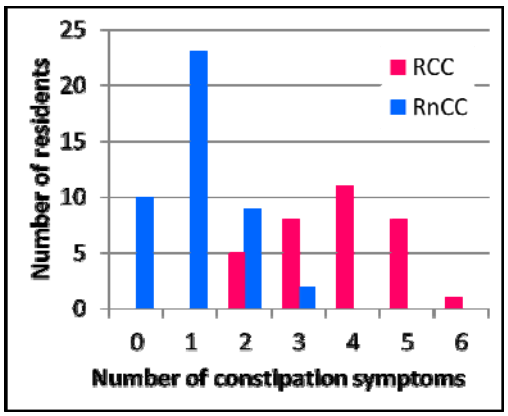


Figure 3.5 Number of constipation symptoms reported by RCC (n = 33) and RnCC (n = 44)

Table 3.4 Types of constipation symptoms reported by NHRs

Constipation Symptoms	RCC (n = 33)	RnCC (n = 44)	*P*-value[a]
Difficulty in bowel movements	30	4	< 0.001
Used laxatives[b]	27	26	0.033
Prescribed with laxatives[c]	24	27	0.297
Prescribed with laxatives (R)[d]	20	14	0.012
Laxative use recall discrepancy	16	17	0.387
Hard stools	22	4	< 0.001
Incomplete bowel movements	19	6	< 0.001
< 3 bowel movements a week	16	4	< 0.001
Abdominal bloating	14	3	< 0.001

[a] Chi-square test.
[b] Corrected NHRs' response with verification from medication administration charts.
[c] NHRs may be prescribed with laxatives, but which may not be administered.

Among the 44 RnCC, more than 50% of them reported using laxatives during the past 3 months. This prevalence had overshadowed that of other constipation symptoms. Of the 27 (61%) RnCC prescribed with laxatives, 14 (32%) of them were prescribed with laxatives for use on a regular basis. When verifying the NHR-reported laxative use against that recorded in the medication administration and order charts, it was noted that 43% of the 77 NHRs had a recall discrepancy; the numbers of NHRs with recall discrepancy between RCC and RnCC (16 and 17 respectively) was not statistically significant. This was not likely due to poor memory of the NHRs, but to a lack of awareness if laxatives were administered to them.

Among the five domains of impact of constipation (Questions 2 to 6 under the section "Perception of Constipation"), RCC reported higher total numbers of domains affected by constipation compared to RnCC (Mann-Whitney *U* test, *p*-value < 0.001, Figure 3.6). Constipation's negative impact on each of these domains (except symptom controllability, which was not statistically significant) was also more likely to be reported by RCC; the severity of impact was also somewhat correlated to the overall symptom severity score obtained from the section "Chronic Constipation & Symptom Severity" (Table 3.5).

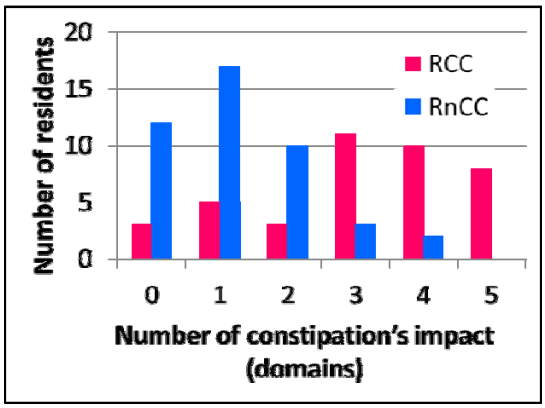


Figure 3.6 Number of constipation's impact (domains) reported among RCC (n = 33) and RnCC (n = 44)

Table 3.5 Constipation's impact (domains) reported by NHRs

Constipation …	RCC (n = 33)	RnCC (n = 44)	*P*-value[a]	r_s
Is bothersome	26	13	< 0.001	0.53[e]
Affects mood	21	9	< 0.001	0.54[e]
Affects health physically	19	4	< 0.001	0.51[e]
Affects life	14	8	0.020	0.29[d]
(Symptoms) cannot be controlled[b]	6[c]	2[c]	0.254	-0.31[d]

[a] Chi-square test.
[b] The analysis excluded 21 NHRs who responded with "I don't know". NHRs were counted if they responded with "zero-not at all" to the question "Do you think constipation symptoms can be controlled?"
[c] Numbers included NHRs who provided a response "zero – not at all".
[d] Spearman correlation test, *p*-value < 0.05.
[e] Spearman correlation test, *p*-value < 0.001.

It was interesting to note that the most commonly reported impact of constipation was that "constipation is bothersome", for both groups of RCC and RnCC. The negative impact "constipation symptoms cannot be controlled" was the least reported by both groups of NHRs, and many did not provide any rating. It was interesting to note that among those who did not provide any rating, 21 NHRs (18 RnCC and three RCC) replied with "I don't know". Among these 21 NHRs, 10 of them had a laxative use recall discrepancy from the medication administration charts, where nine NHRs (seven RnCC and two RCC) had under-recalls.

Satisfaction with the frequency and regularity of their bowel movements were reported among 23 and 24 RCC, and among 42 and 43 RnCC respectively. The difference between the proportions of satisfied NHRs from both groups was statistically significant (χ^2 test, p-value < 0.05). This was expected, as constipation is a chronic problem. From the NHRs' qualitative feedback, satisfaction with bowel movements was discounted by presence of abnormal increases rather than a decrease in toileting frequency as well as being dependent for toileting needs due to dependence of mobility; only one NHR commented about the absolute need to have bowel movement daily. It was further noted that six of the NHRs who provided a non-zero rating on being satisfied seemed to be nonchalant about the state of their bowel movements. Such comments included, "…no issues even if not regular…", "…it's okay to go only 3-4 days a week as I don't eat much. Don't have to go daily…", "…can't be bothered…", "…no *(about satisfaction)*, but what to do? ...", and "…no complains…".

During the interview, NHRs commented on the negative impact of constipation and their satisfaction with bowel movements, as reported in Tables 3.6 and 3.7. To the author's surprise, one RCC who was taking senna and lactulose on a regular basis lamented, "…constipation is especially bothersome, having to deal with side-effects of watery stools from the use of laxatives…" and further elaborated that he would soil his pants if he couldn't get to the toilet in time. Other NHRs also commented on having experienced diarrhea-like SEs from laxatives, specifically lactulose.

Table 3.6 NHRs' perceptions on constipation's impact

Constipation…	NHRs' Descriptions	N
Symptoms	…can be relieved by laxatives	6
	…need to rely on laxatives / healthcare professional's help	3
	…can be relieved by non-pharmacological interventions	2
	…are related to health condition, cannot be controlled	1
Is bothersome	…especially from having to deal with watery stools from laxative use	1
Affects life	…in terms of diet choices (takes more fibrous food, reduces intake of "hard" foods)	2
	…it decreases appetite	2
	…it affects sleep (caused by stirring of the stomach)	1
	…it affects travel plans (outings)	1
Affects health physically	…it affects general well-being ("weakens", causes headache/dizziness)	4
	…it exacerbates weak heart, causes chest pain	2
	…it increases frequency to pass urine	1
Affects mood	…makes a person moody	2
	…severity of mood depends on severity of constipation	1

Table 3.7 NHRs' perceptions on satisfaction with their bowel movements

Satisfaction With…	NHRs' Descriptions	N
Bowel frequency	…is adversely affected if frequency of passing is increased by laxatives (SEs)	4
	…depends on ability to live with the "problem"	2
	…rather, satisfaction is being able to pass freely whenever one needs (not having to depend on "nurses' timing")	1
	…ranges from 2-3 times daily to 3-4 times weekly (consolidated responses)	5
Bowel regularity	…is going to the toilet every morning	4
	…is second to being able to being "able to pass" (clearing of bowels at each toilet visit)	1
	…depends on ability to live with the "problem"	1

Of the 26 NHRs who reported having "watery stools", five were RCC, and 21 were RnCC. Results from the logistic regression tests to identify factors associated with the NHRs' responses of "watery stools" when asked if lumpy or hard stools were present (Question 4 under the "Chronic Constipation & Symptom Severity" section) showed that the reporting of "watery stools" occurred seven times (unadjusted OR) more frequently among NHRs who were using lactulose daily. Despite the wide confidence interval observed, this association remained statistically significant even after adjusting for the presence of other factors such as the presence of chronic

constipation (which may imply spurious incontinence due to stool impaction) and the use of other laxatives on a regular basis (Table 3.8).

Table 3.8 Factors associated with NHR-reported watery stools

Factors	Unadjusted		Adjusted[a]	
	OR	95% CI	OR	95% CI
NH Site				
A	1.0	-	1.0	
B	5.7	(1.7, 19.0)[b]	3.8	(0.8, 18.3)
Age				
65-79 years' old	1.0	-	1.0	-
80 years' old and above	1.0	(0.4, 2.7)	1.1	(0.3, 4.0)
Gender				
Male	1.0	-	1.0	-
Female	0.4	(0.2, 1.3)	0.5	(0.1, 1.6)
Race				
Chinese	1.0	-	1.0	-
Non-Chinese	0.5	(0.1, 2.1)	1.2	(0.2, 7.5)
Mobility				
Independent	1.0	-	1.0	-
Requires some assistance	1.5	(0.3, 8.3)	0.8	(0.1, 6.7)
Requires frequent assistance	0.8	(0.1, 6.0)	0.2	(0.02, 2.7)
Requires total assistance	7.0	(1.0, 46.9)[b]	1.8	(0.2, 16.8)
Chronic Constipation (identified)				
Absent	1.0	-	1.0	-
Present	1.0	(0.4, 2.5)	0.9	(0.3, 3.4)
Lactulose administered daily				
Absent	1.0	-	1.0	-
Present	7.2	(2.5, 20.8)[c]	8.7	(1.9, 40.5)[b]
Laxatives (non-lactulose) administered daily				
Absent	1.0	-	1.0	-
Present	1.1	(0.4, 2.9)	0.5	(0.1, 2.1)

[a] The ORs were adjusted using all the factors reported in this table. The Nagelkerke R Square for this analysis was 0.421.
[b] Binary logistic regression, *p*-value < 0.05.
[c] Binary logistic regression, *p*-value < 0.001.

With regards to the NHRs' perceived need to use laxatives, weak correlations with the severity of constipation symptoms ($r_s = 0.3$, *p*-value = 0.009) and the active use of laxatives (Kappa = 0.3, 95% CI = 0.1 to 0.5) were observed. Similar trends were also noted with regards to the NHRs' perceived need to use non-pharmacological interventions to relieve constipation (with severity of constipation symptoms, $r_s = 0.2$, *p*-value = 0.036; with active use of laxatives, Kappa = 0.1, 95%

CI = 0, 0.4) as illustrated in Figures 3.7 and 3.8. The non-pharmacological interventions reported are listed in Table 3.9.

Table 3.9 Non-pharmacological interventions employed by NHRs to relieve constipation (reported by 39 NHRs)

Interventions	N
Fruits & Vegetables (increase quantity) – banana; papaya, spinach	25
Water (increase quantity)	14
Exercise	4
Water (2 glasses in the morning; 1 glass before going; at mealtimes)	3
Prune juice	2
Cultured drink – Yakult	2
Any food intake	1
'cooling water' (believes body 'heatiness' causes constipation)	1

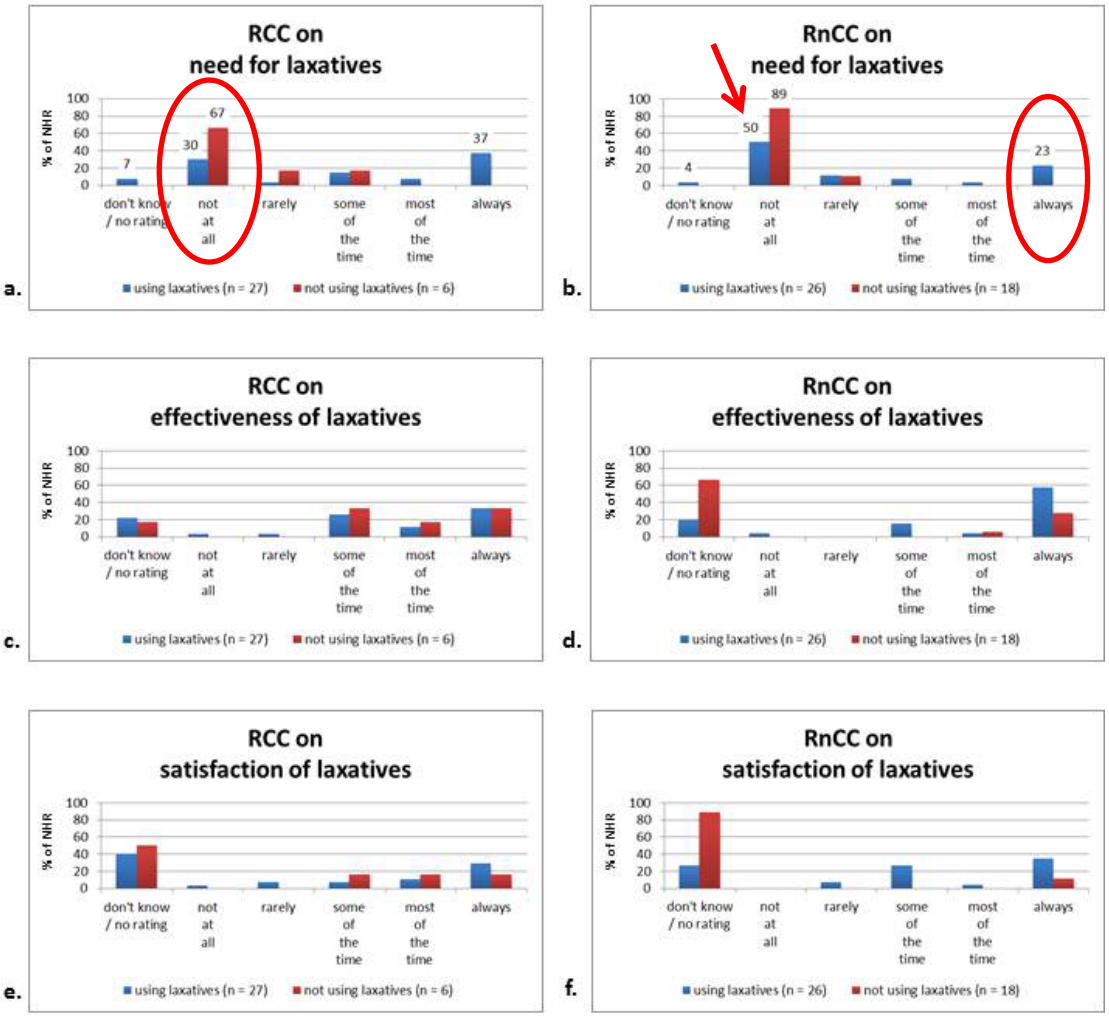


Figure 3.7 NHRs' perception on their need for, effectiveness and satisfaction of laxatives
The percentages of NHR (y-axis) were based on the total number of NHR who were using or not using laxatives.

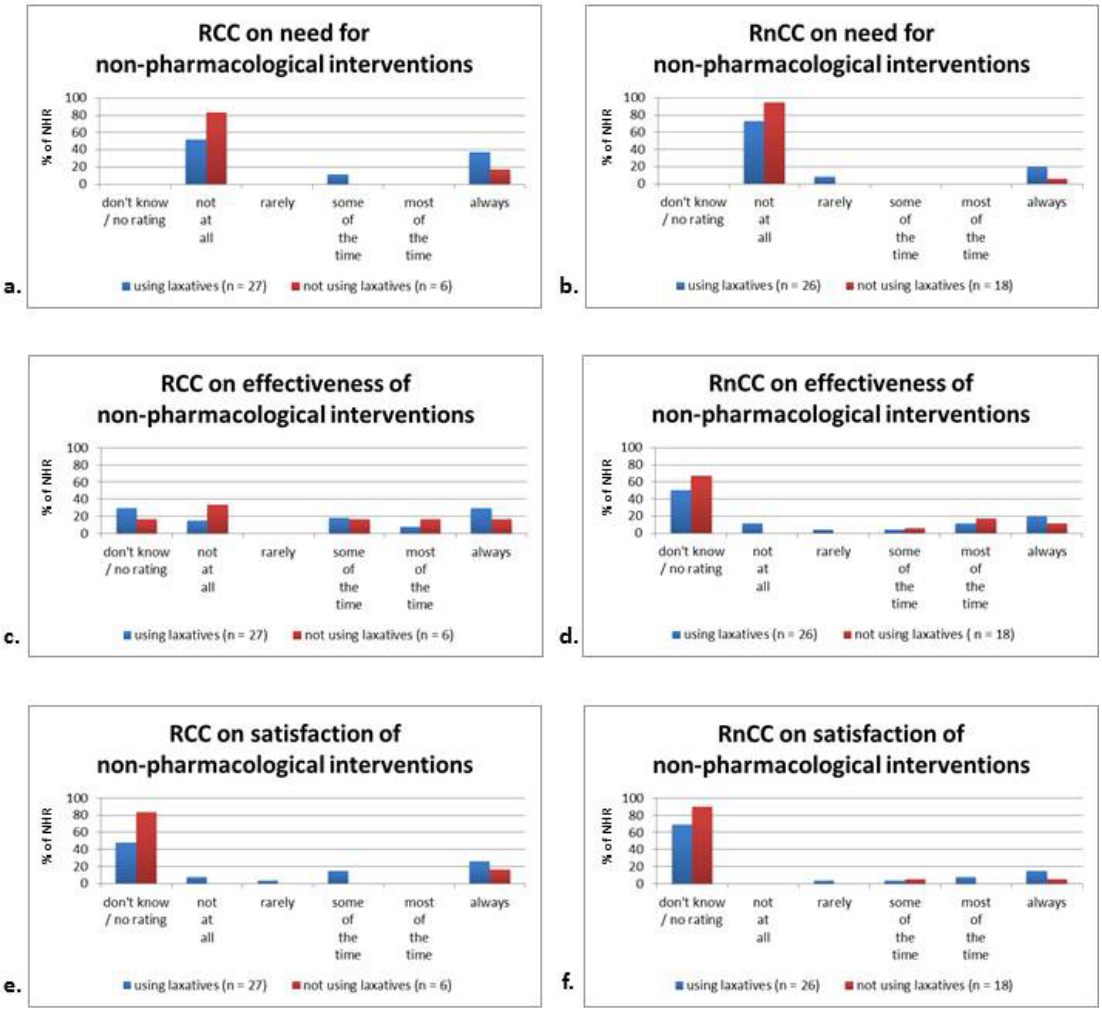


Figure 3.8 NHRs' perception on their need for, effectiveness and satisfaction of non-pharmacological interventions
The percentages of NHR (y-axis) were based on the total number of NHR who were using or not using laxatives.

Of the 33 NHRs who responded that they needed to use laxatives at least "rarely", 14 were RnCC but six of them reported "always" needing to use laxatives (Figure 3.7b) due to reasons such as having fear of not being able to pass motion if laxatives were stopped and wanting to be compliant with medication instructions from healthcare professionals. Of these 14 NHRs, seven perceived non-pharmacological methods to be effective at least "some of the time", but only three reported the need to use non-pharmacological interventions to relieve constipation symptoms. From the NHRs' comments, barriers to using non-pharmacological interventions included

institutional restrictions and lack of knowledge. Comments alluding to these included, "…will ask for more fruits *(at mealtimes)*, however it's up to the nurses to give…", "…everybody *(is being)* treated the same, *(so there's)* no means to use other methods…", "…*(I)* don't know what were the other methods, so did not try…", and "…the nurses know what to do, *(I have)* no comments…".

On the other hand, of the 44 NHRs who reported that they did not need to use laxatives at all, 14 had chronic constipation (Figure 3.7a); the reasons provided by these NHRs included the preference to non-pharmacological interventions and the ineffectiveness of laxatives. Among these 14 NHRs, one was "not at all" satisfied with the laxatives used and another 11 chose to sit on the fence; reasons for these included the lack of effectiveness in relieving constipation, and the presence of SEs such as "watery stools". However, among these 12 opponents of laxative use, five of them were enthusiastic when asked about the use of non-pharmacological interventions to relieve constipation, and reported being "always" conscious about maintaining their bowel movements through increasing dietary fiber intake (in the form of fruits and vegetables, specifically bananas and papayas); these same NHRs also perceived this non-pharmacological method to be effective and satisfactory at least "most of the time".

In addition, among the 26 RnCC who were using laxatives, 13 (50%) did not perceive any need for them, citing reasons of side-effects (frequent need to "go" from lactulose), and savviness to ask for laxatives when required. On the other hand, misconceived beliefs and attitudes of "always" needing laxatives were present among six RnCC (shown in Figure 3.7b). The gaps and recommendations derived from the results reported in this section are discussed in detail in Section 3.1.3.

3.1.2.3 Self-administered survey of NS

93 of 150 NS at the two homes returned the completed consent and survey forms, yielding a 62% participation rate. Amongst these participants were one nursing officer, eight staff nurses, 12 enrolled nurses, 51 nursing aides, and 21 health attendants. Their responses on their NHRs' "Perception of Constipation" are shown in Figure 3.9. The responses of the NS were significantly higher on constipation's severity, controllability of symptoms, how bothersome constipation is and constipation's impact on life, physical health, and mood (Mann-Whitney *U* test, *p*-value < 0.05) compared to the responses of the RCC.

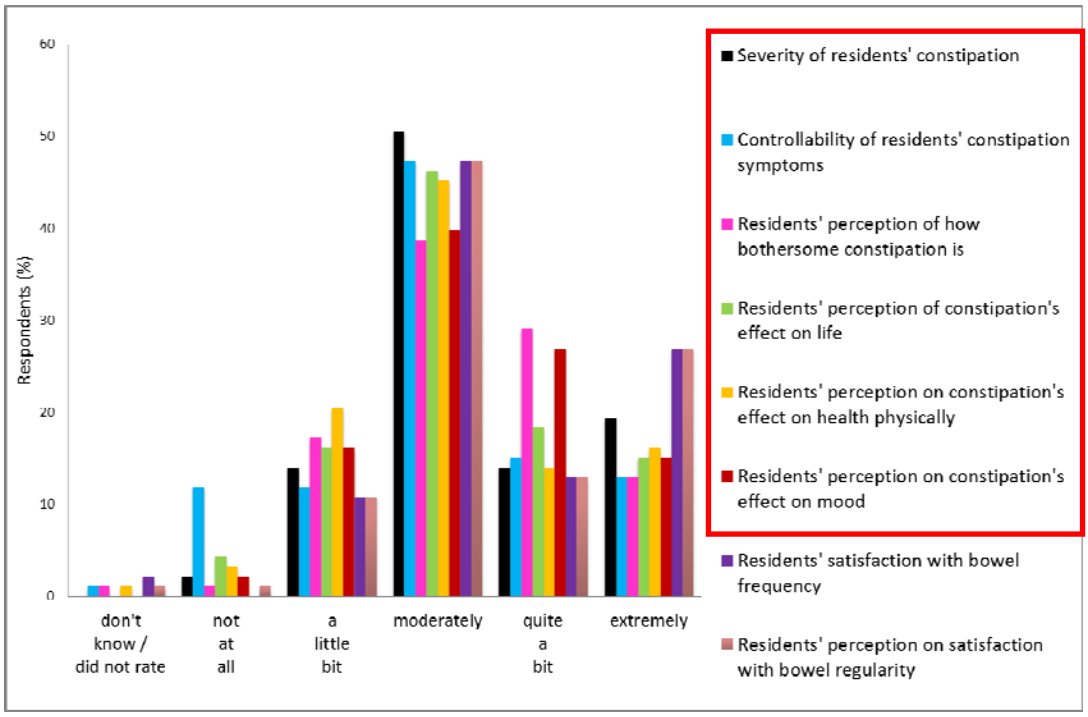


Figure 3.9 NS's responses on NHRs' perception of constipation (n = 93)

With regards to the need for, effectiveness of, and satisfaction with laxative use by the RCC, there is no statistical difference between the ratings of the NS and that of RCC. The NS responded with a higher mean rank for the RCCs' preference

for non-pharmacological intervention to relieve constipation (Mann-Whitney *U* test, *p*-value = 0.003), despite no statistical significance on the perceived effectiveness of non-pharmacological interventions between RCC and NS. With regards to acute methods for relieving constipation, although no statistical difference in the mean rank was provided on the perceived need to administer these on the NHRs, those NS with nursing ranks of enrolled nurses and above reported higher mean rank for their effectiveness of use (Kruskal-Wallis ANOVA test, *p*-value = 0.032). A lack of knowledge was also observed among the NS of lower nursing ranks, who included "high-fiber diet", "increase in water intake", and "lactulose" as acute methods, whereas those of higher nursing ranks accurately reported these as the use of enemas, suppositories, and manual evacuation procedures.

More than half of the 93 NS (60.2%) reported the importance of bowel management among elderly NHRs as being "extremely" important; none of the NS reported "zero – not at all", and two did not respond. By comparison, only 51.6% of the NS thought that bowel management was "not at all" neglected in the NHs. In addition, although there were no written bowel management protocol/guidelines present in the two NHs, 69 (74%) of the NS responded "yes", and 13 (14%) did not respond to the availability of such protocol/guidelines. When asked about the usefulness of having a written bowel management protocol/guidelines, more than half (59%) responded "extremely".

3.1.3 Discussion of identified gaps and recommendations

From the MUE outcomes reported in Section 3.1.2.1, gaps in the assessment and monitoring of indications for and outcomes (particularly efficacy and side-effects) of laxative use were identified. The potential over-use of laxatives from these were of

concern in view of the almost full compliance to prescribed laxatives, and the absence of monitoring (100%) for therapeutic outcomes and potential SEs such as the frequency and consistency of bowel outputs and serum electrolyte disturbances (especially from regular use of lactulose more than six months).[206] Furthermore, the absence of SEs reported from laxative use could be under-reported in the MUE due to inadequate patient monitoring. Hence, improving identification of residents with a true need for laxatives, monitoring for laxative use outcomes and having proper documentation may overcome both over- and under-use of laxatives and improve clinical NHR outcomes. In addition, gaps in optimal duration of laxative use (specifically laxatives prescribed for use when necessary) and dosing (particularly of lactulose) were present. Providing education or guidelines for appropriate when-needed use may effectively address the potential laxative mis-use and over-use while maintaining the timeliness of the treatment intended with such prescribing. Although there is no evidence to discourage lactulose dosing frequency of more than three times daily for managing constipation, there may be other benefits to advocate consolidating lactulose doses to the recommended "one or two divided doses" a day. Firstly, the nursing time spent on medication administration will be reduced, and potentially translated to savings in opportunity cost, as the time can be spent on other NHR care-related duties. Secondly, with lesser administration frequency, there may be reduced likelihood of medication administration errors. Lastly, the NHRs' quality of life may be improved when medications are taken less frequently.[207]

From the outcomes reported in Section 3.1.2.2, a good participation rate (70%) in the interviews was obtained despite excluding 33 NS-identified NHRs. Furthermore, the demographics of the participants summarized in Table 3.3 showed that the exclusion of these NHRs did not result in under-representation of the minority

races residing in nursing homes. Hence the potential limitation in the generalizability of the outcomes to all NHRs may be minimal. From the interviews of NHRs, several gaps and recommendations to overcome inappropriate laxative use were identified. Firstly, the NHRs lacked empowerment with regards to managing constipation. This was evident from the NHRs' lack of awareness if laxatives were administered to them, and understanding of constipation, its treatment options (including non-pharmacological interventions), and the effects that laxatives can produce. Secondly, while misconceived beliefs and attitudes towards laxative use existed among some NHRs, barriers to use non-pharmacological interventions to manage bowels were perceived by others. Hence, recommendations to overcome these gaps may include providing education and counseling to improve NHRs' knowledge on the appropriate use of laxatives and non-pharmacological interventions in managing constipation, as well as addressing NHRs misguided beliefs about constipation and laxative use, and increasing the NS's support towards the use of non-pharmacological interventions to manage bowels. Thirdly, there was inadequate assessment of NHRs' need to use laxatives and monitoring for the outcomes of laxative use (particularly side-effects of lactulose). This was evident from the serendipitous reporting of "watery stools" among many NHRs interviewed, particularly among the RnCCs who were using lactulose on a daily basis. These complaints were not previously detected by the NS, neither were the laxative use flagged up for review by the physicians. Although lactulose's mechanism of action and the resultant soft stools makes it an effective laxative for the elderly,[206] administration of lactulose within the daily recommended doses among residents who do not require laxatives on a regular basis may easily induce diarrhoea-like SEs, hence explaining the complaints of "watery stools". Increasing the awareness of the NS towards assessment for needs, monitoring for

laxative outcomes and SEs, and timely referral to prescribers for optimizing laxative doses, dosing frequency, and change of laxatives may thus improve the appropriateness of laxatives use and NHRs' outcomes. Specifically, adoption of a quick, easy to use and reliable screening tool in the NHs, such as the Chinese constipation questionnaire used in this study, may improve the assessment and documentation of constipation symptoms and the need for laxative use. This may be especially useful for NHRs who are more independent, require minimal assistance with toileting (hence excluded from bowel elimination monitoring), or embarrassed to seek help.

Finally, from the outcomes of the self-administered survey of NS reported in Section 3.1.2.3, disparity in knowledge on bowel management was noted between NS of different ranks. However, most of them agreed that standard guidelines for use of laxatives would be useful. In addition, the NS appeared to be keen to follow guidelines and promote appropriate use of laxatives among NHRs under their care.

3.2 Development, implementation and evaluation of a Pharmacist Led Education on Appropriate Drug-use (PLEAD) program for laxatives

3.2.1 Program description

The identified gaps and recommendations reported in Section 3.1.3 were summarized using the mnemonic iPURGE (Figure 3.10), thus forming the content to be communicated to the various healthcare professionals through the PLEAD program.

iPURGE for PLEAD program for laxatives

Gaps in Bowel Management	Recommendations
Inadequate identification of residents who need laxatives	**Identify** residents who need laxatives. - Use questionnaires such as CCQ - Charting of residents' bowels - Review medications
Barriers to practicing non-pharmacological interventions	**Promote** use of non-pharmacological interventions - Provide opportunities / help to residents who wish to use non-laxative methods. - Encourage fluid intake for residents without fluid restrictions due to medical reasons.
Suboptimal uses of lactulose	**Use** laxatives appropriately DOSE - Avoid use of daily lactulose in residents who are ambulant. - Avoid dosing frequency > 2x a day. - Avoid dose of > 30ml a day. DURATION - Avoid regular use of stimulant laxatives / macrogol. - Recommend administering of PRN laxatives: 1) Lactulose: administer after NBO x 2/7 consecutively, stop after BO x 3/7 consecutively 2) Senna: administer after NBO x 3/7 consecutively, stop after BO x 3/7 consecutively 3) Suppositories & enemas: administer 1 dose after NBO x 4/7 consecutively
Presence of side-effects & lack of satisfaction towards laxatives used	**Review** efficacy & side-effects of laxatives: - Lactulose: not more than 2-3 soft stools per day
Lack of standardized bowel management strategies	**Groom** all NS in bowel management - Provide training for NH to close knowledge gaps and to standardize management strategies
Lack of patient empowerment	**Empower** residents - Provide proper patient education.

Figure 3.10 iPURGE – summary of the gap-finding study results and recommendations
CCQ = Chinese constipation questionnaire; NBO = nil bowel output**.** Laxative-specific recommendations were based on the clinical information compiled from the references used in the MUE. The duration of continuous administration for each PRN laxatives were calculated to provide no less than three bowel movements in a week. Avoidance of daily lactulose use among residents who are ambulant was recommended to avoid potential falls that may result from diarrhea-like side-effects.

The development of the PLEAD program framework was based on the theories of community mobilization[208] and communication for participatory development,[209] which describe behavioral change occurring at the population level. When applied in this instance, communication strategies beginning with creating awareness of a problem and potential solutions followed by dialogue and participation, can allow information sharing, mutual understanding and agreement, and accounting for conflict and its management, hence create cultural identify, trust, commitment, local ownership and empowerment to foster collective action and cooperation

between the various healthcare professionals working in the NH towards the goal of improving inappropriate laxative use and NHRs' clinical outcomes.

Hence, communication of the content (iPURGE) by the pharmacist is aimed to create awareness of existing inappropriate laxative use and foster recommended behavioral changes. In addition to the theories stated above, the delivery of the message for the PLEAD program (iPURGE) was designed to increase the audience's self-efficacy,[208] which is defined as a person's confidence in performing a particular behavior. Thus the emphasis of the delivery was to persuade the audience that achieving appropriate laxative use would be possible. As such, the audience may also be bolstered to add to the discussion and participation for the desirable behavioral changes.

Therefore, a 2-hour workshop (to be conducted at the NH premise) was chosen as a platform to communicate and create awareness of the gaps in appropriate laxative use, share recommended behavioral changes to overcome the gaps, stimulate dialogue, resolve queries and conflict, and encourage audience participation in planning collective action for change. The workshop's target audience was the key administrators (including the executive director and nursing manager) and the NS who are employed by the NH. The flow of the workshop included a 10-minute ice-breaker and 5 minute pop-quiz on topics related to constipation and laxative use to first gain the audience's attention. This was followed by a one-hour PowerPoint presentation (by the pharmacist researcher) of the findings of the three gap-finding studies and the identified gaps and recommendations (iPURGE) derived from these. The presentation was structured to deliver each gap of iPURGE one at a time. The gap was first introduced with reference to the gap-finding studies, then the potential impact on the NHRs the need to take action were explained using visual anaglogies to

trigger connection with the audience's overarching values and relevance to performance,[210] and lastly, the recommendations were provided with specific and measurable examples where appropriate. After the presentation, the leader among the audience (executive director and/or nursing manager) facilitated a 45-minute open discussion session with the NS, in the presence of the presenter, to resolve queries and potential conflicts, decide on the achievable target and strategic behavioral changes, and set the date for initiating these changes.

The visiting physicians were not included as part of the target audience in the workshop, as they are usually volunteers or under institutional/private contract with the NH to provide consultative services to the residents; their short visit hours at the NH and tight schedules may limit their attendance at the workshop. Hence, a more appropriate communication channel was chosen, where the relevant content of the PLEAD program was communicated concisely to the visiting physicians through a mailed "Dear Healthcare Professional Letter" as shown in Appendix 3.2.

3.2.2 Prospective pilot implementation and evaluation of PLEAD program for laxatives

A pilot implementation and evaluation of the PLEAD program were contucted at the same two NHs using a non-randomized controlled before-and-after study design, where one NH was randomly chosen for implementation of the PLEAD program while the other NH was used as a control NH. The workshop was conducted twice by the pharmacist (author) as described in Section 3.2.1, which took place at a meeting room of the intervention NH. A duplicate workshop session was scheduled so that all NS could attend.

The target behavioral changes decided by the audience during the stake-holder facilitated discussions were reported as an outcome of the pilot implementation of PLEAD. The physicians' feedback on the recommendations provided in the Dear Healthcare Professional Letter was obtained by the author using the feedback form shown in Appendix 3.3, through individual face-to-face meetings held within two weeks after the letters were sent. For this purpose, the physicians were contacted via email, to seek their consent and arrange for the meetings. During the meeting, they were asked to rate their responses to the individual recommendations using "agree", "neutral", or "disagree", and to provide comments explaining their responses. Additional informal and spontaneous feedback from the NS, key administrators to the author subsequently was also noted.

The mean changes of the actual amount of laxatives administered, the number of prescriptions for laxative altered, and the NHRs' bowel frequency before and after the set behavior change date were evaluated retrospectively during December 2011 and January 2012. The relevant data was from the medication and medical notes, and the monitoring and elimination charts of the NHRs during the one-month periods before and after the set date of the behavioral changes. A minimum sample size of 85 residents in each intervention group was estimated, using power = 0.9, $\alpha = 0.05$, standard deviation = 1 and mean difference = 0.5 for comparing means between 2 samples.[211, 212] The difference in changes between the intervention and control homes were evaluated using General Linear Model and adjusted for NHR factors that may be associated directly with laxative use[213, 214] or indirectly through gender-associated health-seeking[215] and race-associated lifestyle[216] behaviors. These factors included age, gender, race, presence of dementia, mobility (subscale of RAF), prior duration of stay in the NH, presence of polypharmacy, and the baseline estimates (of the average

bowel frequency, number of laxative prescriptions altered and/or amounts of laxatives administered).

3.2.3 Outcomes of PLEAD program for laxatives

All NS at the intervention NH attended the workshop at least once. Lively discussions ensued between the key administrators and the NS, especially during the first workshop, which was attended by most of the senior NS. During the discussions, consensus was achieved between the key administrators and NS to initiate several behavioral changes beginning from 31st October 2011. The behavioral changes decided upon were those that could be effected readily and quickly in a structured manner; these included (1) alerting physicians to review prescriptions for lactulose if the dosing frequency was more than twice daily or if daily dose was more than 30 milliliters, and (2) improving the "monitoring" stage of laxative use for adequate laxative use reviews, through (a) immediate reporting of observations during diaper change to the nurse-in-charge at each shift for documentation (b) documenting the stool type (using the Bristol Stool Chart)[217-219] in addition to the frequency of bowel opening, and (c) initiating NHR self-reporting at the nursing station after each bowel movement by NHRs who do not need assistance for toileting. These behavioral changes were overseen by the staff nurses-in-charge at each ward, and were executed by all NS. Besides these, the key administrators and NS also expressed interest in exploring promotion of non-pharmacological interventions and provision of medication education in an informal manner.

On a separate note, it was also interesting that although the PLEAD workshop was not provided to the control home, the conduct of the gap-finding studies prompted the nursing manager to initiate elimination charting for the NHRs' bowel

openings in May 2010. This allowed accurate data of residents' bowel frequencies during the pre- and post-PLEAD intervention periods to be obtained from the control home, which ensured unbiased comparison between the control and intervention home (where elimination charting was already present).

3.2.3.1 Impact on laxative use trends and NHR outcomes

The number of NHRs who remained at the NHs before and after the initiation of behavioral changes (October and November 2011) was 112 and 142 in the intervention and control NHs respectively. The NHRs' demographic, clinical and medication use factors were reported in Table 3.10. The profiles of the NHRs at the NHs were similar, except for a higher prevalence of Chinese and NHRs with higher functional dependency status at the intervention NH.

Table 3.10 NHRs' demographic, medical and medication use factors

Factors	Intervention Home (n = 112)	Control Home (n = 142)
Age		
Mean ± SD	83.0 ± 9.0	81.2 ± 8.1
Range	66 to 104	65 to 99
Gender		
Female	51 (45.5%)	79 (55.6%)
Male	61 (54.5%)	63 (44.4%)
Race[b]		
Chinese	100 (89.3%)	112 (78.9%)
Malay	0 (0%)	6 (4.2%)
Indian	7 (6.3%)	22 (15.5%)
Others	5 4.5%)	2 (1.4%)
Duration of prior stay (months)		
Mean ± SD	61.8 ± 54.6	75.1 ± 58.1
Range	0 to 253	1 to 287
Dementia		
Diagnosed	34 (30.4%)	48 (33.8%)
Not diagnosed	78 (69.6%)	94 (66.2%)
RAF[b]		
Category 1 & 2	3 (2.7%)	9 (6.3%)
Category 3	17 (15.2%)	43 (30.3%)
Category 4	92 (82.1%)	90 (63.4%)
Mobility (sub-domain in RAF)		
Independent	6 (5.4%)	5 (3.5%)
Some assistance	29 (25.9%)	53 (37.3%)
Moderate assistance	25 (22.3%)	55 (38.7%)
Total assistance	52 (46.4%)	29 (20.4%)

Factors	Intervention Home (n = 112)	Control Home (n = 142)
Polypharmacy		
Absent	43 (38.4%)	53 (37.3%)
Present	69 (61.6%)	89 (62.7%)
Number of prescribed medications (long-term use)[a]		
Mean ± SD	6.3 ± 3.3	5.6 ± 2.8
Range	0 to 17	0 to 12
Number of prescribed laxatives (all)		
Mean ± SD	1.2 ± 0.9	1.1 ± 1.0
Range	0 to 3	0 to 5
Number of prescribed laxatives (long-term use)		
Mean ± SD	0.7 ± 0.7	0.7 ± 0.8
Range	0 to 2	0 to 2
Number of prescribed laxatives (when-needed use)		
Mean ± SD	0.5 ± 0.6	0.4 ± 0.7
Range	0 to 3	0 to 3

[a] t-test, $p<0.05$.
[b] $\chi 2$-test, $p<0.05$.

As the set date for initiating the behavioral changes was 31st October 2011, the month of October was taken to be the period before the set behavioral change date, and the month of November was taken to be the period after (Figure 3.11).

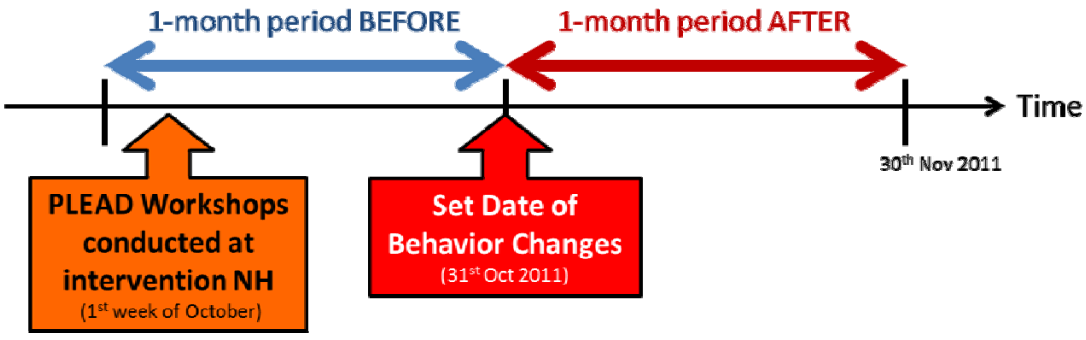


Figure 3.11 Implementation and evaluation of PLEAD program for laxative use
Evaluations of PLEAD's impact on laxative use trends and NHR outcomes were made by comparing data of the intervention and control NHs during the 1-month periods before and after the set date of behavior change.

Hence, the before-and-after changes in the actual amount of laxatives administered and the number of laxative prescriptions altered were calculated using a 30-day average (November) - 31-day average (October) for each NHR; that for the NHRs' bowel frequencies were similarly obtained using a 4-week average (1st-28th

November) - a 4-week average (1st-28th October) for each NHR. The baseline estimates (data from October 2011) of these outcomes were shown in Table 3.11, where the NHRs in the control NH had slightly higher mean average bowel frequencies.

Table 3.11 Baseline estimates (October 2011) of outcome measures before behavioural change

Outcome Measures	Intervention Home (n = 112)	Control Home (n = 142)
Number of laxative prescriptions altered[a]		
Mean ± SD	0.03 ± 0.16	0.01± 0.08
Range	0 to 1	0 to 1
Amount of laxatives administered per NHR[a]		
Lactulose (ml/day)		
Mean ± SD	8.77 ± 11.8	9.12 ± 14.1
Range	0 to 40	0 to 60
Senna (mg/day)[c]		
Mean ± SD	6.47 ± 7.01	8.50 ± 7.38
Range	0 to 15	0 to 15
Bisacodyl suppositories (mg/day)		
Mean ± SD	0.06 ± 0.35	0 ± 0
Range	0 to 3	0 to 0
Bisacodyl tablets (mg/day)		
Mean ± SD	0.23 ± 1.96	0.04 ± 0.42
Range	0 to 20	0 to 5
Sodium/phosphate enema (dose/day)		
Mean ± SD	0.00 ± 0.01	0 ± 0
Range	0 to 0	0 to 0
Isphagula husk (dose/day)		
Mean ± SD	0 ± 0	0 ± 0
Range	0 to 0	0 to 0
NHRs' bowel frequency[b]		
Average number of days per week[d]		
Mean ± SD	3.42 ± 1.70	4.02 ± 1.84
Range	0 to 7	1 to 7
Minimum number of days per week[c]		
Mean ± SD	2.37 ± 1.84	2.85 ± 2.00
Range	0 to 7	0. to 7
Maximum number of days per week[d]		
Mean ± SD	4.46 ± 1.74	5.12 ± 1.80
Range	0 to 7	1 to 7

[a] Estimates of the amounts of laxative administered and number of laxative prescriptions altered were their mean averages obtained over 31 days of October 2011.
[b] Estimates of bowel frequencies were obtained over the first 4 weeks from 1st October 2011.
[c] t-test, $p<0.05$.
[d] t-test, $p<0.01$.

During the period after the behavioral changes, the changes in the number of laxative prescriptions altered at the intervention NH was significantly higher

compared to that at the control NH (Table 3.12). Among the 53 prescriptions altered after the set date of behavior changes, 45 (83%) were for the change of dosing frequency of lactulose from "three times daily" to "once every morning", three were for the change of dosing frequency of lactulose from "two times daily" to "once every morning", three were related to prescribing of new laxatives, and two were related to discontinuing senna and lactulose. Among the prescriptions altered for change of dosing frequency from "three times daily" to "once every morning", 44 (out of 47 possible prescriptions to be altered) occurred in the intervention home while only 1 (out of 36 possible prescriptions to be altered) occurred in the control home. In addition, the improvement in the NHRs' bowel frequencies observed at the intervention NH were statistically significant compared to the negative changes in the NHRs' bowel frequencies observed in the control NH (Table 3.12), despite no statistically significant difference in the mean changes of the average amounts of laxatives administered between the two NHs.

Table 3.12 Change estimates in (November - October 2011) outcome measures after initiating behavioral changes

Outcome Measures	Intervention Home (n = 112)	Control Home (n = 142)	Unadjusted *p*-value[c]	Adjusted *p*-value[c]
Number of laxative prescriptions altered[a]				
Mean ± SD	0.38 ± 0.56	0.01 ± 0.17	< 0.001	< 0.001[d]
Range	-1 to 2	-1 to 1		
Amount of laxatives administered per NHR[a]				
Lactulose (ml/day)				
Mean ± SD	0.48 ± 6.07	-0.21 ± 2.21	0.215	0.408[e]
Range	-23 to 20	-26 to 0		
Senna (mg/day)				
Mean ± SD	0.19 ± 1.80	-0.1 ± 1.18	0.122	0.417[e]
Range	-9 to 14	-14 to 0		
Bisacodyl suppositories (mg/day)				
Mean ± SD	-0.01 ± 0.16	0.03 ± 0.28	0.232	0.267[e]
Range	-1 to 0	0 to 3		
Bisacodyl tablets (mg/day)				
Mean ± SD	-0.05 ± 0.52	0 ± 0	0.261	0.175[e]
Range	-5 to 0	0 to 0		
Sodium/phosphate enema (dose/day)				
Mean ± SD	0.00 ± 0.01	0 ± 0	0.261	1.000[e]
Range	0.0 to 0.0	0 to 0		
Isphagula husk (dose/day)				

Outcome Measures	Intervention Home (n = 112)	Control Home (n = 142)	Unadjusted *p*-value[c]	Adjusted *p*-value[c]
Mean ± SD	0.00 ± 0.05	0 ± 0	0.261	0.984[e]
Range	0 to 1	0 to 0		
NHRs' bowel frequency[b]				
Average number of days per week				
Mean ± SD	0.09 ± 1.13	-0.42 ± 0.88	< 0.001	0.021[f]
Range	-3 to 3	-3 to 1		
Minimum number of days per week				
Mean ± SD	0.06 ± 1.43	-0.31 ± 1.17	0.023	0.540[f]
Range	-4 to 4	-5 to 3		
Maximum number of days per week				
Mean ± SD	0.16 ± 1.47	-0.46 ± 1.20	< 0.001	0.014[f]
Range	-3 to 4	-4 to 3		

[a] Change estimates of the amounts of laxative administered and number of laxative prescriptions altered were their mean differences in the averages obtained over 30days of November less the averages obtained over 31 days of October 2011.
[b] Change estimates of the NHRs' bowel frequencies were their mean differences in the averages obtained over 1st to 28th November less the averages obtained over 1st to 28th October 2011.
[c] General Linear Model was used to obtain the unadjusted and adjusted *p*-values for the comparison of means. Adjustments were made for NHRs' age, gender, race, presence of dementia, mobility, prior duration of stay, and presence of polypharmacy.
[d] Adjustments were also made for the baseline estimates of the average bowel frequency (number of days per week), the amounts of each laxatives administered and the number of laxative prescriptions altered.
[e] Adjustments were also made for the baseline estimates of the average bowel frequency (number of days per week), the amounts of each laxatives administered.
[f] Adjustments were also made for the baseline estimates of the various average bowel frequencies, the amounts of each laxatives administered and the number of laxative prescriptions altered.

3.2.3.2 Feedback from key stakeholders, NS, and physicians

During the author's follow-up visit to conduct data collection for the evaluation of the PLEAD program outcomes in December 2011, the nursing manager and the NS at the wards commented that the reduction of dosing frequency of lactulose cut down the time taken to prepare, serve, and clean up the serving cups. The staff nurses also commented that bowel movements of some NHRs were more pronounced and consistent when lactulose was dosed all at once in the morning in comparison to dosing three times a day. The NS also reported fewer changes of soiled diapers per day for some NHRs.

Two of the general physicians who received the "Dear Healthcare Professional Letters" offered written and face-to-face feedback on the recommendations. One physician agreed to all recommendations, but disagreed on

avoiding the use of lactulose by NHRs who are ambulant, as he had not received complaints from them. However, he also recognized that the NHRs' description on the increased unpleasant urgency to pass motion and "watery stools" induced by lactulose could pose as a fall risk if they were to rush to the toilet. The other physician also agreed to all recommendations, but was concerned if the NS could conduct the regular reviews of NHRs' needs for laxatives in addition to their nursing duties and general manpower constraints, while suggesting that pharmacists should be involved in the monitoring and review of NHRs' medications to optimize the treatment regimens and their outcomes.

3.2.4 Discussion of PLEAD program outcomes

From the outcomes of the PLEAD program reported in Sections 3.2.3.1 and 3.2.3.2, it may be reasonable to conclude that pharmacists can, through the PLEAD program, engage the NS and physicians in the NH to collaborate and improve the appropriateness of laxative use and outcomes of NHRs. Specifically, the significant increase in the number of laxative prescriptions altered in the intervention home suggested that the PLEAD program succeeded in engaging the NS to proactively alert the physicians to review prescriptions with inappropriate lactulose dosing during their usual interactions when the physicians visited the intervention NH, and possibly resulted in significant improvements in residents' bowel frequencies in the intervention NH. Although the mean change in the NHRs' bowel frequencies observed in Table 3.12 seemed low, it was interesting to note that the residents' bowel frequencies had gotten worse in the control home where PLEAD program was not implemented. In addition, the staff nurses' comments on the additional benefits of consolidated lactulose dose on NHRs' bowel movements could be related to the

positive effect of flatulence induced by the larger lactulose dose ingested which augmented the natural colonic stimulation at morning awakening and after breakfast.[220]

Hence, compared to the pharmacists' role as the "police" who conducted medication use evaluations at the control home, it seemed that the pharmacists' role as the "advocator" for appropriate laxative use in PLEAD may be the key for these desirable outcomes observed in the intervention home. However, the generalizability of these outcomes to other homes may be limited by the non-randomized study design employed in this pilot implementation and evaluation of the PLEAD program. Although the statistical analyses included adjustments to account for differences among the NHR profiles that may confound the outcome of laxative use and bowel frequencies, a cluster randomized controlled study will be needed as part of future work to evaluate the success of the PLEAD program to facilitate inter-professional collaborations to improve laxative use appropriateness.

3.3 Developing a set of algorithms for appropriate laxative use (AALU)

As there are no specific criteria/guidelines for assessing the appropriate prescribing/use of laxatives in the general elderly NHRs, a set of Algorithms for Appropriate Laxative Use (AALU) was developed by the author (apart from the PLEAD program), based on the findings reported in earlier Sections 3.1.2 and 3.2.3. AALU is limited to assessing laxatives of the elderly residents without other pre-existing co-morbidities such as irritable bowel syndrome, megacolon, colostomy and neurogenic bowels that may affect bowel management.

AALU consist of two parts (Figures 3.12 and 3.13), where Part (I) assesses the appropriateness of laxatives used on a "when-needed" basis; Part (II) assesses the

appropriateness of laxatives prescribed for use on a "regular" basis. Both of these algorithms were written as a series of questions to be answered stepwise, in order to arrive at the conclusion if the prescribing/use of the laxative was "appropriate" or "inappropriate". An attempt to answer these questions by retrospective medication reviews can be made by the assessor using prior information documented by the physicians, nurses and other healthcare professionals (such as physiotherapists) in the NHRs' medical and medication notes, bowel opening monitoring/charting forms, institutional transfer notes and hospital/ED discharge summaries, where inadequacies in documentation shall be taken as "nil" responses, hence rendering the use of the laxative as "inappropriate".

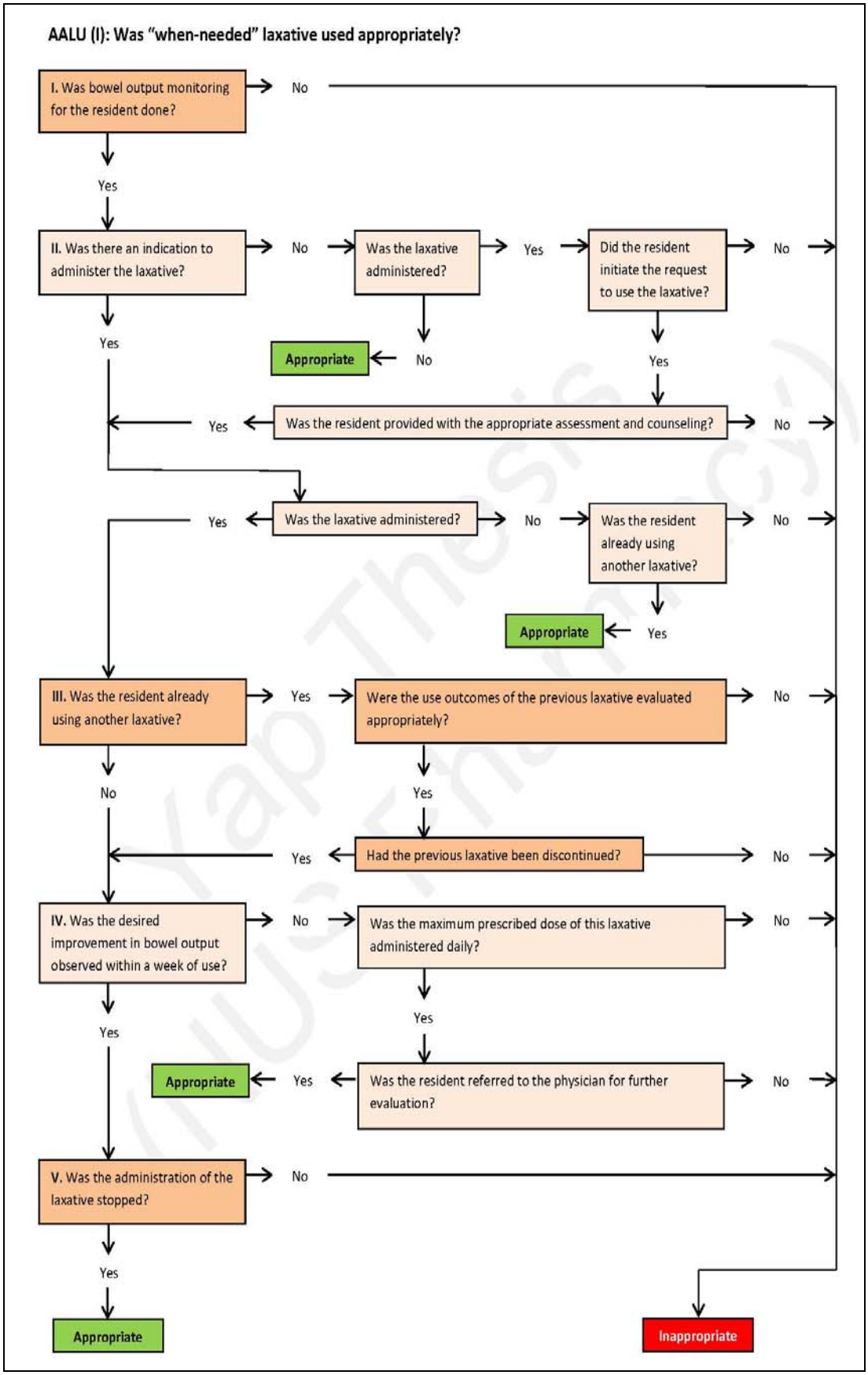


Figure 3.12 AALU on a "when-needed" basis: Part (I)

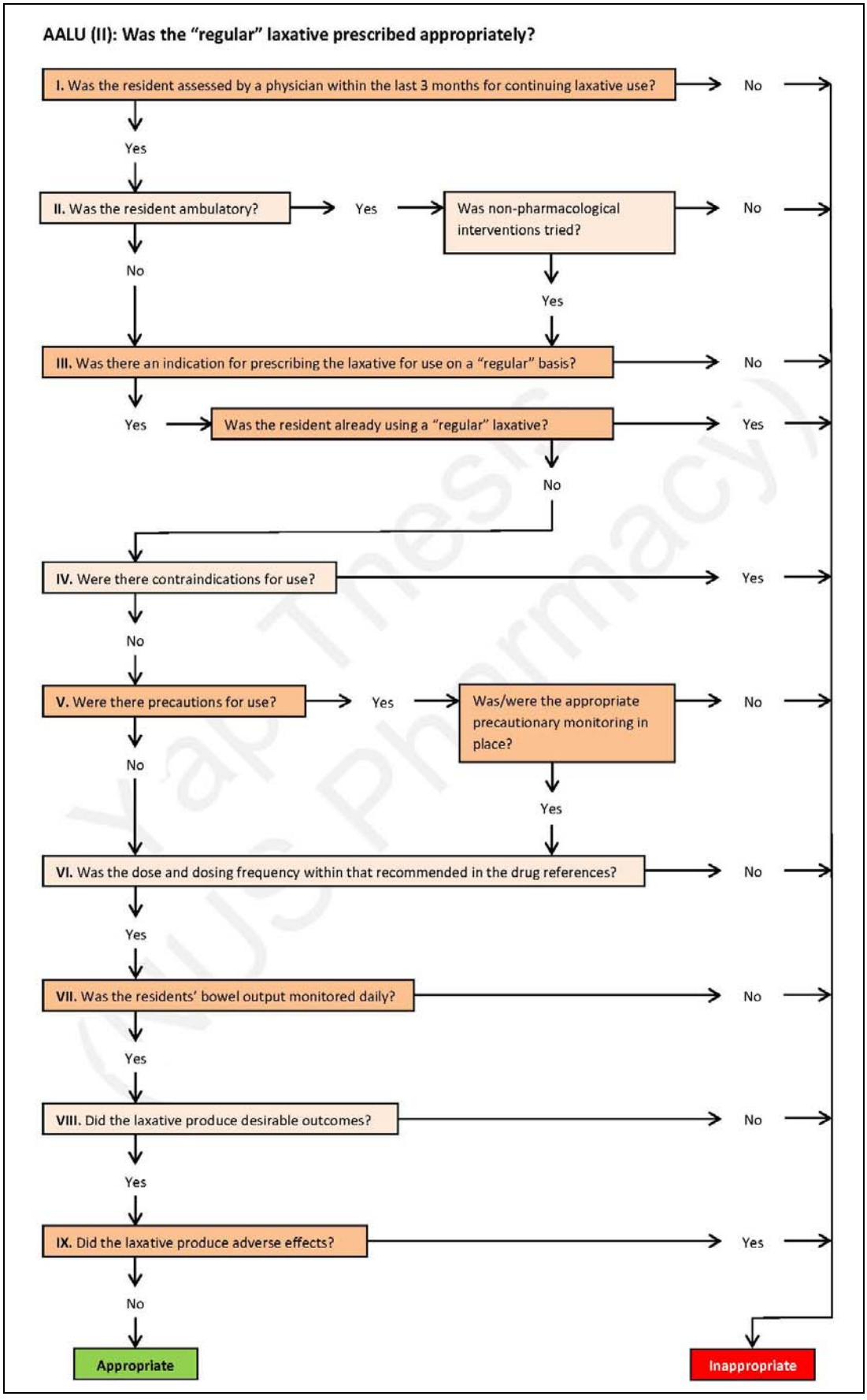


Figure 3.13 AALU on a "regular" basis: Part (II)

Validation[25, 221] for Parts (I) and (II) of AALU was performed by applying the algorithm in a pilot retrospective MUE using a data set of 22 "regular" laxatives and 20 "when-needed" laxatives taken by 24 NHRs, who were chosen at random from the intervention NH. The outcomes of this MUE were reported and their implications on the ability of the AALU in identifying the appropriateness of laxative use were then discussed in the following paragraphs.

The average time taken to complete one laxative evaluation using AALU Part (I) or (II) of AALU was less than one to two minutes, depending on the number questions answered before arriving at being "appropriate" or "inappropriate". In all, AALU Part (I) was triggered 22 times, where 13 of the 20 "when-needed" laxatives were identified to have been inappropriately used and two NHRs with no laxative use were not identified to have under-use of laxatives. The steps in Part (I) that rendered "inappropriate" use of "when-needed" laxative were II (absence of indication and presence of indication with absence of laxative use), III (existing laxative that did not produce desirable therapeutic outcomes was not stopped when the new laxative was started), IV (laxative was used continuously for more than a week without achieving desirable therapeutic outcomes nor referral to a physician for further review), and V (laxative was not stopped despite achieving desirable therapeutic outcomes). The AALU Part (II) was triggered for the 22 "regular" laxatives, of which 14 were identified to have been "inappropriately" prescribed. The steps in AALU Part (II) that rendered "inappropriate" "regular" laxative use were II (no prior trial of non-pharmacological interventions), III (absence of indication), VIII (laxatives continued despite the absence of desirable therapeutic outcomes), and IX (presence of frequent watery stools). Hence, use of AALU identified all categories of IP/use, which included under-, over, and mis-prescribing/use of laxatives. In addition, no ambiguity

was encountered when assessing the appropriateness of multiple laxatives given to an individual NHR.

From the results of the pilot retrospective MUE, the author noted that steps IV and VI of the AALU Parts (I) and (II) for assessing the appropriateness of doses and dosing frequencies were not triggered. The reason for this was that the laxatives had been rendered "inappropriate" at earlier steps in the algorithms, for example, at II and III of the AALU Parts (I) and (II) respectively, due to the absence of indications. As such, once inappropriateness had been identified, considerations of the subsequent steps of the AALU need not be made. Hence, the use of AALU for MUE appeared to be efficient and effective in terms of minimizing the time taken for retrospective reviews of laxative use. In another example of a "regular" lactulose that had been transcribed from a hospital discharge medication list (without documentation of instructions, diagnoses or indications for continuing lactulose on a long-term basis) and used for about two months at the NH with no assessment for its indication, or attempts to taper its use although the NHR's bowel frequency had improved shortly after hospital discharge, the inappropriateness of this "regular" laxative use was identified in the MUE by AALU Part (II) at step II, where the use of lactulose by the NHR should be replaced by a trial of non-pharmacological intervention since the NHR was not bed-bound. In this example, addressing the recommendations provided at step II of AALU Part (II) at the first physician review after hospital discharge might have avoided an over-use of laxative, without requiring additional time and resources to assess for a definite indication for the use of lactulose. Hence, there may be potential to use AALU as a guide for decisions in prescribing and administration of laxatives in a prospective manner, to reduce inappropriate laxative use, minimize cost, and achieve optimal resident outcomes through the timely recommendations provided.

The AALU has several advantages over the existing PA instruments and algorithms for use in the NHs (previously reported in Section 1.3 and Table 1.1). Firstly, AALU provides a comprehensive assessment for all categories of "inappropriate" use of laxatives. Specifically, Part (I) may detect the presence of under-, over- and mis-use of laxatives prescribed for intention of "when-needed" use, or for NHRs who were not already prescribed with any laxatives with the assumption that nurses would administer laxatives on their discretion. On the other hand, Part (II) may detect the potential over- and mis-prescribing; assessment for under-prescribing of laxatives for use on a "regular" basis was covered in Step IV of Part (I). Secondly, AALU also allowed assessment of the use of combination laxatives, with consideration of when the use of the individual laxative was introduced. Thirdly, a copy of the explicit descriptions of the definitions of appropriateness, significance, issues of inappropriateness, and remedial actions to be taken when inappropriateness was triggered at each step was provided to supplement the use of AALU as shown in Appendix 3.4. Hence, similar to the MAI, AALU incorporates both explicit and implicit assessments of the appropriateness of prescribing/use of laxatives. These explicit information may guide the healthcare practitioner in decision-making process or rectify identified IP/use of laxatives. Lastly, the order in which the questions in AALU were placed complements decision-making during the "prescribing" and "administration" processes of laxatives. Hence, the use of AALU in MUE provides a more timely assessment, as the assessor does not need to plough through large amounts of information to arrive at the conclusion if the prescribing/use of laxative was "appropriate" or "inappropriate".

The use of AALU is not without caveats. Firstly, the explicit descriptions regarding the definitions of appropriateness, significance, issues of inappropriateness,

and remedial actions if inappropriateness is triggered should be updated to reflect the current medical evidence and pharmacotherapy practice. Secondly, as the use of AALU may require implicit evaluations to be made, users of the algorithm may need to acquire a basic understanding of the measure of "appropriateness" and sound pharmacotherapy principles, in order to ensure reliable outcomes, especially when used as a guide for prospective decision-making in the prescribing/use of laxatives. Lastly, when used retrospectively, it may be difficult to draft recommendations for inappropriateness identified from concurrent use of multiple laxatives. This could be overcome through inter professional collaborative discussions involving the NS who provides direct care of the NHRs, the prescribing physicians, and the pharmacists to obtain information about the NHR and to achieve consensus on the appropriate interventions for the NHR.

3.4 Summary

In this chapter, a communication program, Pharmacist Led Education on Appropriate Drug-use (PLEAD) was developed based on MUEs, NHR interviews and NS surveys, then implemented and evaluated in a pilot study using a non-randomized controlled before-and-after design in two NHs. The content of PLEAD was summarized as the iPURGE mnemonic. Both the PLEAD workshop and the "Dear Healthcare Professional Letters" were well-received by the NS, key stakeholders and physicians, resulting in interventions that increased the number of prescriptions altered and improved the NHRs' bowel frequencies.

In addition, Algorithms for Appropriate Laxative Use (AALU) was also derived from the preceeding work, to be used as a retrospective assessment of laxative use appropriateness and as a prospective guide in appropriate prescribing and use of

laxatives. Although AALU had been validated for its content and structure as a tool for use in retrospective MUEs, its use as a prospective guide is promising as it has advantages over the current PA instruments, and increases efficiency of the conduct of MUEs and interventional studies for improving appropriateness of laxative use among the elderly.

Chapter 4

Improving the Appropriateness of Psychotropic Use in Managing Behavioral and Psychological Symptoms of Dementia (BPSD)

4.1 Identifying challenges in managing BPSD and appropriate prescribing of antipsychotics in the NHs

In view of the increasing trends in population growth and life expectancy of those aged 65 years and above, the prevalence of dementia among Singaporeans is projected to increase from the estimated 30,000 in year 2010, to 53,000 by year 2020, and 187,000 by year 2050.[222] Dementia is marked by features of progressively worsening memory impairment and cognitive disturbances.[223] As the illness advances, the resulting decline in functional capacity naturally exerts its toll on the patient's family, and/or the society, demanding significant expenditure in time, energy, and resources in caregiving for extended periods. This was estimated to amount to some USD 391 million in societal cost (direct costs plus informal care) in year 2005.[224]

In addition to delaying cognitive and functional decline, research related to dementia was reported to be increasingly focused on defining, measuring and managing BPSD.[225] BPSD is a term that encompasses a heterogeneous range of non-cognitive symptoms, such as disturbed perception, thought content, mood, and behavior;[225] and are broadly classified as "behavioral" or "psychological".[226] These symptoms were estimated to be present in up to 97% of persons with dementia over a five-year period,[227] and was reported to be a significant source of patient distress and caregiver stress,[228, 229] increased costs of care and NH admissions.[230] Hence, it was not surprising that higher point prevalence were reported in the NHs compared to that in the social care setting .[231]

Management of BPSD can be summarized in the following steps: (1) identify the target symptom/s to be addressed, (2) evaluate for underlying causes of BPSD, and alleviate those that are reversible, (3) optimize the environment, implement behavior-response plan, and use of non-pharmacological interventions, (4) use of appropriate pharmacologic agent if necessary, (5) monitor for outcomes of intervention and return to step 1 if response is not at goal. Despite the limited evidence supporting the efficacy of many non-pharmacological interventions, these are clearly recommended over the use of pharmacologic agents, particularly antipsychotics, in managing BPSD, particularly symptoms of severe agitation, aggression, and psychosis, which often pose a threat to the safety of the NHRs and others around him/her.[232-234] The obvious reasons are antipsychotics' inconclusive efficacy of use coupled with limited long-term benefits, numerous SEs, and its association with higher risks of stroke and death. Though debatable, antipsychotic use in the NHs will likely continue to be prevalent.[235, 236] However, NHs face many challenges in the appropriate management of BPSD and prescribing of antipsychotics.

Firsly, dementia is often under-diagnosed or undifferentiated in its diagnoses according to the subtypes for many NHRs in Singapore. Investigations for possible dementia, if any, usually take place at the onset of BPSD. Even then, comprehensive workups involving brain scans and electroencephalography are often not performed due to limitations in resources and the lack of motivation or inability of the NHRs' families to pay for these procedures; diagnoses are often based on physician assessments using brief neuropsychological screening tests. As such, IP of antipsychotics and adverse patient outcomes may ensue. For example, NS who are not informed about the NHRs' conditions may be less attentive and less likely to employ strategies specific for BPSD management during caregiving duties. As such,

frustration among NS during caregiving may arise from nurse-resident conflicts and NHRs' resistance to care, hence, often resulting in ill-managed BPSD, escalation of agitation/aggression in the NHRs, hence, risking their safety, and adversely affecting the quality of care. In turn, ill-managed BPSD and the related risks of NHRs' safety may lead to prescribing of antipsychotics,[236] exposure of the NHRs to antipsychotic SEs and adverse NHR outcomes. In another example, the lack of proper diagnoses may cause antipsychotics to be prescribed unknowingly to NHRs with dementia of the Lewy Body type; this dementia subtype accounts for up to 30% of all dementia cases[237] and has high incidence (up to 60%) of adverse and life-threatening reaction to antipsychotics.[234, 238] Hence, the prescribing of antipsychotics in these NHRs is deemed inappropriate and should be avoided.

Secondly, various attributes of the NS may contribute significantly to challenges in managing BPSD and potential pressures on physicians to prescribe antipsychotics inappropriately. Currently, 70% of the limited 4,000 NH staff in Singapore are drawn from the neighboring countries of the Philippines, Sri Lanka and Myanmar. Two-thirds of them work as nursing aides and healthcare attendants, whose core duties involve providing the basic care such as grooming, feeding, toileting, and transferring.[239] This laborious, time-consuming, low-paying and often unappreciated job scope may be a potential recipe for stress and low tolerance to the disruptive symptoms of agitation, aggression and psychosis. Furthermore, deficiency in language and cross-cultural differences may create little advantage or motivation for the NS to understand and cope with the NHRs' behaviors and underlying needs. The NHRs' disruptive behaviors and outbursts may inflate feelings of stressfulness in caregiving, hence adding to the pressure on physicians to prescribe antipsychotics.

Thirdly, the lack of formal healthcare education among many NS and the

absence of monitoring programs for treatment outcomes and side-effects of antipsychotics across the NHs may contribute to IP of antipsychotics. Without adequate knowledge on BPSD and mandatory training of antipsychotic use monitoring, the NS may have variable observational skills, resulting in feedback that lack clinical insight, objective details and timely reporting of important antecedent/recurring events implicated. As the physician's visits are brief and infrequent (up to once in 3 months[148] and attendance for acute conditions), physicians depend on the NS's input for the report of the NHRs' well-being and behavior. Inappropriateness of antipsychotic prescribing could result from mis-identification of target symptoms, and include "mis-prescribing" of antipsychotics when other psychotropics are needed, "under-prescribing" of antipsychotics when necessary (which may result in AEs related to sub-optimally managed aggression), "over-prescribing" of antipsychotics when not necessary (which may result in unnecessary exposure of NHRs to adverse drug effects and risks for stroke and sudden death), and "over-prescribing" of antipsychotics for use over prolonged periods in an unregulated manner (which may culminate to debilitating ADEs such as falls, irreversible tardive dyskinesia and progressively rapid decline in overall physical functions).

Lastly, although some non-pharmacological strategies such as music therapy, recreational activities and interventions involving sensory stimulation may appear to offer some promise in reducing BPSD and hence, the use of antipsychotics, they are also complicated to set-up and administer, as the interventions are often individualized, time-consuming, labor-intensive, and require high costs.[240, 241] Most of the NHs in Singapore are run by non-profit volunteer welfare organizations, whose operating expenses depended highly on public donations and funding from the government (up to a maximum of 50%); a lack in resources, expertise and funding

may thus hinder long-term implementation of non-pharmacological strategies in managing BPSD, resulting in the reliance of the seemingly cheaper and convenient use of antipsychotics in reducing agitation, aggression and psychotic symptoms.

4.2 Identifying strategies to improve appropriate prescribing of antipsychotics

The first widespread changes in antipsychotic use trends were reported across most NHs in the US during the early 1990s. This was in response to the implementation of the OBRA'87 legislation, which aimed, primarily, to restrict the unjustified use of antipsychotics as a chemical restraint in the NHs, for managing difficult behaviors such as wandering, restlessness, anxiety and uncooperativeness.[90] In tandem with this legislation was the mandatory conduct of routine drug regimen reviews by pharmacists.[88] Although these brought about remarkable reductions in antipsychotic use, evidence on its positive impact on other clinical outcomes (such as reduction in AEs among NHRs) was elusive. Contradictorily, a retrospective cross-sectional study noted that the NHRs in the US were more likely to sustain falls, despite lower prevalence of psychotropic use, compared to those in Denmark, Iceland, Italy, Japan and Sweden.[242] Furthermore, it appeared that providing adequate levels of staffing may be a more crucial ingredient in contributing towards the successful reduction of antipsychotic use in the NHs.[243, 244] In view of the absence of similar legislation in Singapore, and the shortage in NS faced by most of the NHs here, there is a need to explore other interventions to improve the appropriateness of antipsychotic use among NHR with dementia.

A literature search was conducted on PUBMED to identify reports of interventions for improving the appropriateness of antipsychotic use in NHs. A

combination of terms "intervention", "medication", "prescribing", "antipsychotics" (entered as a MeSH term), and "nursing homes" (entered as a MeSH term) was used to sieve out original studies that were published in the English language between 2000 and 2010. The reference lists of review articles (that described nursing home interventions) identified from the search were also reviewed manually for additional publications. Articles included for review were those that reported changes in antipsychotic use/prescribing appropriateness as one of the primary outcome/s, in comparisons with control or baseline estimates. Articles that included improving the appropriate use/prescribing of antipsychotics among that of other medications as the interventions' aims but did not specifically report the changes of antipsychotic use/prescribing appropriateness in the results section were excluded. Table 4.1 summarized the seven studies that were identified. Among these interventions, five involved providing education to healthcare professionals and NH care staff,[121, 124, 125, 142, 245] one involved improving medical documentation and inter-disciplinary communication,[118] and one involved a non-pharmacological intervention for the NHRs with dementia.[126]

Table 4.1 Summary of studies which contained interventions that aimed to improve antipsychotic use in the NH (published in 2000 – 2010)

Intervention Type	Study Design / Period	Health-care Discip-lines Involved	Outcomes Measured				
			Medication Use Trends	Physical Restraint Use Trends	Change in BPSD	Change in Adverse Outcome	Caregiver Response
Providing Education[245] *on reducing agitation and restraint use via one 2-day seminar and monthly guidance group*	**CRCT** *6 mths*	**NS**	**Yes** *no sig. changes in antipsy. use*	**Yes** *not sustained at 12-month*	**Yes** *reduced CMAI score in interv. group*	**No**	**No**
Providing Education[125] *on (1) initial skills training & (2) behavioral management techniques via a trained trainer In addition:*	**CRCT** *10 mths*	**Multi-discipline** *P + NS*	**Yes** *reduced prevalence of antipsy. use in interv.*	**No**	**Yes** *no sig. changes in CMAI score. No change in*	**Yes** *no sig. changes in propor-tions of NHRs*	**No**

Intervention Type	Study Design / Period	Health-care Discip-lines Involved	Outcomes Measured				
			Medication Use Trends	Physical Restraint Use Trends	Change in BPSD	Change in Adverse Outcome	Caregiver Response
(i) clinicians provided twice weekly ongoing training and support for individual cases (ii) psychiatrists reviewed psychotropic prescribing every 3 months and communicated recommendations personally to the NH prescribers involved and ensured actions by the prescribers.			*group*		*episodes of aggres-sion*	*with falls*	
Providing Education[142, 143] *(1) on risks and modest benefits associated with antipsy. & benzodiazepine use in dementia via two medication audits & feedback cycles (2) on non-pharmacological approaches to manage BPSD and sleep disturbance via guidelines developed*	**CRCT** *6 mths*	**Multi-discipline** *P + NS + Ph*	**Yes** *more dose reductions/ cessations of benzodia-zepine and antipsy.*	**No**	**No**	**No**	**No**
Providing Education[124] *on non-pharmacological approaches for initial treatment of disruptive behaviors and pharmacotherapy via (1) raising consciousness, (2) one educational session for each discipline involved and (3) monthly clinical follow-up for re-evaluation of antipsy. used for more than 3 mths by Ph*	**Single group before-after study** *7 mths*	**Multi-discipline** *P + NS + Ph*	**Yes** *63% successful discontinua tions /dose reductions in antipsy.*	**Yes** *no sig. changes*	**Yes** *reduced NHBPS scores in interv. group*	**No**	**Yes** *no sig. changes in the number of stressful events*
Providing Education[121] *On algorithm of non-pharmacological approaches for managing agitation and guidelines for psychotropic drug use in long-term care via (1) academic detailing to P, (2) education session to facility PH & NS, (3) distributed notes*	**CT** *3 mths before; 3 mths after*	**Ph**	**Yes** *Increase in prevalence of antipsychot ic use after interventio n; higher prevalence of antipsychot ic use in control group at all time points measured*	**No**	**No**	**No**	**No**
Improving documentation and inter-disciplinary communication[118] *A questionnaire is completed biyearly and as-needed for all residents at family conference meetings (attended by family member, nurse, and social worker), for subsequently*	**Single group before-after study** *1 yr*	**Multi-discipline** *P + NS + Ph + administr ator + social worker*	**Yes** *5 (4.5%) recommend ations were made to taper or discontinue antipsychot ic & 1 to*	**No**	**No**	**No** *Prevalenc e of medicatio n-related sideeffect s document ed during*	**No**

Intervention Type	Study Design / Period	Health-care Discip-lines Involved	Outcomes Measured				
			Medication Use Trends	Physical Restraint Use Trends	Change in BPSD	Change in Adverse Outcome	Caregiver Response
discussion with interdisciplinary team on recommendations for psychotropic use			*increase antipsychotic dose; no sig. reduction in prevalence of antipsychotic use*			*interventi on period were reported.*	
Structured Non-pharmacological Intervention[126] *to provide activities in a small group setting in an environment that was less stimulating than that of the NH unit*	**Single group before-after study** *2 yrs*	**NS**	**Yes** *no sig. changes in antipsy. use*	**Yes** *no sig. changes*	**Yes** *reduced CMAI scores*	**No**	**No**

Antipsy. = antipsychotics; CMAI = Cluster-randomized controlled trial; interv. = intervention; P = physician; mths = months; Ph = pharmacist; sig. = significant; yrs = years.

From these recent studies, it appeared that the presence of two factors were essential ingredients to bring about significant changes in antipsychotic prescribing trends. Firstly, interventions should involve healthcare providers from more than one discipline, especially the NS as they were likely to influence physicians' decisions on antipsychotic prescribing.[246] Secondly, interventions that involved improving healthcare providers' knowledge on the appropriate use and concerns of antipsychotic, with/without active medication review by a prescriber/pharmacist reported desirable changes in antipsychotic use. These findings were consistent with that reported in studies published more than a decade ago.[116, 247-251]

Of the interventions identified, most of them require additional time of NS, pharmacists and clinicians outside of their regular duty/consultation visits for regular multi-disciplinary conferencing,[116, 118] regular training and support sessions,[125] or resident-centered psychosocial intervention.[126] Such requirement may render these interventions unrealistic for long-term implementation in the NHs in Singapore due to

shortage of manpower resource as explained in Sections 1.4 and 4.1. Hence, the preferred multidisciplinary approaches are expected to not only produce desirable outcomes but also need to be easily implemented without taxing on resources; such interventions would be more practical and sustainable in the local NH setting.

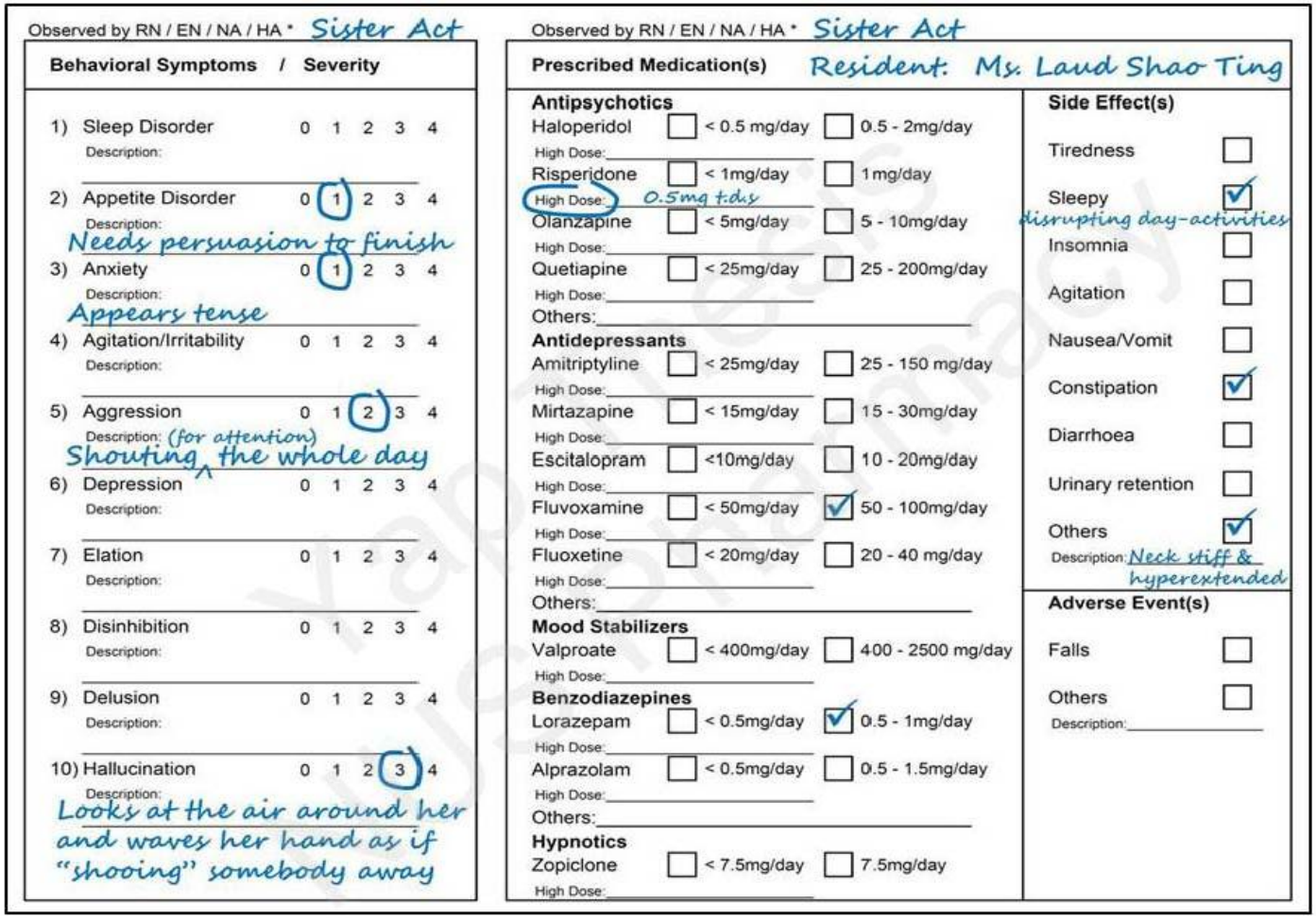
In addition, many of these interventions (and many others reported a decade ago) did not measure the impact of changes in antipsychotic use trends on adverse outcomes among NHRs.[252] In Chapter 1, improvements in both the NHR's therapeutic and reductions in adverse outcomes had been shown to be important indicators of medication use appropriateness,[10, 11] and should be measured in evaluation studies of interventions that aim to improve medication use appropriateness.[51, 52] Among the seven reported here, only one measured changes in the number of NHR falls (an AE widely associated with antipsychotic use).[125] Although most of these studies measured the change in BPSD using various instruments,[124-126, 245] positive results in this outcome measure may not be attributed entirely the appropriateness of antipsychotic use as BPSD, specifically agitation, is intermittent in nature.[253] Furthermore, it was also noted, that interventions to improve the appropriateness of antipsychotic use among NHR with dementia seemed to be focused on reducing the use of antipsychotics, which is synonymous with preventing an "overuse" and "mis-use" of antipsychotics. None of these interventions addressed the potential "underuse" of antipsychotics due to under- or mis-identification of symptoms such as psychosis, which may respond to short-term treatment using antipsychotics.[233] The use of antipsychotics to manage symptoms of severe agitation, aggression and psychosis may be warranted in some cases, especially when these behaviors threaten the safety of the NHR and others around him/her.

From the above analysis of current local practices and published literature, the author opined that timely and objective monitoring and documentation of (1) identification of target BPSD for treatment with antipsychotics (and/or other psychotropic agents), (2) evaluation of therapeutic outcomes, and (3) monitoring for SEs of antipsychotic (and other psychotropic agents) are pivotal steps in preventing inappropriate antipsychotic use among NHRs with dementia, via providing critical information for physician decisions during the "prescribing" stage of the medication use process in the NHs. Specifically, the information derived from these steps may (i) allow targeted use of non-pharmacological interventions or antipsychotics (and/or other psychotropic agents) on specific "type/s" BPSD identified, (ii) prevent unjustifiable decisions to initiate antipsychotic treatment in managing BPSD, (iii) allow timely use of antipsychotics to reduce symptoms of severe agitation/aggression and psychosis in order to alleviate safety concerns, and (iv) allow timely prescribing decisions to reduce, stop, or switch the antipsychotic in use when the therapeutic goal is reached or when SEs interfere with the well-being of the NHRs. Hence, such monitoring may comprehensively address some of the challenges related to "overuse", "mis-use" and "underuse" of inappropriate antipsychotic use and concerns of their related SEs and AEs. Hence, to actualize these steps in a single program and overcome the challenges identified above, a Psychotropic Use Monitoring (PUM) program which involves an inter-professional collaborative practice model was developed. The development, implementation and evaluation of PUM are described in the following sections.

4.3 Development, implementation and evaluation of a Psychotropic Use Monitoring (PUM) program to improve appropriateness of antipsychotic prescribing among NHRs with dementia

4.3.1 Development of the PUM form and the Assessment for Psychotropic Prescriptions (APP) scale

A PUM form was first developed, to serve as a reference and hard-copy documentation of the observations made by the NS during PUM interventions. The form contains 3 sections: (1) an Assessment for Psychotropic Prescriptions (APP) scale for the identification and documentation of recently observed changes in the different 'type' of BPSD, (2) a list of psychotropic agents frequently used for managing BPSD, and (3) a checklist for common SEs of the psychotropic agents frequently used in managing BPSD. Figure 4.1(a) and 4.1(b) shows an example of the PUM form.



Observed by RN / EN / NA / HA * Sister Act

Behavioral Symptoms / Severity

1) Sleep Disorder 0 1 2 3 4
Description:

2) Appetite Disorder 0 **1** 2 3 4
Description: Needs persuasion to finish

3) Anxiety 0 **1** 2 3 4
Description: Appears tense

4) Agitation/Irritability 0 1 2 3 4
Description:

5) Aggression 0 1 **2** 3 4
Description: (for attention) Shouting the whole day

6) Depression 0 1 2 3 4
Description:

7) Elation 0 1 2 3 4
Description:

8) Disinhibition 0 1 2 3 4
Description:

9) Delusion 0 1 2 3 4
Description:

10) Hallucination 0 1 2 **3** 4
Description: Looks at the air around her and waves her hand as if "shooing" somebody away

Observed by RN / EN / NA / HA * Sister Act

Prescribed Medication(s) Resident: Ms. Laud Shao Ting

Antipsychotics
- Haloperidol ☐ < 0.5 mg/day ☐ 0.5 - 2mg/day — High Dose:
- Risperidone ☐ < 1mg/day ☐ 1mg/day — High Dose: 0.5mg t.d.s
- Olanzapine ☐ < 5mg/day ☐ 5 - 10mg/day — High Dose:
- Quetiapine ☐ < 25mg/day ☐ 25 - 200mg/day — High Dose:
- Others:

Antidepressants
- Amitriptyline ☐ < 25mg/day ☐ 25 - 150 mg/day — High Dose:
- Mirtazapine ☐ < 15mg/day ☐ 15 - 30mg/day — High Dose:
- Escitalopram ☐ <10mg/day ☐ 10 - 20mg/day — High Dose:
- Fluvoxamine ☐ < 50mg/day ☑ 50 - 100mg/day — High Dose:
- Fluoxetine ☐ < 20mg/day ☐ 20 - 40 mg/day — High Dose:
- Others:

Mood Stabilizers
- Valproate ☐ < 400mg/day ☐ 400 - 2500 mg/day — High Dose:

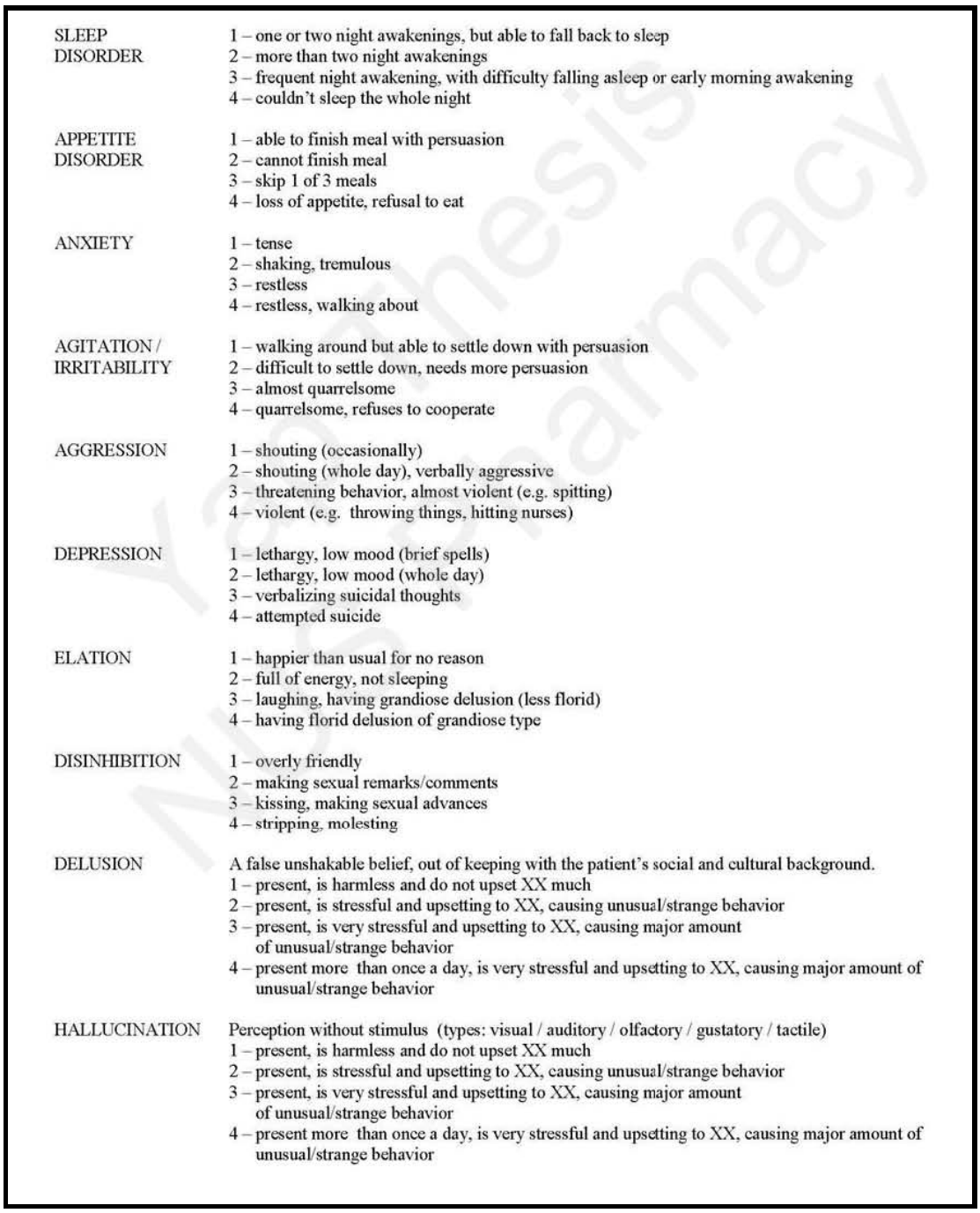
Benzodiazepines
- Lorazepam ☐ < 0.5mg/day ☑ 0.5 - 1mg/day — High Dose:
- Alprazolam ☐ < 0.5mg/day ☐ 0.5 - 1.5mg/day — High Dose:
- Others:

Hypnotics
- Zopiclone ☐ < 7.5mg/day ☐ 7.5mg/day — High Dose:

Side Effect(s)
- Tiredness ☐
- Sleepy ☑ disrupting day-activities
- Insomnia ☐
- Agitation ☐
- Nausea/Vomit ☐
- Constipation ☑
- Diarrhoea ☐
- Urinary retention ☐
- Others ☑ Description: Neck stiff & hyperextended

Adverse Event(s)
- Falls ☐
- Others ☐ Description:

Figure 4.1a Example of a completed Psychotropic Use Monitoring (PUM) form
It contains a column for documenting (1) recently observed BPSD according to the 'type/s' of BPSD defined by the Assessment for Psychotropic Prescriptions (APP) scale, (2) current psychotropics used by the NHR, and (3) recently observed SEs of psychotropics.



SLEEP DISORDER	1 – one or two night awakenings, but able to fall back to sleep 2 – more than two night awakenings 3 – frequent night awakening, with difficulty falling asleep or early morning awakening 4 – couldn't sleep the whole night
APPETITE DISORDER	1 – able to finish meal with persuasion 2 – cannot finish meal 3 – skip 1 of 3 meals 4 – loss of appetite, refusal to eat
ANXIETY	1 – tense 2 – shaking, tremulous 3 – restless 4 – restless, walking about
AGITATION / IRRITABILITY	1 – walking around but able to settle down with persuasion 2 – difficult to settle down, needs more persuasion 3 – almost quarrelsome 4 – quarrelsome, refuses to cooperate
AGGRESSION	1 – shouting (occasionally) 2 – shouting (whole day), verbally aggressive 3 – threatening behavior, almost violent (e.g. spitting) 4 – violent (e.g. throwing things, hitting nurses)
DEPRESSION	1 – lethargy, low mood (brief spells) 2 – lethargy, low mood (whole day) 3 – verbalizing suicidal thoughts 4 – attempted suicide
ELATION	1 – happier than usual for no reason 2 – full of energy, not sleeping 3 – laughing, having grandiose delusion (less florid) 4 – having florid delusion of grandiose type
DISINHIBITION	1 – overly friendly 2 – making sexual remarks/comments 3 – kissing, making sexual advances 4 – stripping, molesting
DELUSION	A false unshakable belief, out of keeping with the patient's social and cultural background. 1 – present, is harmless and do not upset XX much 2 – present, is stressful and upsetting to XX, causing unusual/strange behavior 3 – present, is very stressful and upsetting to XX, causing major amount of unusual/strange behavior 4 – present more than once a day, is very stressful and upsetting to XX, causing major amount of unusual/strange behavior
HALLUCINATION	Perception without stimulus (types: visual / auditory / olfactory / gustatory / tactile) 1 – present, is harmless and do not upset XX much 2 – present, is stressful and upsetting to XX, causing unusual/strange behavior 3 – present, is very stressful and upsetting to XX, causing major amount of unusual/strange behavior 4 – present more than once a day, is very stressful and upsetting to XX, causing major amount of unusual/strange behavior

Figure 4.1b Assessment for Psychotropic Prescriptions (APP) scale
This reference is printed on the back of the PUM form. It allows the user to differentiate the observed incidents / difficult behaviors into one or more BPSD types, and their severity, according to the descriptions provided. Such assessment of BPSD aids in identifying target symptoms for management / pharmacological treatment more readily.

The PUM form was developed by a panel consisting of a senior consultant and professor of psychiatry, a pharmacotherapy expert and clinical pharmacist, a pharmacy practice research consultant and pharmacist, and the author, who reached

consensus after convening over four sessions of half-hour face-to-face meetings. The draft of the PUM form was then shown to a psychiatrist, a geriatrician, and a nursing manager, who are familiar with the NH setting for their comments on the face and content validity of the PUM form. A revised version was then piloted by two registered nurses at the inpatient psychiatric ward at a tertiary hospital. All feedback and input provided were then considered and a final version of the PUM form was then derived by the panel through consensus after a final half-hour face-to-face conference. The developments of these three sections in the PUM form are described as follows.

4.3.1.1 APP scale

The APP scale is a short and simple-to-use tool for objective assessment and documentation of BPSD according to its different "type/s". This scale is meant for routine use by the NS in the clinical setting of a NH, to help with better identification of target symptoms for pharmacological treatment. The development of the APP scale was based in part on the Neuropsychiatric Inventory (NPI),[254] which by far, was the most comprehensive[255] and well-validated criteria, which had also been widely translated[256] and employed in clinical trials for measuring BPSD.[257] Although the original NPI was a reputable measure of BPSD in clinical trials, it would be challenging to operationalize its use in a clinical setting for the purpose of routine monitoring as it contained many screening questions (7-9 sub-questions under each main screening question for all 12 BPSD domains), which would tax the NS's time significantly (20 minutes or more for each assessment). Albeit slightly shorter versions of the NPI were available, the inter-rater reliability was not optimal;[258, 259] furthermore, the clinical relevance of their use in improving the management and

appropriate antipsychotic prescribing in BPSD among the elderly NHRs with dementia have not been clinically evaluated.

Hence, the consensus panel trimmed the 12 BPSD domains in the NPI to 10 BPSD "types" for monitoring in PUM, that were deemed to (1) cause much disruptions to the nursing/caregiving process and (2) have relevance in influencing decisions on psychotropic use. A comparison of the BPSD domains contained in both the NPI and the APP scale was summarized in Table 4.2.

Table 4.2 Comparisons of the BPSD domains in the NPI and the APP scale

NPI	Issues of NPI Domain in PUM	Expert Panel's Decision	BPSD "Types" in APP Scale
Sleep and Nighttime Behavior Disorders	No issues	Included	Sleep Disorder
Appetite and Eating Disorders	No issues	Included	Appetite Disorder
Anxiety	No issues	Included	Anxiety
Irritability/Lability	Symptom descriptions overlaps with "agitation"	Regrouped	Agitation/Irritability
Agitation/Aggression	Aggression should be further differentiated from agitation		Aggression
Depression/Dysphoria	No issues	Included	Depression
Elation/Euphoria	No issues	Included	Elation
Disinhibition	No issues	Included	Disinhibition
Delusions	No issues	Included	Delusion
Hallucinations	No issues	Included	Hallucination
Apathy/Indifference	Not main target symptoms for pharmacological prescribing	Excluded	-
Aberrant Motor Behavior	Not main target symptoms for pharmacological prescribing	Excluded	-

Specifically, "apathy/indifference" and "aberrant motor behavior" from the NPI were not included in the APP scale, as these were not main target symptoms for pharmacological treatment with antipsychotics, antidepressants, antiepileptics or benzodiazepines. In addition, modifications to the "agitation/aggression" domain were made in the APP scale from the NPI. Where symptoms of agitation and aggression were reported to be most disruptive to professional carers,[229] and were the main reasons for the use of antipsychotics, they were also often vaguely

reported/documented as “restlessness” in NHRs’ medical prescribing notes, with little objectivity on the severity of the agitation symptom, presence of an eminent potential for the NHR to “hit out”, and the potential harm to the NHR or others around him/her, where the use of antipsychotics to abate the latter two may be warranted. The use of a single “agitation/aggression” domain in the NPI may not differentiate between symptoms of agitation and aggression in a clinically relevant manner. Hence, this domain was regrouped with “irritability/lability” to produce “agitation/irritability” and “aggression” in the APP scale. As such, “agitation/irritability” symptoms were differentiated from “aggression” symptoms where the former describes increasing restlessness, and the latter describes increasingly threatening behaviors, with a potential to hurt. The 10 BPSD “types” in the first draft of the APP scale were listed by an increasing order of difficulty in assessment. The severity of each BPSD type was rated using a 5-point scale (“0” to “4”). The descriptions of each severity scale, provided by the senior consultant and professor of psychiatry, were printed at the back of the PUM form to increase the objectivity and reliability of the symptom severity ratings.

Feedback was made by the nursing manager to provide more space on the PUM form for the user to add comments for each BPSD “type” rated. She also suggested improvements on the input to the severity rating scale by changing tick boxes to circled options in order to improve the visual and ease of documentation by the NS. These suggestions were incorporated into the final version of the PUM form. In general, both the geriatrician and the psychiatrist agreed to the BPSD domains of the APP scale. Specifically, the psychiatrist and the nursing manager concurred with the exclusion of the domain “apathy/indifference”, as NHRs who exhibited apathy/indifference usually appeared to be quiet and comfortable, hence active

pharmacological or non-pharmacological interventions were usually not required; whereas active interventions would be recommended however, for behaviors that may interfere with the rehabilitation plans for the NHRs.

In addition to face and content validity, the APP scale was also evaluated for its concurrent validity with the NPI and clinical relevance of the BPSD "types" in the APP scale. Inter-rater reliability of the APP scale between (1) pharmacist researcher and physician researcher and between (2) the staff nurse, nursing aide, and nursing attendant were also evaluated.

To evaluate the concurrent validity of the APP scale with the NPI, ratings of NHRs' frequency and severity of BPSD obtained by the author using NPI were compared with the staff nurse's ratings of the same NHRs using the APP scale; both of whom were trained on the use of APPs by the professor of psychiatry. Each pair of rating was based on observations of the same nursing aide, who provided information on the NHR's behavior changes in the 2-weeks prior to the assessment and perceived level of occupational disruptiveness to each NPI domains rated. The interviews with the nursing aide for the NPI and APPs took place at scheduled meetings where all three were present, but were conducted independently by the author and the staff nurse respectively. Spearman's correlation test was then used to compare the individual ratings of each APP scale's BPSD "types" with the corresponding domain scores of the NPI, whereas Pearson's correlation test was used to compare the total rating score of the APP scale with the total score of the NPI. Cohen's Kappa test was used to evaluate the agreement in the prevalence of BPSD symptoms identified by the APP scale and the NPI. Lastly, McNemar's test was used to evaluate the differences in prevalence of each BPSD "types" identified using the APP scale with the prevalence of corresponding BPSD domains identified using the NPI. Using this set

of data, the clinical relevance of the APP scale was also evaluated by comparing the occupational disruptiveness ratings with the NPI domain score and severity rating of the corresponding BPSD "types" of the APP scale using Spearman's correlation test and Cohen's Kappa test.

In all, 18 pairs of ratings were made on 18 separate residents over five meetings (each lasting between 30 to 45 minutes). This sample size was the minimum required to detect an acceptable kappa value of 0.6 against a null value of 0.0 and a correlation coefficient of 0.6 at 80% power and α of 0.05.[162, 260] The results of the correlation and agreement tests between the ratings and scores obtained from the APP scale and the NPI were summarized in Table 4.3.

Table 4.3 Concurrent validity of the APP scale with NPI (n = 18)

APP scale's BPSD "Types"	Corresponding NPI Domains	Comparison of the corresponding domains of the APP scale with NPI			
		Total Scores[a]		Frequency Scores	Severity Scores
		Correlation Coefficient	Kappa	Correlation Coefficient	Correlation Coefficient
Sleep Disorder	Sleep and Nighttime Behavior Disorders	0.50[c,e]	0.51[e]	0.53[c,e]	0.48[c,e]
Appetite Disorder	Appetite and Eating Disorders	-0.11[c]	-0.09	-0.11[c]	-0.11[c]
Anxiety	Anxiety	0.98[c,f]	1.00[f]	0.98[c,f]	0.98[c,f]
Agitation / Irritability	Irritability / Lability	0.69[c,e]	0.57[e]	0.66[c,e]	0.72[c,e]
	Agitation / Aggression	0.74[c,f]	0.75[e]	0.68[c,e]	0.83[c,f]
Aggression	Agitation / Aggression	0.70[c,f]	0.77[e]	0.65[c,e]	0.80[c,f]
Depression	Depression / Dysphoria	1.00[c,f]	1.00[f]	1.00[c,f]	1.00[c,f]
Elation	Elation / Euphoria	1.00[c,f]	1.00[f]	1.00[c,f]	1.00[c,f]
Disinhibition	Disinhibition	-0.06[c]	-0.06	-0.06[c]	-0.06[c]
Delusion	Delusions	1.00[c,f]	1.00[f]	1.00[c,f]	1.00[c,f]
Hallucination	Hallucinations	0.73[c,e]	0.68[e]	0.71[c,f]	0.75[c,f]
All Domains	All Domains[b]	0.83[d,e]	0.60[e]	0.84[d,f]	0.89[d,f]

The domain ratings from PUM's criteria for monitoring BPSD types and severity were compared with the scores from the corresponding domains of NPI, using Pearson's correlation for normally distributed data and Spearman's correlation for non-normally distributed data. The prevalence of non-zero ratings from PUM's criteria domains were compared with non-zero scores from the corresponding NPI domains, using Cohen's Kappa.
[a] The total score of each NPI domain was obtained by multiplying its "frequency" score with its "severity" score.
[b] The "sum of all NPI domains" included the domains "apathy/indifference" and "aberrant motor behavior", which were excluded in the APP scale.
[c] Spearman correlation was used.
[d] Pearson correlation was used for normally distributed data.
[e] p-value < 0.05.
[f] p-value < 0.001.

The ratings of all individual domains in the APP scale strongly correlated with the scores (frequency, severity, and total) of the corresponding NPI domains ($r \geq 0.7$, $p < 0.05$), except for "sleep disorder", "appetite disorder", and "disinhibition". Similar trends were also observed in the agreement of identified BPSD "types" between the use of APP scale and NPI. In addition, the summated rating score for all BPSD "types" in the APP scale strongly correlated with the summated score for all domains in the NPI ($r = 0.83$, $p < 0.05$). The prevalence of having one or more BPSD "types" identified by the APP scale had moderately high agreement with that identified by NPI (Kappa = 0.60, $p < 0.05$). The results of the McNemar's test were summarized in Table 4.4; there were no statistically significant differences in the prevalence of each individual BPSD "types" identified using the APP scale from the use of NPI.

These findings suggested that the exclusion of NPI domains "apathy/indifference" and "aberrant motor behavior" in the APP scale, and the re-grouping of domains "agitation/aggression" and "irritability/lability" did not adversely impact the general measure of BPSD. Furthermore, the target symptoms for antipsychotic use, which included the BPSD "types" "agitation/irritability", "aggression", "delusion" and "hallucination" in the APP scale, were observed to have good correlation and agreement with the corresponding domain measured using NPI, in terms of its total, frequency of occurrence, and severity scores. Hence, the APP scale showed adequate concurrent validity with the NPI.

Table 4.4 Comparison of the prevalence of domains triggered between the APP scale and NPI (n = 18)

APP scale's BPSD "Types"	Corresponding NPI Domains	Prevalence of individual domain symptoms identified		
		APP scale (%)	NPI (%)	Difference (%)
Sleep Disorder	Sleep and Nighttime Behavior Disorders	7 (38.9)	5 (27.8)	2 (11.1)
Appetite Disorder	Appetite and Eating Disorders	1 (5.6)	3 (16.7)	-2 (11.1)
Anxiety	Anxiety	5 (27.8)	5 (27.8)	0
Agitation / Irritability	Irritability / Lability	12 (66.7)	8 (44.4)	2 (11.1)[a]
	Agitation / Aggression		12 (66.7)	
Aggression	Agitation / Aggression	10 (55.6)	12 (66.7)	
Depression	Depression / Dysphoria	2 (11.1)	2 (11.1)	0
Elation	Elation / Euphoria	2 (11.1)	2 (11.1)	0
Disinhibition	Disinhibition	1 (5.6)	1 (5.6)	0
Delusion	Delusions	3 (16.7)	3 (16.7)	0
Hallucination	Hallucinations	3 (16.7)	5 (16.7)	-2 (11.1)
-	Apathy / Indifference	-	2 (11.1)	-2 (11.1)
-	Aberrant Motor Behavior	-	4 (22.2)	-4 (22.2)
≥ 1 Domains	≥ 1 Domains[b]	15 (83.3)	15 (83.3)	0
Absolute total number of domain symptoms identified		46	52	-6 (33.3)

All differences in prevalence reported were not statistically significant (McNemar's test).
[a] The difference in total prevalence of "agitation/irritability" and "aggression" in APP scale (22 counts) was compared against the total prevalence of "irritability/lability" and "agitation/aggression" in NPI (20 counts).

It was noted, however, that the correlation and agreement findings reported for the BPSD "types" "sleep disorder", "appetite disorder" and "disinhibition" with their corresponding domains in the NPI may be limited by the small number of NHRs with mild and/or infrequent symptoms. Although these domains were not deemed as target symptoms for treatment with antipsychotics, and hence were not likely to influence the outcomes in antipsychotic use trends during the prospective PUM implementation study, an assessment with larger number of NHRs should be carried out to further assess the concurrent validity of these BPSD "types" with their corresponding domains in the NPI.

Of the 52 symptoms identified by NPI, occupational disruption was elicited for only 14 of them. Specifically, occupational disruptions were reported for "agitation/aggression", "anxiety", "Irritability/lability", "delusion", "aberrant motor

behavior", "hallucination", and "sleep and nighttime behavior disorders" (Table 4.5). The agreement between the presence of occupational disruption and positive ratings for APP scale's BPSD "types" "aggression" and "hallucinations" were observed to be much higher than that of the corresponding domain scores of NPI. Furthermore, the agreement between the prevalence of occupational disruption and domain ratings for APP scale's domain "agitation/irritability" was observed to be lesser than that of the corresponding "agitation/aggression" NPI domain.

Table 4.5 Correlation and agreement between occupational disruptiveness rating and the corresponding domain rating/scores of NPI and the APP scale (n = 18)

APP scale's BPSD "Types"	Corresponding NPI Domains	Prevalence of Occupational Disruption Reported by NS	Agreement (Kappa) of the prevalence of occupational disruptiveness elicited in NPI with the corresponding…		Correlation coefficient (r_s) of occupational disruptiveness rating in NPI with the corresponding…	
			BPSD "types" in APP scale	NPI Domain	BPSD "types" in APP scale	NPI Domain Score
Sleep Disorder	Sleep and Nighttime Behavior Disorders	1	0.17	0.265	0.30	0.33
Appetite Disorder	Appetite and Eating Disorders	-	0	0	-	-
Anxiety	Anxiety	2	0.49[a]	0.49[a]	0.69[a]	0.77[b]
Agitation / Irritability	Irritability / Lability	2	0.40[a]	0.40[a]	0.53[a]	0.55[a]
	Agitation / Aggression[a]	6	0.12	0.27	0.69[a]	0.77[b]
Aggression	Agitation / Aggression[a]	6	0.57[a]	0.27	0.61[a]	0.77[b]
Depression	Depression / Dysphoria	-	0	0	-	-
Elation	Elation / Euphoria	-	0	0	-	-
Disinhibition	Disinhibition	-	0	0	-	-
Delusion	Delusions	1	0.46[a]	0.46[a]	0.61[a]	0.61[a]
Hallucination	Hallucinations	1	0.46[a]	0.27	0.54[a]	0.47[a]
-	Apathy / Indifference	-	-	0	-	-
-	Aberrant Motor Behavior	1	-	0.34	-	0.39

[a] p-value ≤ 0.05.
[b] p-value ≤ 0.001.

These suggested that use of the APP scale differentiated and identified symptoms of aggression from symptoms of agitation, where the former were more likely to elicit a perception of occupational disruption and/or treatment with

antipsychotics. Compared to the NPI, the prevalence of "hallucination" identified using the APP scale was also more likely to be associated with a presence of occupational disruption, which may warrant pharmacological interventions with antipsychotics. As such, the use of the APP scale in the clinical setting could result in better identification of target symptom for treatment with antipsychotics, and potentially improve the appropriateness of antipsychotic use, compared to using the NPI.

Inter-rater reliability of the APP scale was evaluated between the pharmacist researcher (author) and a physician researcher involved in other aging- and dementia-related studies. For this purpose, independent ratings were made by both researchers on the same set of patients/NHRs with dementia at two clinical sites: (1) the outpatient clinic of a tertiary hospital and (2) the dementia ward of the participating NH, after permission was obtained from the hospital outpatient clinic and the management committee of the NH. The independent ratings of each BPSD "types" in the APP scale from the two raters were compared using Cohen's Kappa test. The summated rating scores for all BPSD "types" between the raters were compared using Spearman's correlation test. In all, 76 pairs of rating using the APP scale were obtained over 13 hospital outpatient clinic sessions and two visits to the NH. The Kappa statistics for all the BPSD "types" are greater than 0.7 (Table 4.6), In addition, the summated rating for all domains between the raters are highly correlated ($r_s = 0.97$, p-value <0.001). Thus, the APP scale has good inter-rater reliability.

Table 4.6 Inter-rater reliability of APP scale between the pharmacist researcher and a physician researcher (n=76)

APP scale's BPSD "Types"	Cohen's Unweighted Kappa	(95% C.I.)
Sleep Disorder	0.84	(0.71, 0.96)
Appetite Disorder	1	(1, 1)
Anxiety	0.77	(0.62, 0.91)
Agitation / Irritability	0.94	(0.83, 1)
Aggression	1	(1, 1)
Depression	0.91	(0.80, 1)
Elation	1	(1, 1)
Disinhibition	0.92	(0.76, 1)
Delusion	1	(1, 1)
Hallucination	1	(1, 1)

In addition, the inter-rater reliability of the APP scale was also evaluated for multiple raters who were NS at the NH. They included one registered staff nurse, one nursing aide and one nursing attendant, all of whom were non-Singaporeans, and working at the dementia ward of the NH. Among these three NS, only the staff nurse had formal healthcare training. After adequate training on the use of the APP scale, three sets of independent ratings on 25 NHRs in the dementia ward were provided by the NS. These ratings of each BPSD "types" were compared using the Fleiss Kappa (generalized kappa) test using a Microsoft Excel template which was developed to calculate a generalized kappa statistic for a maximum of six categories and five raters. The template was last downloaded in December 2011, from http://www.ccitonline.org/jking/homepage/interrater.html. The summated ratings for all BPSD "types" were compared using the intraclass correlation test (two-way random model for evaluating absolute agreement) on the SPSS v.19. The Kappa statistics obtained for all BPSD "types" in the APP scale are > 0.7 (Table 4.7). A high intraclass correlation coefficient (ICC = 0.97, 95% C. I. = 0.94 to 0.98, p-value < 0.001) was also obtained for the comparison of the summated rating scores for the APP scale provided between the registered staff nurse, nursing aide and healthcare attendant. Hence, good inter-reliability of the APP scale has been achieved among the NS. This implied that with adequate training, the APP scale can be reliably used

by the NS to provide objective observations and documentations on changes in the NHRs' BPSD, despite having differing background in formal healthcare education and potential language barrier with the NHRs.

Table 4.7 Inter-rater reliability of APP scale between multiple NS-raters of different healthcare training background (n=25)

APP scale's BPSD "Types"	Generalized Kappa	(95% C.I.)
Sleep Disorder	0.79	(0.61, 0.98)
Appetite Disorder	0.87	(0.69, 1.04)
Anxiety	0.85	(0.67, 1.02)
Agitation / Irritability	0.82	(0.67, 0.96)
Aggression	0.79	(0.61, 0.98)
Depression	0.94	(0.75, 1.12)
Elation	0.74	(0.51, 0.96)
Disinhibition	0.77	(0.63, 0.91)
Delusion	0.89	(0.66, 1.11)
Hallucination	0.88	(0.69, 1.06)

4.3.1.2 List of Psychotropics Frequently Prescribed for Managing BPSD

Although the focus of the study is to improve the PA of antipsychotics, multiple psychotropics with overlapping SEs may be prescribed simultaneously to target different BPSD "types". Therefore it was necessary to list other psychotropics commonly prescribed for BPSD in the PUM form, so that the users of the PUM form have comprehensive information to decide if the observations made resulted from the desirable or side effects of the treatment. The list of psychotropic agents, identified from the background study reported in Chapter 2 for inclusion in the PUM form were "antipsychotics", "antidepressants", "antiepileptics", and "benzodiazepines". In addition to the primary list, alprazolam was added by the consensus panel. Further to this, both the geriatrician and psychiatrist suggested adding anticholinesterases such as memantine; however, the consensus panel deemed that these agents were primarily prescribed for treatment of dementia and not for the management of BPSD, and did not include this pharmacological group in the list. The psychiatrist also suggested

increasing the maximum dose for haloperidol, risperidone, and fluvoxamine to 5, 2, and 150 mg respectively; however, the consensus panel disagreed on these doses as they were deemed to be beyond those that were suggested in clinical trials and clinical guidelines for managing BPSD.

4.3.1.3 Checklist for psychotropic SEs

All the SEs of the common psychotropics used for managing BPSD were first compiled by the author from drug references, which included the Geriatric Dosage Handbook (14th edition), British National Formulary (61st edition), and DRUGDEX® System [Internet database]. The top 20 SEs that were prevalent among most of these psychotropics were then short-listed by the author for further discussion, with the aim of keeping the final checklist short and simple, so as to encourage its use by the NS. Hence, the SEs, deemed to have the most clinical relevance for inclusion in the primary draft of the PUM form, were blurred vision, weakness, dizziness, sedation, insomnia, tremor, parkinsonism, agitation, headache, dry mouth, dyspepsia, nausea, constipation, diarrhoea, urinary retention, and sweating.

This primary draft was then modified using the feedback provided by the geriatrician to add documentation for AEs such as falls. The geriatrician also suggested monitoring for postural hypotension, but further noted that such monitoring may not apply to the nursing aides and health care attendants. Hence, although monitoring for postural hypotension was not included in the checklist, it was specifically taught to the NS during the PUM-related training (Section 4.3.2.1). In addition, one of the hospital registered nurses who piloted the PUM form noted difficulty in assessing subjective SEs such as “dizziness”, “sedation”, “insomnia”, “headache”, “dyspepsia”, and “nausea”, as she did not speak the same language as the

patient. Hence, the consensus panel removed the items "blurred vision", "dizziness", "headache", "dry mouth", and "dyspepsia" which relied on verbal assessment through interviewing NHRs, as these may be difficult to assess by the majority of the NS who do not speak the same language (Mandarin and/or Mandarin dialects) as the NHRs in the NHs. Further to this, the items "weakness", "sedation", and "nausea" were rephrased as "tiredness", "sleepy", and "nausea/vomiting" respectively, in order to define the items as simply as possible. Both nurses also commented that they faced some difficulty in terms of ascertaining an observed effect to be a medication-related SE; this was noted, and addressed during the PUM training provided for the NS (Section 4.3.2.1). In addition, the consensus panel removed the item "sweating", as the presence of this SE is unlikely to influence changes in the prescribing decisions and adverse patient outcomes. The consensus panel also felt that the items "tremor" and "parkinsonism" did not fully represent the spectrum of possible extra-pyramidal SEs (EPSE), which are clinically significant with antipsychotic use. Hence, instead of adding to the checklist, these items were removed to keep the checklist short. However, the topic on "assessment for EPSE" was specifically introduced to the NS during the training session (Section 4.3.2.1).

4.3.1.4 Disruption to care rating scale

Initially, a 5-point scale to assess the NS's general perception of BPSD's occupational disruptiveness was included in the first draft of the PUM form. However, this was removed in the final version, as one of the two hospital registered nurses who piloted the form feedback that she had difficulty in responding, as (1) she did not know the definition of "disruption" and the purpose of rating it, and (2) she

did not know how her response will affect her superior's assessment of her performance as a professional caregiver.

4.3.2 Prospective implementation of PUM among NS

Following ethics approval from the institutional review board of the university (where the author is a research student) to carry out the implementation and evaluation of the PUM program, consent was sought from the NS in the dementia ward of one NH to participate in the 24-week prospective pilot study. This NH was randomly chosen from five VWO NHs, with one or more specialized dementia wards each and are under the purview of the Ministry of Health.

4.3.2.1 Description of PUM-related training

PUM-related training of the NS was provided by the pharmacist (author), under the supervision of the professor of psychiatry. All the participating NS underwent one main teaching and case discussion during the introductory session. This was followed by 2-week pilot for the NS to apply the knowledge gained through hands-on-practice before the formal implementation of PUM. After implementing PUM, three review and further learning sessions were provided at Weeks 4, 8 and 12. A copy of the schedule, objectives and content outline of the training is provided in Appendix 4.1.

During the introduction session, the NS was first introduced to the clinical significance of performing PUM. Then, specific observational and assessment skills needed for the identification and differentiation of the BPSD "types" using the APP scale and SEs of psychotropic agents were taught and demonstrated. Specifically, they were also taught to observe NHRs' behavioral changes and note their onset with

relation to events that had occurred and to the timing of medication regimen changes; where in general, (1) behavior changes that recur in a consistent pattern or with increasing frequency or intensity for at least a week were likely to be related to an onset/changes in BPSD, (2) those that had occurred within days to a few weeks from a recent change in medication regimens were likely to be medication SEs. As mentioned in the earlier Section 4.3.1.3, the assessment, identification and management of drug-induced postural hypotension and EPSE were further elaborated in separate review sessions at week '8' and '12' respectively, in order to emphasize the clinical significance of these SEs on adverse consequences such as falls. A copy of the handouts provided during the introduction and review sessions were inserted as Appendix 4.2 to 4.4.

Case discussions (using actual NHRs as examples) were used to facilitate learning. In addition, the introduction and review sessions were conducted in groups of about eight to 10 NS to encourage participation and enhance the learning experience. During the 2-week pilot, the NS were randomly paired, and assigned to different NHRs each day to practice and apply the principles and observational skills acquired from the introduction session. In order to accommodate for shift duty and NH activities, repeat sessions were provided within the scheduled study week as much as possible, for individuals who were unable to attend the sessions on the original scheduled dates and time. Make-up sessions were also provided for those who had newly-joined the dementia ward during the period after PUM was implemented.

4.3.2.2 Description of PUM intervention protocol

PUM intervention was carried out by the NS at the dementia ward using the protocol shown in Figure 4.2 for a period of 24 weeks, where the NS applied the acquired observational skills in (1) monitoring to identify target symptoms for treatment with psychotropics, and (2) monitoring for therapeutic outcomes and (3) SEs of psychotropic use.

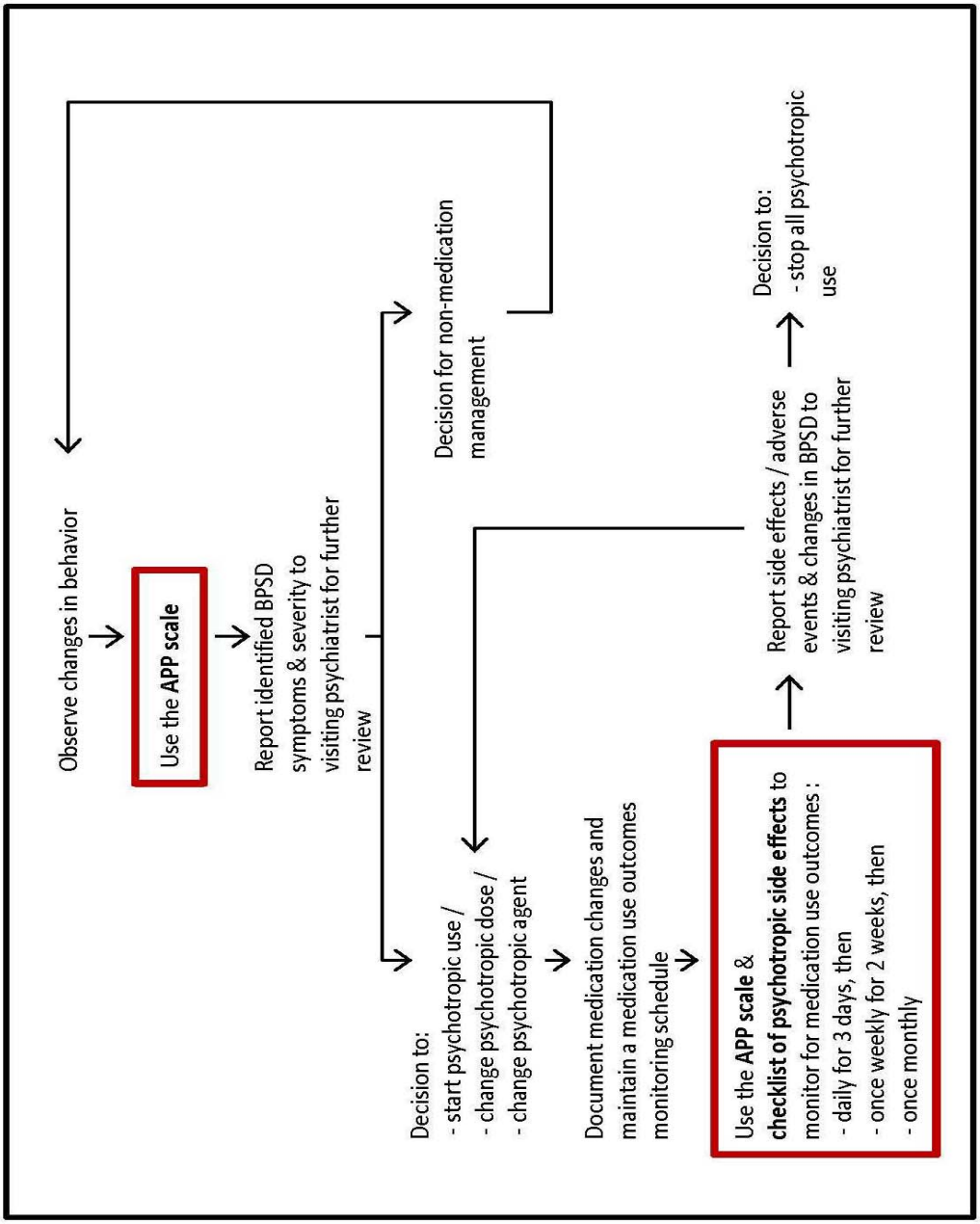


Figure 4.2 Protocol for PUM

The use of the PUM form was triggered when changes in behavior (compared to how the NHR would normally behave) were observed to be recurring in a consistent pattern, or with increasing frequency or severity for at least a week. Based on the APP scale, the observed behavior change/s was/were differentiated according to one or more BPSD "types" and their severity on the PUM form. Such observation and documentation may be made by one or more of the NS who had firsthand observations about the changes or who were affected/implicated by the behavior changes. The documented PUM forms were then filed, collated, summarized and reported by the staff nurse to the psychiatrist for further review and assessment, in order to better identify the target symptoms and the appropriate treatment/management strategy.

When a decision was made to initiate treatment with psychotropic agents or change the current regimen of the psychotropic agents used by the NHR, use of the PUM form was then triggered to monitor for (1) therapeutic outcomes in terms of changes in the types and severity of the original target symptoms identified and (2) onset of psychotropic SEs. Specifically, monitoring for the latter was scheduled to take place daily for the first three days after the prescribed changes, followed by once weekly for two weeks, then once monthly. For NHRs who were already using psychotropic agents with no change in their regimens, use of the PUM form was triggered according to the schedule described above, by taking reference from the last date of change in the NHRs' psychotropic regimens.

In order to ensure compliance with the scheduled monitoring of psychotropic use outcomes, the pharmacist researcher (author) maintained a log, to chart the date of change in psychotropic regimen for each NHR and the pre-scheduled dates where the monitoring would take place. The staff nurse then pre-assigned one NS from each

shift to carry out the monitoring for the particular NHR on the pre-scheduled dates. Input on the log was made after each psychiatrist's review. In addition, the pharmacist also indicated the SEs that were likely to be observed with regards to the psychotropic agent/s implicated. Documentations on the PUM form were then filed, collated, summarized and reported by the staff nurse to the psychiatrist for timely review of the psychotropic use outcomes and optimization of the use of these medications. In addition, the NS was also encouraged to use the PUM form whenever changes in behavior were observed. Hence, the pharmacist plays the role as an educator and advocator for appropriate use of medications (antipsychotics). The success of which, may be established by the impact of the PUM-related training on the NS, degree of engagement by the NS in positive behavioral change, and in the outcomes of PUM on antipsychotic use trends and NHR outcomes.

4.3.2.3 Evaluation of PUM

The impact of PUM and the PUM-related training on the NS were evaluated using a structured face-to-face survey at the end of the 24-week intervention period. This survey method was chosen as almost all of the nursing staff working in the dementia ward was from Myanmar and the Philippines with difficulty communicating in written English; face-to-face surveys allowed for validation of the NS's understanding of the survey questions, provision of further explanation, and verification of responses when necessary. Thus, validation of their understanding was done by direct probing if the respondent took an unusually long time to respond, or if he/she appeared uncertain. Verification of their responses was done by paraphrasing, reflecting of feelings, summarizing long verbal accounts of his/her experiences, and direct probing using positive and negative synonyms of neutral key terms provided by

the respondent. As such, the face-to-face method ensured a good response rate and reliable responses compared to other methods such as a paper-and-pen administered survey. The survey questions, as shown in Appendix 4.5, aimed to elicit responses on the perceived changes in behavior, knowledge, attitudes, ability (application of knowledge gained), and feelings of stressfulness of the NS, and the possible reasons related to these changes. The quantitative responses were given on a 5-point scale, where options ranged from "0" to "4" of increasing intensity. A rating above "2" was considered strong. All qualitative responses by the respondents were also noted. The survey questions were also piloted by five NS from the non-dementia wards before their use to ensure that the questions were well defined and clearly understood. In order to minimize response bias, namely, respondents giving input based on their perception of (1) the investigator's expectations or (2) the effect on the assessment of their work performance, the surveys were conducted individually with each NS at the end of the intervention period in a private area of the NH, at a time that was convenient for the respondents. The anonymity of the respondents was also assured.

In addition, feedback on the prescriber's perception of PUM's impact was also obtained from the regular psychiatrist who visits the home every fortnightly. For this purpose, a semi-structured face-to-face interview was conducted with the psychiatrist at the end of the 24-week intervention period, using the set of questions shown in Appendix 4.6. The psychiatrist's responses have been reported descriptively.

The impact of the intervention on antipsychotic use trends and NHR outcomes, which included the overall measures of BPSD and the occurrence of AEs, were evaluated using a before-and-after study design, where these outcome measures over 24-week periods before and after formal implementation of PUM were compared. In addition, the before-and-after changes in the prevalence of other psychotropics used in

managing BPSD, including antidepressants, antiepileptics and benzodiazepines, were determined as secondary outcomes. Data collection of these outcome measures was conducted retrospectively, and included those of NHRs who were already diagnosed with dementia by a physician and were present in the dementia ward during both the 24-week periods before and after PUM implementation. The data of NHRs who were deceased or transferred out of the dementia ward during the 24-week period before PUM implementation was excluded. Those of newly admitted NHRs during the 24-week period after PUM implementation were omitted. Specifically, the prevalence of antipsychotics and other psychotropics used to manage BPSD were determined from the medication notes. The details pertaining to antipsychotic use were obtained from the medical and medication records. These included the prevalence of use, duration of use, prescribed dose, type of prescribing decisions made, and physician-documented reasons underlying the prescribing decisions. The RAF subscale rating for psychiatric problems and behavioral problems among the NHRs at the start of the 24-week period before PUM implementation, at PUM implementation, and at the end of the 24-week period after PUM implementation were collected from the NH administrator's file, to be used as the overall measure to determine the overall changes in BPSD. Incidents and the details of all AEs that had occurred among the NHRs were obtained from discharge summaries of unplanned hospitalizations and visits to the ED, and nursing incident reports to the administrator's office. The NHRs' demographic, clinical and medication factors at the time of PUM implementation were obtained from the summary in the medical notes.

The duration of antipsychotic use for each NHR was converted to a ratio (the number of days with antipsychotics ÷ number of days residing in the ward during the study period), and reported as "resident-days". All antipsychotic doses were

converted to chlorpromazine equivalent doses for standardized reporting and comparison of doses. Conversions of the doses for depot injections were according to the recommendations of Kane *et al*.[261] The conversions for oral antipsychotic were obtained from Woods,[262] and that for sulpiride was derived from the BNF (61st Edition, 2011). The average daily chlorpromazine equivalent dose of antipsychotics used per NHR in each study period is computed using the equation (total dose taken during the study period ÷ total number of days during the study period taking the medication). The mean average daily chlorpromazine equivalent dose of antipsychotic used in each study period before and after PUM implementation was based on the total number of NHRs who were prescribed with one or more antipsychotics during the study period. All prescribing decisions made on antipsychotics were categorized by four dose adjustment types, which included "start new", "increase dose", "decrease dose", and "discontinue". The prescribing decisions on antipsychotics were also grouped and evaluated according to their underlying reasons, which included antipsychotic dose adjustments which were "BPSD-related", "SE-related" and with "no documented reason". The changes in RAF subscales for psychiatric problems and behavioral problems over each 24-week period before and after PUM implementation were calculated using (scores at PUM implementation – scores at start of 24-week period before PUM implementation) and (scores at end of 24-week period after PUM implementation – scores at PUM implementation) respectively. All AEs of unplanned hospitalizations and ED visits were categorized by the documented reasons for referral to a tertiary care institution, and the diagnoses of the referrals. The AEs obtained from incident reports archived in the nursing administrator's office were categorized by the nature of the incidents and their

underlying causes (if stated in the report). Only the AEs related to falls, and injuries related to medication use and/or BPSD were evaluated and discussed.

No sample size calculation was required for this pilot study; however, the sample size of at least 20 to 25 was recommended for an efficacy pilot study such as this.[263] Evaluation of the survey responses was done using Wilcoxon signed rank test, binomial test (using test proportion of 0.5) and Spearman's correlation test w. Statistical analyses on all the medication use and resident outcome measures were performed using McNemar tests, Wilcoxon signed rank test and Spearman's correlation test.

4.3.3 Outcomes of PUM implementation

4.3.3.1 Impact on NS

All 25 NS in the dementia ward during the 24-week intervention period provided consent to participate in PUM. Among them, six NS were transferred to the non-dementia wards mid-way through the intervention period (due to the pre-scheduled internal rotation of staff at the NH), two resigned and one did not participate in the training sessions, citing personal reasons. Thus, only 16 staff received the full training and participated in the survey.

Of these 16 NS, two were staff nurses, one enrolled nurse, six nursing aides and seven healthcare attendants. All of them were foreigners from Myanmar (n = 10) and the Philippines (n = 6). Their years' of experience in a NH setting and dementia ward setting were summarized in Table 4.8. Among them were four who joined the dementia ward half-way through the intervention period; although they did not have

prior experience working in a dementia ward setting or managing BPSD, they received the full training and carried out PUM after joining the dementia ward.

Table 4.8 Ranks and years of experience of NS who completed the PUM-related training

Ranks	n	Number of years' experience in NH setting				Number of years' experience in dementia ward setting			
		Min, Max	Mean (SD)	Median	Mode	Min, Max	Mean (SD)	Median	Mode
Enrolled nurse & above	3	5, 13	8.5 (4.3)	8	5[a]	0, 1	0.4 (0.3)	0.3	0
Nursing aide	6	2, 8	4.3 (2.4)	4	4	0, 2	1.3 (0.8)	1.5	2
Healthcare attendant	7	2, 12	4.8 (3.6)	3	3	0, 5	1.3 (1.7)	0.6	1

[a] The smallest value among the multiple modes is reported.

A summary of the survey results in terms of the perceived changes in behavior, knowledge, attitudes, ability and perceived stress were shown in Table 4.9. Firstly, majority of NS reported positive behavior changes after PUM implementation, specifically, the frequency of monitoring for psychotropic SEs increased (binomial test, *p*-value = 0.004), suggesting that the NS were motivated and engaged to carry out PUM. However, six (36%) of them did not perceive a change in the frequency in managing BPSD. Thus, the reports of increased frequency in managing BPSD may be reflective of an increased prevalence or severity of BPSD among some NHRs during the period of intervention and the increase in exposure to BPSD experienced by the new NS who had recently joined the dementia ward. The distribution of responses to survey Questions 1 and 2 are reflected in Figures 4.3 and 4.4 respectively.

Table 4.9 Outcomes of NS's perceived impact of PUM and PUM-related training (n = 16)

Survey Question		Mean Rating (SD) [a]				Wilcoxon Signed Rank Test, *P* - value	Number of NS with Positive Change [b]	Binomial Test, *P* - value
No.	Description	Before Implementing PUM	After Implementing PUM	Difference (After – Before)	% Increase			
Changes in Behavior								
1	frequency in managing BPSD	1.3 (0.9)	2.4 (0.8)	1.1 (1.1)	84.6	0.004	10	0.454
2	frequency in monitoring SE	1.3 (1.2)	2.7 (0.9)	1.4 (0.9)	107.7	0.001	14	0.004
Changes in Knowledge								
5	on BPSD	1.2 (0.8)	2.5 (1.0)	1.3 (0.9)	108.3	0.002	12	0.077
13	on SE	1.3 (0.7)	3.0 (0.6)	1.8 (0.6)	138.5	<0.001	15	0.001
Changes in Attitudes								
14	awareness to monitor SE	1.1 (0.7)	3.3 (0.6)	2.2 (0.8)	200	<0.001	16	<0.001
16	confidence in correctly identifying SE	1.5 (0.8)	3.3 (0.7)	1.8 (1.0)	120	0.001	14	0.004
Changes in Ability (in applying knowledge)								
3	manage BPSD well	1.4 (0.7)	2.5 (0.8)	1.1 (0.6)	78.6	0.001	14	0.004
10	differentiate BPSD types & severity	1.0 (0.8)	2.8 (0.8)	1.8 (1.0)	180	0.001	15	0.001
15	recognize SE	1.4 (0.8)	3.1 (0.6)	1.6 (1.0)	114.3	0.001	14	0.004
Changes in Perceived Stress(during caregiving)								
4	feel stressful when managing BPSD	1.7 (1.3)	1.7 (0.9)	0 (1.2)	0	0.971	7	0.804

[a] Ratings were made on a 5-point scale, with increasing intensity from "0" to "4".
[b] Positive change was defined as mean difference (After-Before) in rating < 0 in survey Question 4. For all other Questions in this table, it was defined as mean difference (After-Before) in rating > 0.

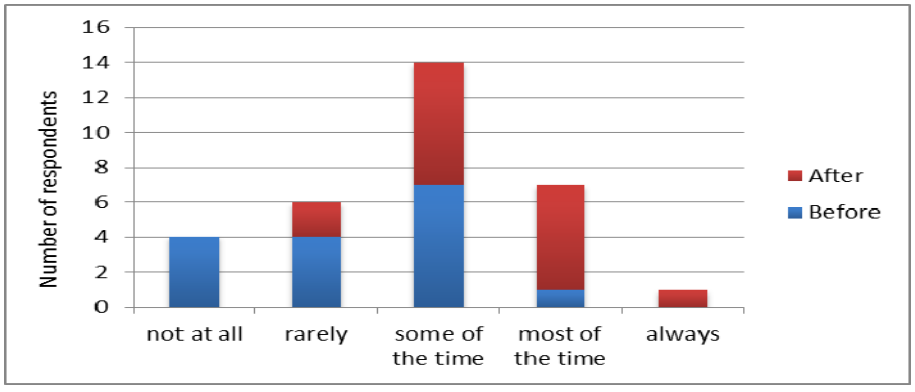


Figure 4.3 Distribution of the responses to Question 1 of the NS survey on frequency in managing BPSD (n = 16)

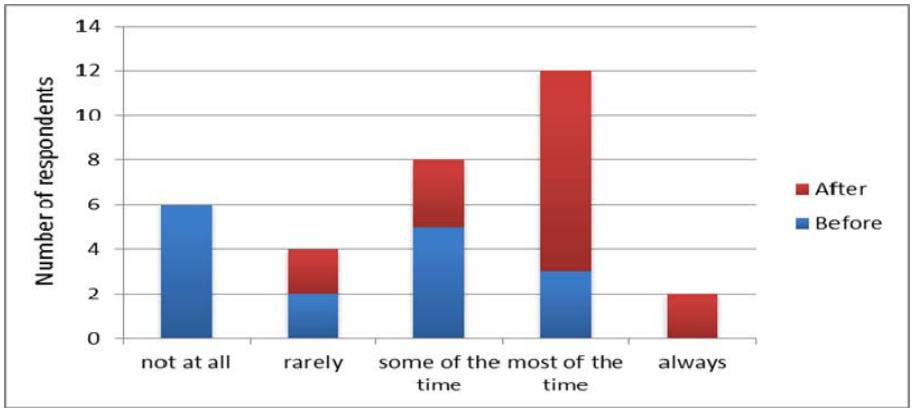


Figure 4.4 Distribution of the responses to Question 2 of the NS survey on frequency of monitoring psychotropic SEs (n = 16)

The NS reported a significant increase in knowledge on BPSD after PUM implementation (Wilcoxon signed rank test, *p*-value < 0.05). The distributions of the responses to survey Questions 5 and 13 were reflected in Figures 4.5 and 4.6 respectively. By comparison, more NS reported an increase in their knowledge on psychotropic SEs. The mean difference in rating reported for the perceived difference in knowledge on psychotropic SEs after implementing PUM was also greater compared to that for BPSD. Further to this, almost all NS attributed the increase in knowledge to the PUM-related training received (refer to Table 4.10). Hence, it appeared that the PUM-related training was successful and contributed to NS's increased knowledge.

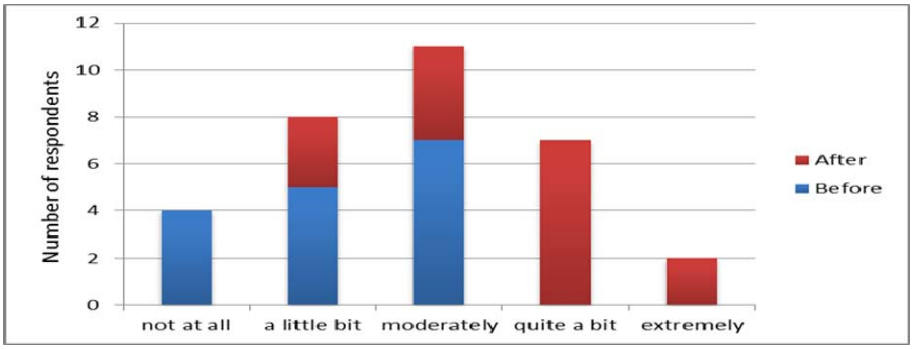


Figure 4.5 Distribution of the responses to Question 5 of the NS survey on perceived knowledge on BPSD (n = 16)

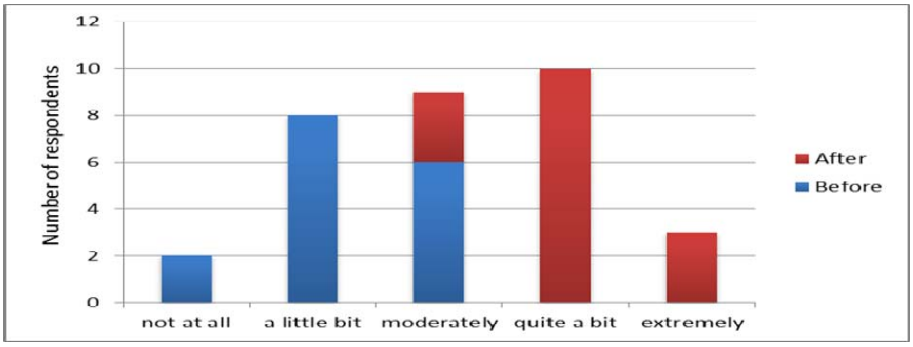


Figure 4.6 Distribution of the responses to Question 13 of the NS survey on perceived knowledge on psychotropic SEs (n = 16)

Table 4.10 Summary of NS's perception on the influence of the postulated factors on the change outcomes in terms of knowledge, attitude, ability and perceived stress (n = 16)

Survey Question				Mean Rating (SD)	Number of NS Who Perceived Positive Influence[a]	Number of NS Who Perceived Strong Influence[b]	Binomial Test *(strong influence), P* - value
No.	**Postulated Factors' Influence on Change outcomes**						
Changes in Knowledge							
6	PUM-related training	on	BPSD	3.3 (0.7)	16	14	0.004
17	PUM-related training	on	SE	3.4 (0.7)	16	14	0.004
Changes in Attitudes							
18	Increase knowledge on SE	on	awareness to monitor SE	3.2 (0.5)	16	15	0.001
20	Increase knowledge on SE	on	confidence in correctly identifying SE	3.0 (0.7)	16	14	0.004
21	Schedule for monitoring SE	on	awareness to monitor SE	3.5 (0.5)	16	16	<0.001
Changes in Ability (in applying knowledge)							
7	increase knowledge on BPSD	on	manage BPSD well	3.3 (0.7)	16	14	0.004
11	documenting BPSD changes on PUM form	on	manage BPSD well	3.0 (0.8)	16	14	0.004
19	Increase knowledge on SE	on	recognize SE	3.0 (0.5)	16	14	0.004
Changes in Perceived Stress							
8	Increase knowledge on BPSD	on	stress when managing BPSD	3.0 (0.5)	16	14	0.004

[a] Positive influence is defined by a rating of > "0".
[b] Strong influence is defined by a rating of > "2".

With regards to change of attitudes, almost all the NS reported being more aware about monitoring for psychotropic SEs after implementing PUM (Table 4.9). The distribution of the responses to survey Question 14 is shown in Figure 4.7. It was

also noteworthy that this change in awareness had the largest positive difference in rating after PUM implementation (200% difference). Furthermore, majority of the NS attributed much of this to an increase in knowledge on psychotropic SEs, and the presence of a pharmacist-maintained schedule as a reminder to monitor for SEs (Table 4.10). In addition, an increase in confidence in identifying psychotropic SEs correctly during the PUM intervention period is reported (Table 4.9). This was perceived to have been influenced strongly by the knowledge of psychotropic SEs gained from the PUM-related training (Table 4.10). The distribution of the responses to survey Question 16 is shown in Figure 4.8.

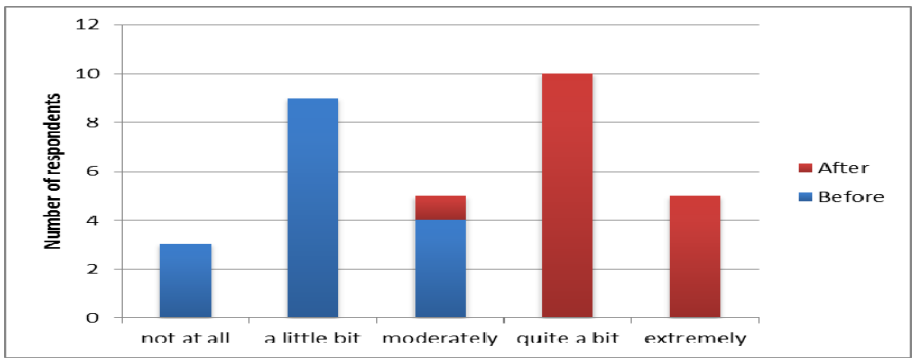


Figure 4.7 Distribution of the responses to Question 14 of the NS survey on awareness to monitor for psychotropic SEs (n = 16)

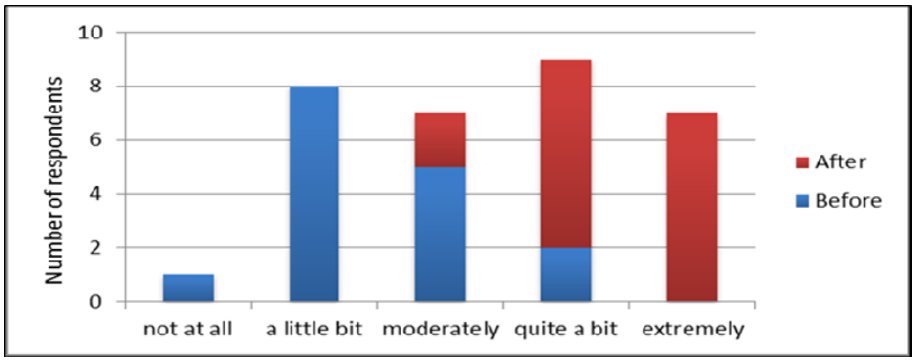


Figure 4.8 Distribution of the responses to Question 16 of the NS survey on their perceived confidence in correctly identifying psychotropic SEs (n = 16)

Further to this, the other changes in attitudes (towards managing BPSD) elicited among the NS in their qualitative responses to survey Questions 9, 12 and 23

are summarized in Table 4.11. They include: being more discerning about residents' behaviors, feeling more capable and more confident in managing BPSD, being more motivated in managing BPSD by taking more initiative and ownership, being more attentive to the NHRs' needs, being more accepting of the NHRs' behaviors, and showing more patience, gentleness, kindness, empathy and sympathy towards the NHRs. Therefore, it seemed that through the increase in knowledge, the PUM-related training had successfully induced positive attitude changes among the NS towards managing BPSD. These positive attitudes could have influenced the desired behavior changes reported, and possibly play a role in reducing the stress of the NS when managing the NHRs with BPSD. The use of the APP scale also resulted in a more discerning attitude among the NS in observing and reporting NHRs' behavior such that the identification of target symptoms for treatment was more discriminative and objective, as the NS reported that they focused on and tried to understand NHRs' behavior.

Table 4.11 Types of attitude changes towards managing BPSD in relation to the increase in knowledge and the use of the APP scale

Qn. No.	Key Words/Phrases Used by NS [a]	Reflected Attitude Changes Towards Managing BPSD [b]	Response Frequency (n = 14)
9	**in relation to the increase in knowledge on BPSD [c]**		
	"more effective…"; "can overcome language barrier… know what to observe"; "know how to handle"	Feels more capable	3
	"understanding towards NHRs"; "accept the NHRs better"	Shows more acceptance towards NHRs' behaviors	3
	"more patient"	Shows more patience towards NHRs	3
	"treat NHRs well by coaxing and talking in a nice way"; "more gentle"	Is more gentle / kind towards NHRs	3
	"understand *(NHRs')* behaviors"	More discerning about NHRs' behaviors	2
	"more ready to approach *(not so scared)* NHRs, especially when they are angry"; "more confidence"	Is more confident	2
	"take more ownership to help manage behavior"; "do more for the NHRs"	More motivated / takes more initiative / ownership towards managing BPSD	2
	"attentive"	More attentive towards NHRs	1

Qn. No.	Key Words/Phrases Used by NS [a]	Reflected Attitude Changes Towards Managing BPSD [b]	Response Frequency (n = 14)
	"can think my mind to them"	Shows more empathy towards the NHRs	1
12	**in relation to the use of the APP scale for documenting BPSD [d]**		
	"can easily understand how the medications change *(depending on identified target symptoms)* and learned how to manage *(BPSD*) correctly"; "*(documenting)* gives a lot of knowledge, especially in how we *(can)* focus on the NHRs' behavior"; "try to understand *(NHRs')* behavior"; "*(become)* familiar with the BPSD and can manage better"; "using the form helped better in terms of observing as we know what to inform doctor"	More discerning about NHRs' behaviors	10
	"more ownership"; "*(documenting)* made me observe and think of ways to effectively manage the behaviors"; "take more initiative to try and help when NHRs are agitated"; "*(documenting made me)* do more assessment, and more likely to feedback the observations"	More motivated / takes more initiative / ownership towards managing BPSD	4
	"made me observe"; "more aware of the underlying problem and reason for behaviors"; "more attentive"	More attentive towards NHRs	3
	"not scared to try to manage NHRs"	Is more confident	1
	"increase empathy"	Shows more empathy towards the NHRs	1
23	**in relation to the increase in knowledge on psychotropic SEs [d]**		
	"helps in recognizing behavior accurately and easy understanding on identifying SE"	More discerning about NHRs' behavior *(in identifying and distinguishing psychotropic SEs from BPSD)*	3
	"more observant"; "more aware of medication's effects on NHRs"; "become more alert and concerned about the NHRs' needs"	More attentive towards NHRs	3
	"more patient"	Shows more patience towards NHRs	3
	"increased confidence, e.g. because I know what is happening, and what to do when NHR suddenly feels drowsy and cannot feed because of that SE"; "less afraid"	Is more confident	3
	"sympathize the NHRs when they have SE and ADL is affected"	Is more sympathetic towards the NHRs	2
	"more ownership"	More motivated / takes more initiative / ownership towards managing BPSD	1
	"feels more effective due to increased capability in assessing SEs"	Feels more capable	1
	"more gentle"	Is more gentle / kind towards NHRs	1

[a] Remarks in parentheses were added by the author.
[b] Reflected attitude change towards managing BPSD were based on the interviewer's understanding of the responses, and were verified with the interviewee during the face-to-face survey interview process.
[c] 15 out of 16 NS responded "yes" to survey Question 9, but only 14 elaborated on their response.
[d] The same 14 out of 16 NS responded "yes" to survey Questions 12 and 23.

After implementing PUM, the NS reported increased abilities in managing BPSD, differentiating BPSD types and severity, and recognizing psychotropic SEs (Table 4.9); these were perceived to be related to the gain in knowledge from PUM-related training (Table 4.10). The distributions of the responses are summarized in Figures 4.9 to 4.11. The perceived increase in ability to manage BPSD was also postulated to be indirectly related to the positive changes in attitude. In addition, a handful of the NS also reported that the use of the APP scale helped them to manage BPSD better, possibly by enabling the NS to differentiate BPSD types and severity and to identify target symptoms for treatment.

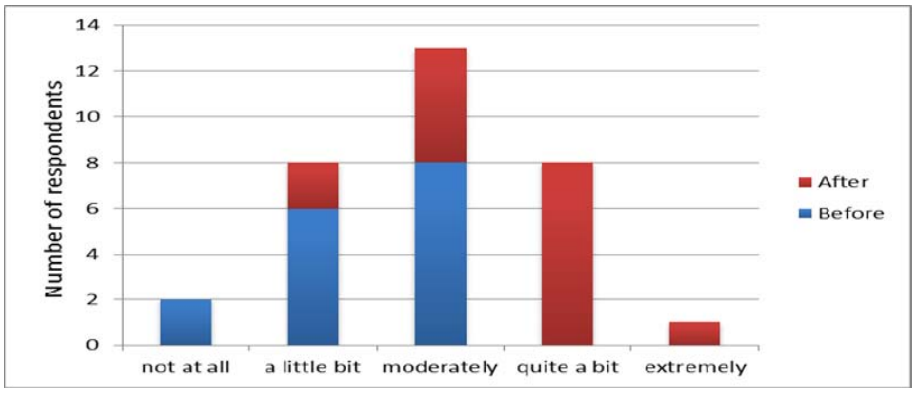


Figure 4.9 Distribution of the responses to Question 3 of the NS survey on their perceived ability in managing BPSD (n = 16)

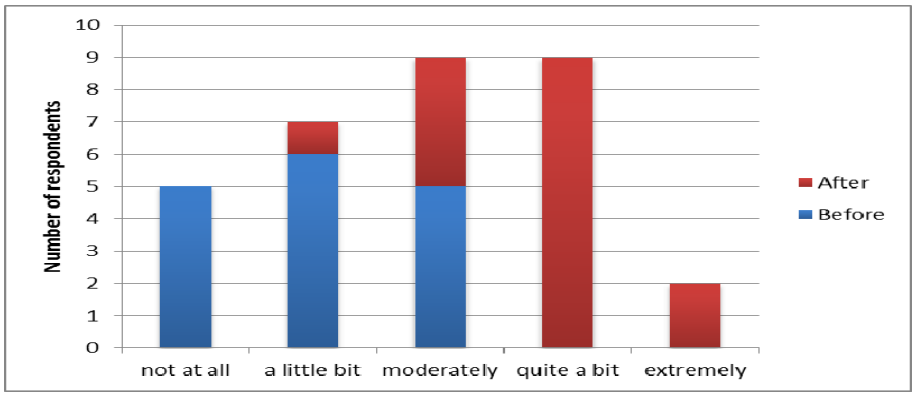


Figure 4.10 Distribution of the responses to Question 10 of the NS survey on their perceived ability to differentiate between BPSD "types" and severity (n = 16)

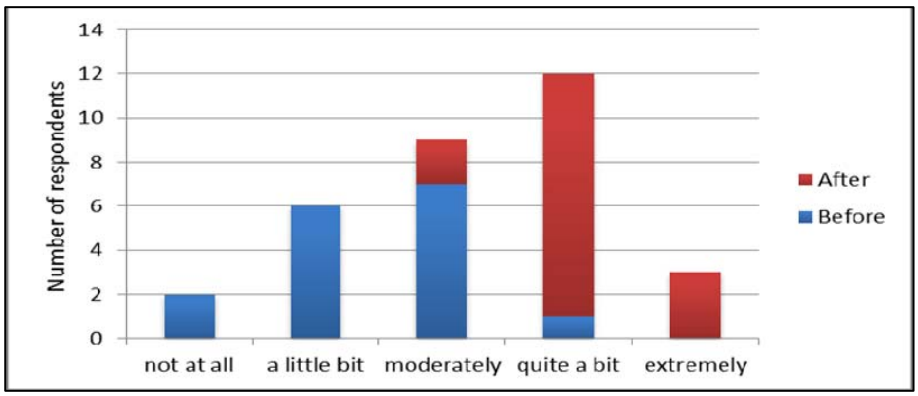


Figure 4.11 Distribution of the responses to Question 15 of the NS survey on their perceived ability to recognize SEs (n = 16)

Despite the unanimous response of the NS towards positive changes in knowledge, attitude, ability, and behavior related to PUM and PUM-related training, there were mixed responses among the 16 NS regarding changes in perceived stress before and after implementing PUM (Table 4.9 and Figure 4.12). While seven of them reported feeling less stressful in managing BPSD, three reported no change in stress level, and six reported feeling more stressful. It was observed that majority of the NS perceived a reduction in stress level with an increase in knowledge on BPSD (Table 4.10), whereas those who reported no change had a low level of stress ("a little bit") at baseline. Interestingly, among the six who reported feeling more stressful after PUM implementation, all of them cited "having an increased sense of responsibility towards the NHRs in terms of monitoring as they become more aware of the SEs of psychotropics and the amounted fall risk as the reason for the increase in stress level. Hence, both the decrease and increase in stress levels were deemed as desirable outcomes of PUM and PUM-related training.

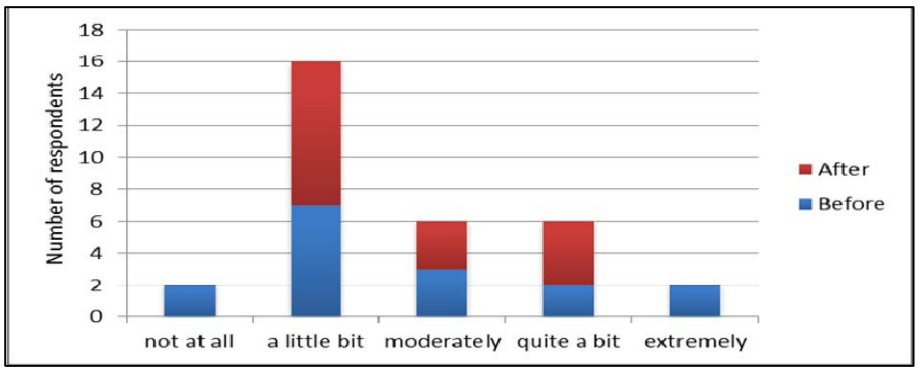


Figure 4.12 Distribution of the responses to Question 4 of the NS survey on their perceived stress when managing BPSD (n = 16)

Lastly, it was noteworthy that all NS responded that they would strongly recommend PUM and PUM-related training to other nurses who manage BPSD at a NH setting (mean rating = 3.7 ± 0.48; Binomial test, $p < 0.001$). When compared with the changes in behavior, knowledge, attitude, ability, and stress perceived by NS, only the change in stress level was found to correlate significantly with the strength of recommending PUM and PUM-related training. Specifically, decreasing levels of stress was strongly correlated with increasing strengths of recommendation ($r_s = -0.79$, $p < 0.001$).

4.3.3.2 Feedback from the psychiatrist

The visiting psychiatrist (who was not aware of the details of the intervention and outcome measures) did not notice significant changes in the general level of disruptions/stress in caregiving reported by the NS, his assessment of psychotropic SEs among the NHRs, or the need to use psychotropics among the NHRs. With regards to the NS's feedback on changes in BPSD and psychotropic SEs, the psychiatrist specifically noted the frequency of reporting psychotropic SEs during his visits to have "increased moderately" after PUM implementation. He also observed that the frequency of correctly identifying SEs by the NS "increased a little bit".

With regards to factors that could have influenced his decision to prescribe psychotropic agents, the psychiatrist reported that it was not likely to be influenced by NS-reported changes in the level of disruptions/stress, but was based on the reporting of individual NHRs' needs by the NS, and that the prescribed psychotropics for management of BPSD was likely to be maintained for several months before attempts to taper off. However, he added that reported SEs related to the use of antipsychotics and benzodiazepines would, however, prompt him to reduce the medication dose or switch to another agent within the same therapeutic class.

4.3.3.3 Impact on antipsychotic use trends

During the 24-week intervention period after PUM implementation, of the 55 NHRs at the dementia ward, four were excluded from the analysis as they were newly admitted, and data was collected from the rest of the NHRs. The demographics of these 51 NHRs at PUM implementation are summarized in Table 4.12.

Table 4.12 NHRs' demographic, medication, and clinical Factors at PUM implementation (n = 51)

Factors	N (%)	Mean ± SD	Median (Range)
Age (years)	-	79.8 ± 9.5	79.5 (60.4 to 98.2)
Gender			
Male	28 (54.9)	-	-
Female	23 (45.1)	-	-
Race			
Chinese	38 (74.5)	-	-
Non-Chinese	13 (25.5)	-	-
Duration of Stay (days)			
[before PUM implementation]	-	163.0 ± 21.9	168 (3 to 168)
[after PUM implementation]	-	150.8 ± 42.0	168 (49 to 168)
Total Number of Medication	-	8.7 ± 4.8	8 (1 to 20)
Polypharmacy [a]			
No	20 (39.2)	-	-
Yes	31 (60.8)	-	-
RAF			
Category 1 & 2	0	-	-
Category 3	16 (31.4)	-	-
Category 4	35 (68.6)	-	-
Mobility Status (RAF Sub-scale)			
Independent	10 (19.6)	-	-
Requires some assistance	25 (49.0)	-	-

Factors	N (%)	Mean ± SD	Median (Range)
Requires frequent assistance/ turning in bed	4 (7.8)	-	-
Requires total assistance	12 (23.5)	-	-
Feeding Status (RAF Sub-scale)			
Independent	28 (54.9)	-	-
Requires some assistance	12 (23.5)	-	-
Requires total assistance	6 (11.8)	-	-
Tube-feeding	5 (9.8)	-	-
Toileting (RAF Sub-scale)			
Independent	6 (11.8)	-	-
Requires some physical assistance	5 (9.8)	-	-
Requires commodes/bed pans/urinals	9 (17.6)	-	-
Incontinent and totally dependent	31 (60.8)	-	-
Psychiatric Problems (RAF Sub-scale) [b]			
Nil	5 (9.8)	-	-
Mild interference in life	21 (41.2)	-	-
Moderate interference in life	22 (43.1)	-	-
Severe interference in life	3 (5.9)	-	-
Behavioral Problems (RAF Sub-scale) [c]			
Nil	4 (7.8)	-	-
Occasionally: 1-3 x a week	14 (27.5)	-	-
Often: 4-6 x a week	23 (45.1)	-	-
Always: daily	10 (19.6)	-	-
Diagnosed Schizophrenia			
No	49 (96.1)	-	-
Yes	2 (3.9)	-	-
Physician-diagnosed Dementia Subtypes			
Alzheimer's	15 (29..4)	-	-
Vascular	19 (37.2)	-	-
Others/Mixed	1 (2.0)	-	-
Unspecified	16 (31.4)	-	-

[a] Polypharmacy is defined by the use of ≥ 5 medications on a regular basis.
[b] Psychiatric problems include hallucination, delusions, anxiety, and depression.
[c] Behavioral problems include restlessness, disruptiveness, uncooperativeness, and abscondment.

Ten (19.6%) NHRs were admitted to the dementia ward during the 24-week period before PUM implementation, three (5.9%) were transferred to other wards during the 24-week period after PUM implementation, and the remaining 38 (74.5%) NHRs resided in the dementia ward for both periods before and after PUM implementation. The proportions of male and female NHRs in the ward were almost equal, 74.5% were Chinese, and mean age was 79.8 (± 9.5) years' old.

When PUM was implemented, the mean total number of medications used was 8.7 (± 4.8), and polypharmacy was present in more than half of the NHRs. Although the majority of these NHRs were relatively independent in mobility and feeding

(68.6% and 78.4% of NHRs were under the categories "independent" and "requires some assistance" of the RAF sub-scales for mobility and feeding respectively), most of them needed much assistance for toileting (78.4% with categories "requires commodes/bed pans/urinals" and "incontinent and totally dependent" of the RAF sub-scale for toileting). Psychiatric problems (assessed by the RAF sub-scale) which include hallucination, delusions, anxiety, and depression were observed in 46 (90.2%) NHRs, and behavioral problems (assessed by the RAF sub-scale) which include restlessness, disruptiveness, uncooperativeness, and abscondment were reported in 47 (92.2%) NHRs. Only two NHRs had a previous diagnosis of schizophrenia. Physician's documentation of "dementia" were recorded in the summary pages of the medical notes of all NHRs included in this analysis, while close to a third of their diagnosis were not further specified according to the subtypes.

The changes in the prevalence of antipsychotics, antidepressants, antiepileptics and benzodiazepines used among 51 NHRs during the 24-week periods before and after PUM implementation are shown in Figure 4.13. Prior to PUM implementation, antipsychotic (45%) and antidepressants (47%) were the most commonly used psychotropic. This was followed by antiepileptics (22%) and benzodiazepines (22%). After PUM implementation, the prevalence of antipsychotic (53%) use among the 51 NHRs remained high. However, the prevalence of the use of antidepressants (41%) and benzodiazepines (18%) was lower. These before-and-after changes were not statistically significant on the McNemar test.

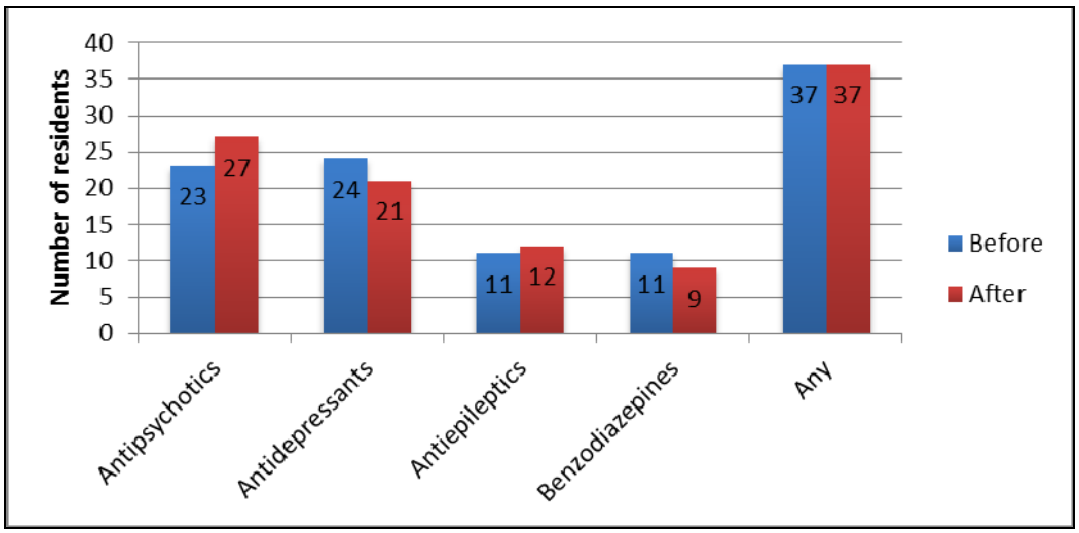


Figure 4.13 Prevalence of psychotropics prescribed among 51 elderly NHRs for managing BPSD before and after PUM implementation

Of the 23 NHRs who took antipsychotics before PUM was implemented, 20 continued to do so after PUM. The number of NHRs who were started on antipsychotics during both study periods (seven versus eight) was about the same (Figure 4.14). Of the 30 NHRs who took antipsychotics during the 48-week period, 13 (25%) used antipsychotics throughout the entire duration. Twenty-one (41%) of the 51 NHRs did not use antipsychotics during the 48-week period. Although the mean duration of antipsychotic use by these 51 NHRs after PUM implementation was higher (0.48 ± 0.48 versus 0.39 ± 0.47 resident-days), it was not statistically significant.

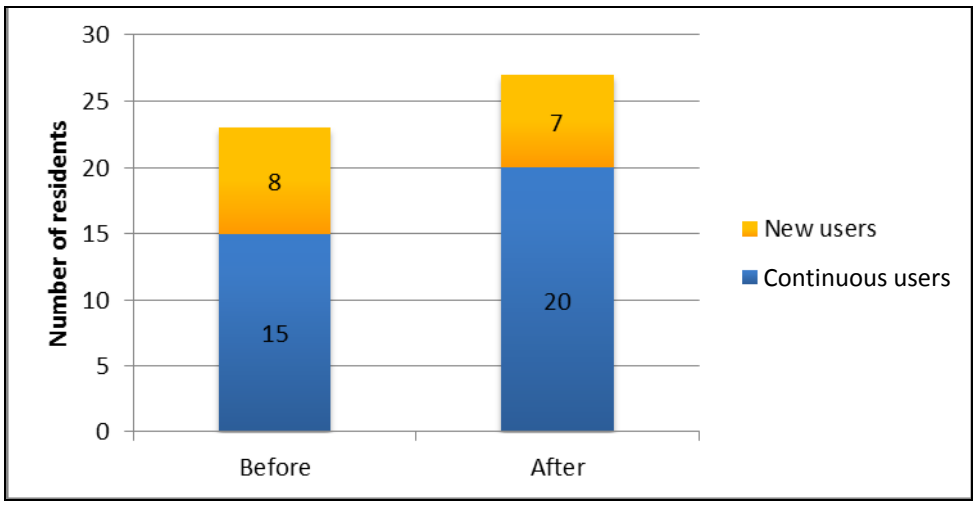


Figure 4.14 Prevalence of antipsychotic use among 51 elderly NHRs for managing BPSD before and after PUM implementation

New users were NHRs who were started with antipsychotics during the study period. Continuous users were those who were already using antipsychotics prior to the study period.

The mean absolute number of days of antipsychotic use before and after PUM implementation was 127.6 ± 55.3 among 23 NHRs and 150.81 ± 34.4 among 27 NHRs respectively. After adjusting for their duration of residence in the ward during each study period, the mean duration of antipsychotic use was similar (0.86 ± 0.27 before PUM implementation versus 0.90 ± 0.20 resident-days after PUM implementation). Among the 23 NHRs who were using antipsychotics, eight NHRs remained unchanged, seven used lower average daily doses (mean difference = -38.5 ± 31.8 mg/day), and eight used higher average daily doses (mean difference = 37.0 ± 40.0 mg/day) after PUM was implemented. Overall, the mean average daily chlorpromazine equivalent dose of antipsychotics used by NHRs prescribed with antipsychotics was slightly lower after PUM implementation (67.26 ± 51.84 mg/day versus 70.2 ± 63.2 mg/day), but the median average daily dose before PUM implementation was slightly lower (48.5, ranging from 16.7 to 249.9 mg/day versus 50.0, ranging from 12.5 to 182.5 mg/day).

The total number of dose adjustments made by the psychiatrist on antipsychotics was higher after PUM implementation (47 versus 34), while the average number of dose adjustments per NHR (for those who were using antipsychotics in each study period) was higher after PUM implementation (1.74 versus 1.48). Hence, it appeared that the PUM intervention could have resulted in an increase in dose adjustments of antipsychotics. Specifically, this higher number of dose adjustments made after PUM implementation was contributed by the higher number of adjustments to "increase dose" (increased by 2.7 times), and the higher number of adjustments to "start new" antipsychotics (increased by 36%). This was evident from the illustration in Figure 4.15 and the positive correlation results from Spearman's correlation test reported in Table 4.13. The lower mean average daily antipsychotic dose used after PUM implementation could be attributed to smaller, more frequent, and probably more cautious dose increments of antipsychotics. It was interesting to note, however, that the total number of the adjustment to "decrease dose" after PUM implementation was similar to that before PUM implementation, but the total number of dose adjustments to "discontinue" antipsychotics was much lower after PUM implementation. These four types of dose adjustment were further evaluated and discussed by relating to the reasons underlying the prescribing decisions.

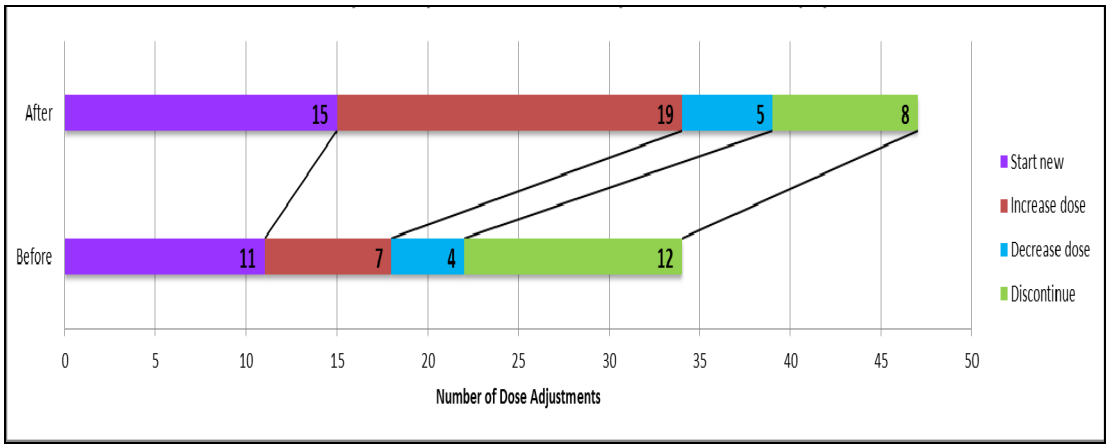


Figure 4.15 Types of dose adjustments made on antipsychotics during the 24-week periods before and after PUM implementation

Table 4.13 Correlations with the difference (after - before) in the total number of dose adjustments (n = 51)

Difference (after - before) in Dose Adjustments of Antipsychotics		Correlation Coefficient (r_s)	*P* - value
by Types	Start New	0.647	<0.001
	Increase Dose	0.560	<0.001
	Decrease Dose	0.342	0.014
	Discontinue	0.340	0.015
by Reasons[a]	No reasons documented	0.224	0.114
	BPSD-related	0.664	<0.001
	SE-related	0.596	<0.001

[a] Reasons for the dose adjustments were determined from the physician's documentation in the NHRs' medical notes.

The prevalence of all dose adjustments categorized by reasons for adjustment as "BPSD-related", "SE-related" or with "no documented reason" as summarized in Figures 4.16 and 4.17 showed that after PUM was implemented, the absolute number of dose adjustments with no documented reasons was reduced by almost 50%, and six of the 12 dose adjustments to "discontinue" antipsychotics before PUM implementation were made with no documented reasons. Hence, prescribing decisions after PUM implementation were relatively more definite, clear and accountable.

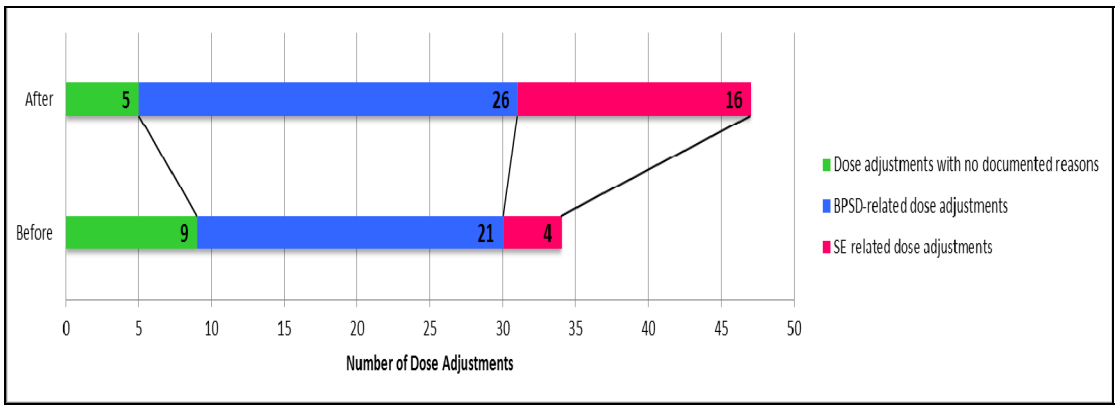


Figure 4.16 Reasons underlying the dose adjustments made on antipsychotics during the 24-week periods before and after PUM implementation

The number of dose adjustments made due to reasons that were "BPSD-related" and "SE-related" increased by 24% and four times respectively after compared to before implementation of PUM. These were also observed to be positively correlated to the before-and-after difference in the total number of all dose adjustments ("BPSD-related" $r_s = 0.66$, $p < 0.001$; "SE-related" $r_s = 0.60$, $p < 0.001$). Therefore, PUM apparently led to more frequent reporting of BPSD changes, therapeutic responses to antipsychotics and antipsychotic SEs by the NS, attributed to more dose adjustments of these pharmacological agents. This observation matched the feedback by the visiting psychiatrist that more SEs were reported by the NS after implementation of PUM.

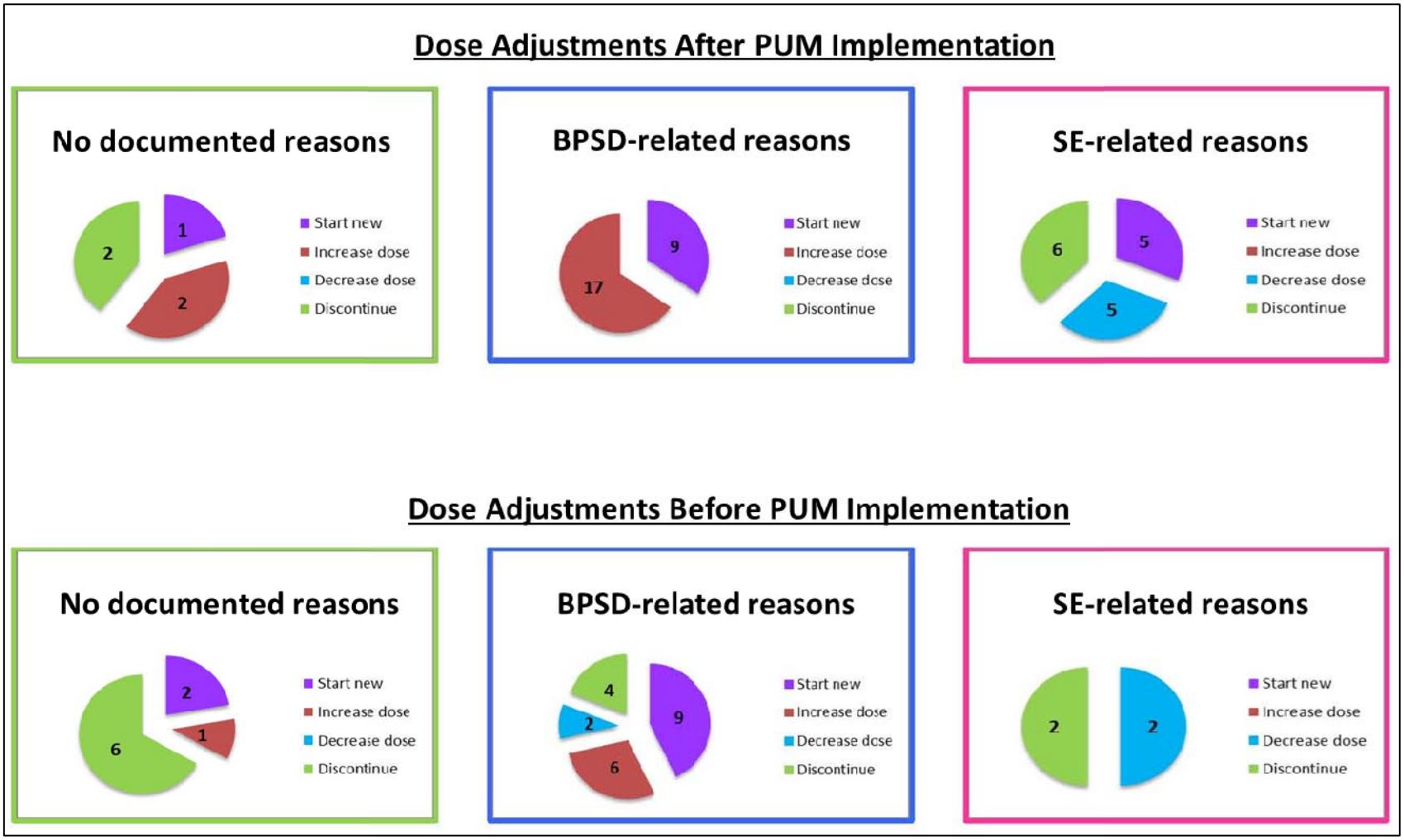


Figure 4.17 The number and type of dose adjustments made due to the various classified reasons before and after PUM implementation

Among the "SE-related" adjustments observed after PUM implementation (Figure 4.17), the decisions to "discontinue" and "start new" antipsychotics occurred simultaneously among five NHRs. These were due to the switching of antipsychotic agents (risperidone, haloperidol and chlorpromazine) to quetiapine, which has less propensity to cause SEs – EPSE and tardive dyskinesia. In addition, three of these switches were preceded by dose decreases of the previous antipsychotics. The documented SEs that led to the prescribing decisions in both study periods are shown in Table 4.14.

Table 4.14 Documented SEs that led to the prescribing decisions in each study period

Before PUM Implementation	After PUM Implementation
"drowsiness"	"tremors of extremities"
"recurrent aspiration"	"general stiffness (causing difficulty in caregiving duties)"
"drug-induced dystonia and secondary aspiration pneumonia and dysphagia" – hospital discharge diagnosis	"drooling"
-	"decreased facial expression"
-	"hyperextension of neck and swallowing impairment"
-	"changes in gait"
-	"tardive dyskinesia involving abnormal mouth movements"
-	"slanting to one side when seated"
-	"stiffness of neck"
-	"drowsiness, causing decreased ability to feed"
-	"abnormal mouth movements"

By contrast, the reporting of SEs before PUM implementation was less frequent, and appeared to occur only after AEs had occurred. After PUM, NS were encouraged to report more SEs, which in turn, improved PA, through timely adjustments of antipsychotics to prevent possible AEs such as falls, and permanent deconditioning of physical functions.

Before PUM implementation, the "BPSD-related" reasons that led to dose adjustments to "decrease dose" and "discontinue" antipsychotics included those that were documented as "no BPSD", "behavior better", and "no more agitation". These BPSD-related dose adjustments were not documented after PUM. The documented

"BPSD-related" reasons that led to dose adjustments of "start new" and "increase dose" in both study periods are shown in Table 4.15.

Table 4.15 Documented "BPSD-related" reasons that led to dose adjustments of "start new" and "increase dose" in each study period

Before PUM Implementation	After PUM Implementation
"noisy"	"aggressive – punch others, accusing his victims as having disturbed him"
"restless"	"shouting vulgarity and refusing food"
"throw urine, throw items out of window, drinking urine in urinal"	"quarrelsome and gets into fights with other NHRs"
"poor sleep at night, waiting at the door to go home, but not aggressive"	"resistive to care, restless, aggressive"
"increase mood and psychomotor excitation – more noisy, shouting, talking of past issue to staff"	"refused food, scold vulgarities, grab staff nurse, spits at staff, and shouts all day"

The "BPSD-related" documentations that led to these dose adjustments before PUM implementation were considered vague as they were not clearly linked to agitation, aggression and psychosis that required the use of antipsychotics; these symptoms and incidents could be related to confusion secondary to dementia and symptoms of elation, which would not warrant the use of antipsychotics. By comparison, the documented reasons for dose adjustments to "start new" and "increase dose" of antipsychotics after PUM implementation were clearly indicative of severe agitation, aggression and/or psychosis and the maintenance of antipsychotic use to reduce these symptoms. Hence, the NS used PUM to provide specific feedback to the physicians, with clear identification of target symptoms, proper documentation and improved appropriateness of prescribing yielding discriminative use of antipsychotics to manage BPSD.

4.3.3.4 Impact on NHR outcomes

The mean RAF subscale rating for "psychiatric problems" and "behavioral problems" at the start of the 24-week period before PUM implementation, at PUM

implementation and at the end of the 24-week period after PUM implementation are shown in Figure 4.18.

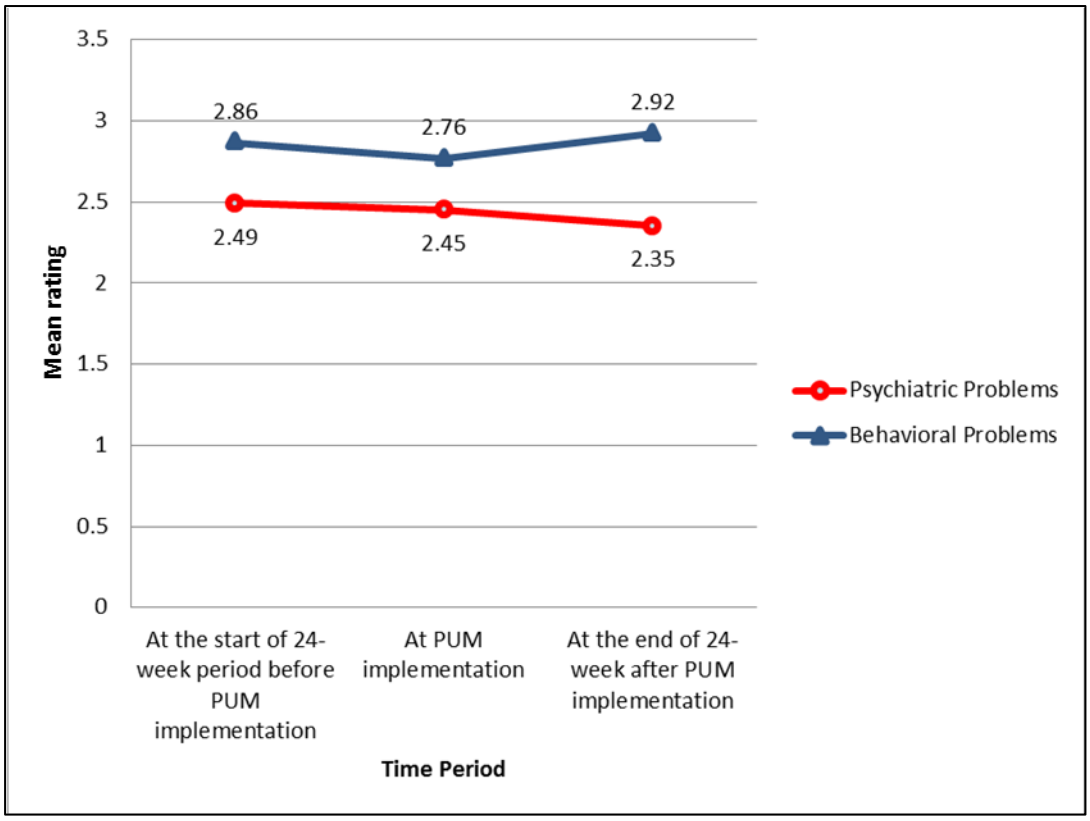


Figure 4.18 Mean RAF subscale rating of psychiatric and behavioral problems
Psychiatric problems included hallucination, delusions, anxiety, and depression; and were rated on a scale of '1' to '4', which corresponds to 'nil', 'mild interference in life', 'moderate interference in life', and 'severe interference in life'. Behavioral problems included restlessness, disruptiveness, uncooperativeness, and abscondment; and were rated on a scale of '1' to '4', which corresponds to 'nil', 'occasionally: 1-3 x a week', 'often: 4-6 x a week', and 'always: daily'.

The mean before-and-after PUM changes of these ratings are summarized in Table 4.16. Overall, the rating for "psychiatric problems" was reduced after compared to before PUM implementation (mean difference = -0.06 ± 0.10; Wilcoxon signed rank test, $p = 0.581$); but, this was not statistically significant.

Table 4.16 Changes in rating of RAF subscales of psychiatric and behavioral problems (n = 51)

RAF Subscale	Changes (after - before) in Rating over the Study Period (SD)		Mean Difference (SD) [c]	Prevalence of NHRs with Positive Outcomes[d]	Prevalence of NHRs with Negative Outcomes[e]
	Before PUM Implementation[a]	After PUM Implementation[b]			
Psychiatric Problems	-0.04 (1.96)	-0.10 (0.61)	-0.06 (0.10)	10	6
Behavioral Problems	-0.10 (0.50)	0.16 (0.70)	0.25 (0.96)	5	14

[a] Mean rating changes over the period before PUM implementation = rating obtained at PUM implementation - rating obtained at the start of the study period.
[b] Mean rating changes for over period after PUM implementation = rating obtained at the end of the study period - rating obtained at PUM implementation.
[c] Mean difference = mean rating changes over the period after PUM implementation - mean rating changes over the period before PUM implementation.
[d] NHRs with positive outcomes were those with a negative mean difference, which implied a decrease in psychiatric/behavioral problems after PUM implementation.
[e] NHRs with negative outcomes were those with a positive mean difference, which implied an increase in psychiatric/behavioral problems after PUM implementation.

The increase in the number of newly initiated antipsychotics after PUM implementation was significantly correlated to the decrease in rating for "psychiatric problems" (r_s = -0.308, p = 0.028, Table 4.17). The overall rating for behavioral problems did not appear to show any downward trends (Figure 4.18). The changes in the rating of behavioral symptoms also did not correlate with the changes in psychiatric symptoms (r_s = 0.067, p = 0.642). Possible reasons for this could be (1) the increased awareness and ability of the NS to identify and report the BPSD "types" and (2) the intermittent nature of BPSD. Hence, although PUM did not appear to have positive effects on reducing "behavioral problems" of the NHRs, it could have contributed to improvement of BPSD in terms of reducing "psychiatric problems", through more targeted and appropriate prescribing of antipsychotics.

Table 4.17 Correlations with the difference (after - before) in the changes in ratings for RAF subscales of psychiatric and behavioral problems (n = 51)

RAF subscale	Correlated Factors	Correlation Coefficient (r_s)	*P* - value
Psychiatric Problem	**Difference (after - before) in Antipsychotic Use Trends**		
	Average daily dose	0.025	0.863
	Duration of use (resident-days)	-0.010	0.947
	Difference (after - before) in Dose Adjustments of Antipsychotics by Types		
	All	-0.140	0.326
	Start New	-0.308	0.028[b]
	Increase Dose	-0.093	0.518
	Decrease Dose	-0.081	0.574
	Discontinue	0.119	0.406
	Difference (after - before) in Dose Adjustments of Antipsychotics by Reasons[a]		
	No reasons documented	-0.011	0.937
	BPSD-related	-0.101	0.481
	SE-related	-0.197	0.165
Behavioral Problem	**Difference (after - before) in Antipsychotic Use Trends**		
	Average daily dose	0.201	0.158
	Duration of use (resident-days)	0.144	0.314
	Difference (after - before) in Dose Adjustments of Antipsychotics by Types		
	All	-0.042	0.769
	Start New	0.025	0.860
	Increase Dose	-0.212	0.136
	Decrease Dose	-0.189	0.184
	Discontinue	0.054	0.707
	Difference (after - before) in Dose Adjustments of Antipsychotics by Reasons[a]		
	No reasons documented	-0.130	0.363
	BPSD-related	-0.073	0.613
	SE-related	-0.110	0.444

[a] Reasons for the dose adjustments were determined from the physician's documentation in the NHRs' medical notes.
[b] Statistically significant at $\alpha = 0.05$.

In addition to positive changes in NHRs' BPSD, the total number AEs reported by the NS to the NH administrator's office was reduced by half after PUM implementation, compared to before. Specifically, among the 16 AEs reported before PUM implementation, 15 were incidents of falls, and one was an incident linked to a badly managed BPSD (irritability and accusatory behavior) of one NHR; documented details of the latter described a quarrel that broke out between two NHRs which had quickly escalated to physical aggression. After PUM implementation, only eight AEs were reported; seven were related to falls and one was related to agitation and resistance to care leading to mild injury (superficial skin abrasion). These incidents occurred among 12 and seven NHRs before and after PUM respectively and the same

two NHRs suffered AEs during both study periods. No statistical significance was obtained, however, on the McNemar test or the Wilcoxon signed rank test.

Lastly, PUM impacted NHRs' outcomes with regards to unplanned hospitalizations and ED visits. During the period before PUM implementation, 10 unplanned hospitalizations and ED visits were documented; of these, three were related to falls and one was related to adverse outcome from antipsychotic use. After PUM implementation, 13 unplanned hospitalizations and ED visits were identified; of these, two were related to falls and one was related to antipsychotic use, as summarized in Table 4.18. The incidents of AEs that were excluded from the comparison and discussion had medical-related diagnoses, such as "dysphagia", "subacute intestinal obstruction", "pneumonia", "constipation (with spurious diarrhoea)", "deep vein thrombosis of left lower limbs", "vomiting", "delirium due to sepsis", "pneumonitis secondary to poor swallowing (from cardiovascular accident – acute on chronic subdural hematoma)", "bronchiolitis", "pyrexia of unknown origin", "acute cholecystitis", "acute on chronic cholecystitis with multiple gallstones", "upper urinary tract infection", "lower urinary tract infection", "open wound of buttock", and "shoulder and groin contusion".

Table 4.18 Description of unplanned hospitalizations and ED visits for falls and injuries related to medication use and/or BPSD

AE Type	Reason for Referral [a]	Diagnosis at Discharge [a]	Length of Hospitalization
Before PUM Implementation			
Fall related	- Was found lying on the floor beside the bed at about 1pm	- Unwitnessed fall	ED Visit
	- Fell the day before, allegedly pushed by another NHR (after one of the quarrels between the two NHRs) - Unable to walk due to pain - Had swelling of right middle finger	- Fracture (pubic rami)	2
	- Fell at about 4pm - Sustained laceration to left occipital area - Found to be less active and drowsy after the fall	- Fall (likely multifactorial)	4

AE Type	Reason for Referral [a]	Diagnosis at Discharge [a]	Length of Hospitalization
Medication use related	- Refused to eat/drink for **a few months** - Decreased weight	- Drug-induced dystonia	1
After PUM Implementation			
Fall related	- Fell the day before (found on the ground) - Complained of pain in the right hip with swelling and decreased movement of right lower limbs - Sustained a bump over the right forehead	- Fracture (closed, right femoral neck)	6
	- Was found face down on the floor at 10pm - Sustained laceration over forehead, with some bleeding and small abrasion over right cheek and left parietal region - On NGT since two days ago for refusal of food	- Fall (with stable injury) - Mild-moderate oropharyngeal dysphagia likely secondary to CVA and vascular dementia	7
Medication use related	- Noted by NS to be in a daze - NHR was referred to the physician at the NH, noted NHR to have dystonia and hyperextension of the neck and swallowing difficulty (cannot tolerate porridge **recently**)	- BPSD - Constipation (during in-patient stay)	3

NGT = nasogastric intubation; CVA = cardio vascular accident.
[a] The "reasons for referral" and "diagnosis at discharge" were obtained from the documentation in the discharge summaries.

4.3.4 Discussion of PUM program outcomes

The PUM had been developed, implemented and evaluated with several limitations. Secondary to the limitation in sample NHRs and BPSD cases, testing of the concurrent validity with the NPI was affected, specifically for BPSD "types" such as "sleep disorders", "appetite disorders" and "disinhibition". However, this was unlikely to affect the outcomes of the implementation and evaluation of the PUM program as the occurrence of these BPSD "types" were not common in the NH during the study period, and may not lead to the use of antipsychotics; the concurrent validity of these domains with that in the NPI can be further evaluated using a larger sample size from other NHs.

Although a cluster randomized controlled trial may be a better study design to evaluate the impact of PUM and PUM-related training, it was not feasible due to a

lack of time and manpower to run the study at multiple sites. Furthermore, since this is the first time PUM was developed and studied, a pilot study using a simple before-and-after design was chosen to evaluate the potential impact of PUM. Based on this pilot study, future evaluations on the external validity of PUM applied to NHRs of other NHs using cluster randomized controlled study can be designed and carried out.

In this pilot study, the outcome measures were comprehensive and included most of those recommended for evaluating interventions that aim to improve drug prescribing and utilization in the NH setting.[51] However, these results may be limited by the reliability of documentation at the NHs in terms of mis-placed/missing reports, mis-entries, and under-reporting. Hence, limitations of mis-placed/missing reports were minimized by conducting data collection every eight weeks after the implementation of PUM. In addition, limitations due to mis-entries and under reporting were minimized by retrieving data from original data sources, which included medication charts, physician's handwritten entries in the NHRs' files, hospital discharge summaries, and reports that were submitted and archived in the administrator's office. The use of descriptive data collection methods also allowed for more complete reporting and analysis of the outcomes. Further to these, potential mis-transcribing of the data was minimized by engaging a research assistant to double check the data entry from the hard-copy data collection forms.

Lastly, during the course of the study, a high turnover of NS was seen in the dementia ward, which may have a negative impact on the outcomes of the study and threaten internal validity of the study results.[264] However, this was anticipated and minimized by providing reviews, repeated and make-up sessions for the PUM-related training. Responses and feedback from the participants were also obtained and analyzed to ensure the internal validity of the PUM-related training and intervention

with regards to the outcomes measured.[264] Although the use of a face-to-face survey to collect responses and feedback from the NS could have led to response biases as mentioned earlier in Section 4.3.2.3, this was minimized by conducting the feedback after the implementation period, assuring the respondent of his/her anonymity and privacy, and allowing the respondent to give his/her feedback at a comfortable pace and setting (such as narrating their actual experience if they had difficulty expressing their feelings and attitudes in written format). In addition, the rapport and understanding forged between the interviewer and the respondents during the intervention period allowed both the negative and positive responses to be given with less inhibition. This was evident from the results where no post-intervention change in knowledge gained and no post-intervention decrease stress levels among two and six respondents respectively.

Despite these limitations, PUM appeared to have potential in improving the appropriateness of antipsychotic use and NHR outcomes, through the timely and objective (1) identification of target BPSD for treatment with antipsychotics (and/or other psychotropic agents), (2) evaluation of therapeutic outcomes, and (3) monitoring for SEs of antipsychotic (and other psychotropic agents). Specifically, the PUM-related training provided by the pharmacist appeared to have contributed to the increase in NS's knowledge, induced positive attitude changes towards managing BPSD, hence leading to the desired behavior changes to perform PUM and reduced stress of the NS when managing NHRs with BPSD. In turn, PUM led to an increase in reporting of BPSD changes, therapeutic responses to antipsychotics and antipsychotic SEs by the NS to the visiting psychiatrist, attributing to more dose adjustments of these pharmacological agents.

Although the number of AEs observed were too few to establish statistical significance in any statistical tests, the reduction in the prevalence of fall incidents after PUM implementation is encouraging compared to that reported in other interventions.[125, 144] Specifically, reasons for the observed decrease in these AEs after PUM implementation could be: Firstly, the increased reporting of SEs by the NS and the corresponding increase in prescribing decisions to change the antipsychotic regimens of the NHRs may have alleviated SEs such as EPSE, impairment to balance, and drowsiness, hence leading to the prevention of fall incidents; secondly, the more discriminative and timely reporting of changes in BPSD could have resulted in the increased use of antipsychotics among NHRs with severe agitation, aggression and psychotic symptoms, hence reducing behaviors that would predispose to falls or pose risks of injuries; thirdly, the extension from the NS's positive feedback on PUM and PUM-related training, the vigilance of the NS towards patient safety in general was raised, hence the reduced number of falls. In addition, it was noted that despite a non-significant increase in the prevalence of antipsychotic use during the period after PUM implementation, the numbers of fall incidents that resulted in unplanned referrals for medical attention at the hospitals did not increase. This observation was contrary to common pharmacoepidemiological findings of increased falls and injuries with increased prevalence of antipsychotic use.[157, 265, 266] Hence, it appeared that despite the lack of an emphasis to reduce the overall prevalence of antipsychotic use, PUM's emphasis on monitoring to improve appropriate antipsychotic use may prevent unrecognized adverse drug effects, adverse events such as falls, and related complications, potentially improving NHRs' quality of life and reducing healthcare costs.

Due to the limited sample size and small numbers of unplanned hospitalizations and ED visits reported, statistical significant conclusion on the effect of PUM on reduction of these AEs could not be drawn. However, it appeared that PUM interventions resulted in greater vigilance with regards to reporting and managing SEs of antipsychotics as evident from the different referrals for the medication use-related incidents reported during both study periods. In the specific example of the medication use related AE reported before PUM implementation in Table 4.18, although symptoms of tardive dyskinesia from antipsychotic use in the NHR were first noted by a physiotherapist, who then requested for a review to alter the antipsychotic prescription in the medical notes before PUM implementation, the documentation went unnoticed and no further action was taken. The antipsychotic depot injections were continued for four months before this NHR was referred to the hospital when he showed reluctance to eat for two months. The NHR was then diagnosed with drug-induced dysphagia and was subsequently put on tube-feeding. By contrast, prompt referral to the hospital for further assessment of suspected antipsychotic SE was made concurrently with a decision to withhold the next antipsychotic dose during the period after PUM implementation, when another NHR was observed to have acute dystonia and hyperextension of the neck area.

4.4 Summary

This chapter details the development and implementation of a psychotropic use monitoring (PUM) program at the dementia ward of a NH through inter-professional collaborative efforts. The evaluation outcomes suggested that the 24-week prospective intervention with PUM had the potential to improve the

appropriateness of antipsychotic use and NHRs' outcomes, in terms of reduced BPSD and incident of falls and other AEs such as unplanned hospitalizations and ED visits.

An Assessment for Psychotropic Prescriptions (APP) scale was developed and validated with good results for its face and content validity, clinical relevance, inter-rater reliability and concurrent validity with the NPI. A set of training materials for teaching how to use the APP scale and PUM intervention was also developed and used to train the NS to increase their awareness, knowledge, and skills to manage BPSD and to better identify SEs of antipsychotics. These prompted the active participation of the NS to carry out PUM, and translated to the positive outcomes over the 24-week intervention period.

From the evaluation outcomes, PUM appeared to be effective in encouraging more judicious prescribing of antipsychotics in the NH. Especially in Asia with huge patient loads and meager human resources, interventions such as PUM that uses short and reliable assessment scales such as APP is much needed, even in busy outpatient clinics and inpatient facilities. Besides validating the external applicability of PUM among NHRs at other NHs and clinical settings, future studies could also evaluate the application of PUM to improve the appropriateness of other psychotropic drug classes including antidepressants, antiepileptics, and benzodiazepines often prescribed for the management of BPSD.

Chapter 5

Exploring the use of computer games in managing BPSD in a NH

5.1 Introduction

In Chapter 4, the pilot implementation and evaluation of the newly developed PUM program in a NH appeared to have potential in improving the appropriateness of antipsychotic use and NHR outcomes in the management of BPSD, specifically through the timely and objective (1) identification of target BPSD for treatment with antipsychotics (and/or other psychotropic agents), (2) evaluation of therapeutic outcomes, and (3) monitoring for SEs of antipsychotic (and other psychotropic agents). However, in view of the risks of increased incidents for stroke and sudden death with the use of antipsychotics in this population group, the need to explore the use of non-pharmacological interventions over the use of antipsychotics in managing BPSD persists. Although evidence on the effectiveness of non-pharmacotherapy strategies to reduce BPSD have been limited to studies with small samples and of limited duration, stimulation-oriented approaches that involve music, recreational activities and various sensory stimulation have been identified to be beneficial, specifically in reducing behavioral problems and improving mood while they are in use.[233] However, these may also be complicated to set-up and administer, as these interventions are often individualized, time-consuming, labor-intensive, and require high costs.[240, 241] Given the various limitations at the NHs for implementing these non-pharmacological interventions, alternative stimulation-oriented approaches that is relatively cheap, simple in set-up and administration, and that requires minimal input in terms of manpower resources could be explored. The use of digital and multimedia technology in the form of computer games may hold promise in filling this gap.

In a 2010 national survey, 84% of Singapore households had access to at least one computer at home. Among those aged 60 years and above, although only 24% and 22% reported to have used computer and internet respectively, a much higher percentage of this population group reported having access to a computer (76%) and internet (71%) respectively.[267] In the US, although seniors were considered to be under-represented among the population who play digital games, the percentage of gamers over 50 years of age had increased from 9% in 1999 to 26% in 2008.[268] Hence, computers are ubiquitous, readily available at low cost and may require minimal training for the NS to facilitate its use. Compared to interventions such as music and massage therapy, interventions using computers also have the advantages of being less labor-intensive and relatively less costly to maintain.

In the past two decades, investigations on computer games as a recreational activity in NHs yielded many positive effects among the frail NHRs, such as improving socialization, stimulation, feelings of success of achievement, emotional well-being, reaction time, hand-eye coordination, and perceptual-motor skills.[269, 270] Although the feasibility of introducing computer games among NHRs with dementia has not been studied, another digital and multimedia intervention of using video simulated presence of a family member showed positive effects on reducing BPSD of a NHR. Specifically, when the video was played from an iPad during specific care tasks, it allowed the care staff to continue with the normal operating procedures of care with minimal resistance from the resident, possibly through positive distraction provided by the video.[271]

Hence, it is postulated that simple yet interactive computers games of suitable content, music and graphics can serve as a recreational activity, provide sensory stimulation and create positive diversion for the NHRs who have BPSD. Secondary

to these effects, the need to use antipsychotics in the NHs may be reduced as BPSD becomes more manageable. Hence, a pilot study was conducted, with the primary objectives to determine the feasibility of using computer games as a diversional strategy to manage BPSD among the elderly NHR in Singapore.

5.2 Methodology

The study was carried out in three phases, namely, (1) game screening, (2) game selection, and (3) feasibility evaluation, in one NH. A brief summary of the study was illustrated in Figure 5.1.

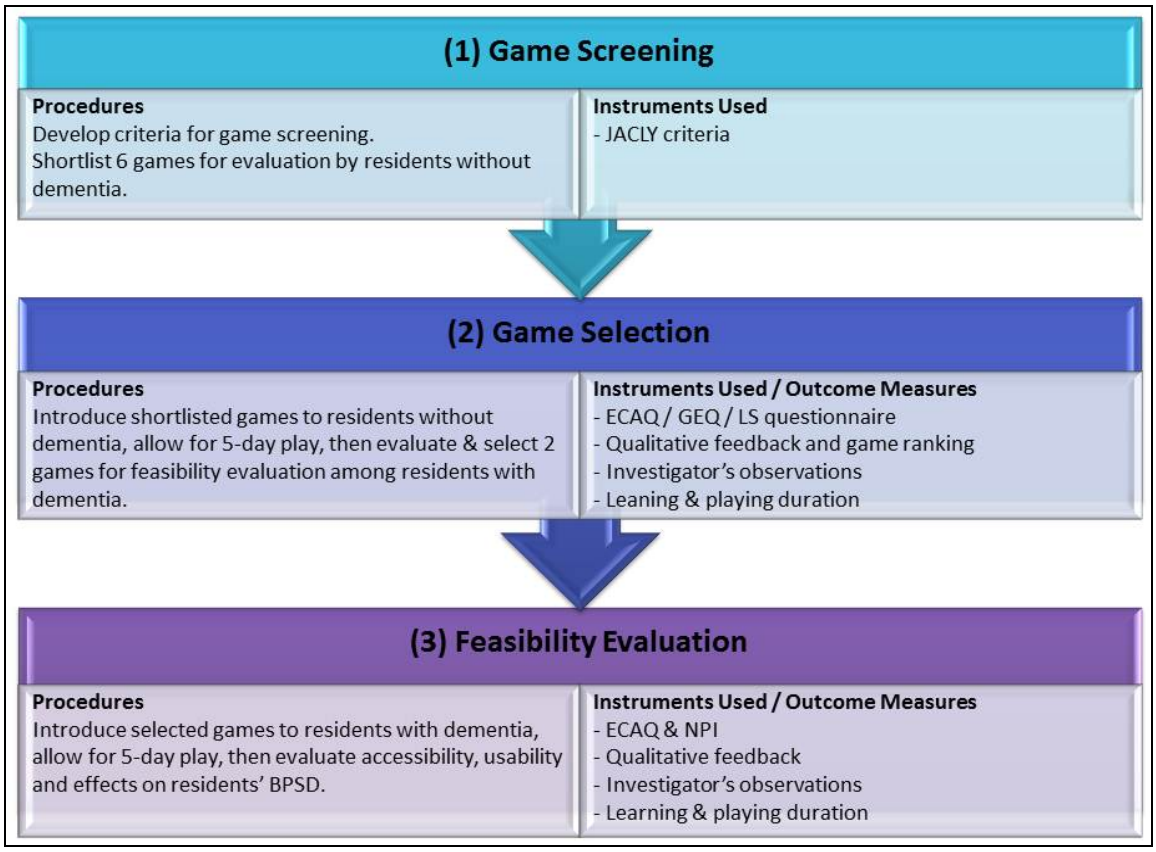


Figure 5.1 Brief methodology for the pilot study to determine the feasibility of computer games as a diversional strategy to manage BPSD among elderly NHRs

5.2.1 Phase 1 – Game screening

In Phase 1, free to play games from the internet were first screened to identify those that were suitable for the study. This was important as characteristics of the games in terms of its interface, task requirements to make inputs, and the gameplay may influence participation, play experience, and outcomes of play, particularly for the elderly who often have age-related decline in sensory perception, cognitive processes (in dementia), motor abilities, and speed of tasks.[269, 272] Hence, based on IJsselsteijn and team's report,[272] a criteria for elder-friendly games was first developed and used as a quick screening tool to short-list six computer games for use in Phase 2.

5.2.2 Phase 2 – Game selection

Phase 2 involved selecting two of the six short-listed games. The selections were based on survey responses and feedback from the participants after they had tried the games. In particular, the games that were most engaging and have good accessibility and usability[273-275] were selected. As such, the ability of the games to engage was measured by the time spent on playing the game, NHRs' preference, and experience during gameplay. Accessibility referred to the extent to which the computer games was designed for the elderly with/without cognitive, motor and/or physical disabilities; the evaluation of this was based on the feedback of the participants and investigators' observations on each game. Usability referred to the degree of playability by the elderly, and was measured by the number of errors made during interaction with the computer mouse and game interface, amount of time spent on learning and re-learning the game, and NHRs' ability to have fun while playing the games. The evaluation on the NHRs' ability to have fun was based on the

participants' responses while playing computer games as observed by the investigators.

In addition, the general impact of playing computer games on life satisfaction of the NHRs was measured. The measure of life satisfaction is a reflection of the NHRs' psychological well-being.[276] As many studies had reported the positive benefit of computer games on the psychological well-being of NHRs,[269, 270] it would be important to determine if this hypothesis holds true among the study sample in this pilot study. As such, improvements in life satisfaction in relation to playing of computer games observed in Phase 2 could provide the basis for introducing computer gaming as a tool to create positive diversion for NHRs with BPSD with the benefit of enhancing their psychological well-being.

NHRs without dementia were first identified by the nurses in-charge. After obtaining consent from the NHRs, the Elderly Cognitive Assessment Questionnaire (ECAQ)[277] was administered to ascertain the absence of dementia (score > 6). Following inclusion, all the games were introduced and taught to each participant individually on day "1", who was then allowed to play the game/s of their choice once daily from days "2" to "5". The duration of each play session was not limited, and the participant could start and stop playing when he/she desired. The same two investigators were present at all times, who provided technical assistance or to re-teach the games when required. These games were played on two similar desktops decked with 17-inch flat-screen monitors with non-reflective screens, and the computer mouse was used as the game controller. The set-ups were placed in the common area near the nursing station at the NH. Feedback on the experience during gameplay and general impact of playing computer games were obtained through administering the In-game version of the Game Experience Questionnaire (GEQ)[278]

and LS[276] questionnaire in face-to-face interviews at the end of day "5". Evaluation of the GEQ focused on the domains for "competence", "immersion", "flow", and "tension", which described the game's ability to engage the participants at their levels of skills, encourage the participants to focus their attention on the game and elicit enjoyment in the process,[275, 279] and were deemed to be important measures of the games' purpose as a diversional strategy to manage BPSD. A copy of these questionnaires is shown in Appendix 5.1. In addition, the participants were asked to rank the games according to their preferences. The time spent on learning and playing the games, qualitative feedback from the NHRs and observations by the investigators were also recorded. Friedman two-way ANOVA test was used to evaluate the responses to the GEQ and the participants' game rankings; post-hoc pairwise comparisons were done using Wilcoxon signed rank tests. Wilcoxon signed rank test was also used to evaluate the responses to the LS questionnaire.

5.2.3 Phase 3 – Feasibility evaluation

In Phase 3, the two selected games were piloted among NHRs with dementia, to determine the feasibility of computer games as a diversional strategy to manage BPSD. Feasibility was based on the ability of the games to engage the participants, its accessibility and usability, and the effect of gameplay on those with BPSD; where evaluation of the games' ability to engage was based on the amount of time NHRs spent playing and their responses to the games, while evaluation of the game's accessibility and usability was same as that for Phase 2. Similar to Phase 2, NHRs with dementia were identified by the nurses-in-charge prior to recruitment. However, in addition to obtaining the NHR's consent to participate, consent was also obtained from the NHR's family members or next-of-kin. The ECAQ was then administered to

ascertain the presence of dementia (score < 7). Following this, the steps to introduce, teach and allow the participants to familiarize the two selected games were the same as those in Phase 2. NHRs' responses and qualitative feedback during gameplay were observed and recorded by the investigators. The time taken for learning and playing the games over the five days were also measured. In addition, nurses-in-charge of the NHRs were interviewed at Days 1 and 5 using the NPI[254] to measure changes in the NHRs' behavior between 5-day periods before and after introducing computer games. Wilcoxon signed rank test was used to evaluate changes in NPI scores.

5.3 Results

5.3.1 Phase 1 – Game screening

A JACLY (an acronym which stands for the initials of the investigators involved in this study) criteria for elder-friendly games was developed (Figure 5.2) and used to screen 300 free online games obtained from www.onlinegamesforseniors.com under the category "bubbles", "puzzles" and "shooting" and their related website links. Games which met all the criteria were short-listed and voted by co-investigators. This resulted in a final six to be evaluated by NHRs without dementia in Phase 2. These games were Bubble Pandy, Linyca, Jungle Tower, Color Breaker, Mushroom Madness, and Simon. The description of each game is provided in Appendix 5.2.

JACLY Criteria Description	
1.	Visual elements are large and well-defined
2.	Music/audio is distinct and clear
3.	The gameplay is easy to master and control
4.	The gameplay is not too fast
5.	The game is free/affordable
6.	The game is accessible (logistically)

Figure 5.2 JACLY criteria for elder-friendly games

5.3.2 Phase 2 – Game selection

Of the 15 NHRs approached for Phase 2, eight provided consent. Common reasons for refusal to participate were "…I am not interested…", "…I am too busy with other activities and have no time to play computer games…" and "…computer games are not for old people but for younger kids…". Of the eight NHRs willing to try playing computer games although they had never done so before, seven completed all five days of gameplay and provided feedback for the selection of games, however, one dropped out after Day 3 due to medical reasons. The demographic and clinical factors of the seven participants were reported in Table 5.1.

Table 5.1 Demographic and clinical factors of participants

Factors		Phase 2 (n = 7)	Phase 3 (n = 4)
Age	Mean ± SD	70.3 ± 14.6	81.8 ± 14.9
Gender	Male	5	1
	Female	2	3
Race	Chinese	7	2
	Others	0	2
RAF Category	I & II	2	0
	III	2	1
	IV	3	3
ECAQ score	Mean ± SD	8.4 ± 0.8	4.0 ± 1.8

The learning and playing duration for the games, outcomes for the GEQ, and participants' ranking of game preference are illustrated in Figures 5.3 to 5.6. Linyca and Jungle Tower were consistently the top three of the six games that required the shortest time for participants to learn (4.3 ± 4.1 and 5.4 ± 1.8 minutes respectively) and had the longest duration of play (50.2 ± 28.8 and 80.0 ± 26.3 minutes respectively) over the 5-day study period (Figures 5.3 and 5.4). These two games were also ranked among the highest in the GEQ in-game domains (Figure 5.5) for competence, immersion and flow of the GEQ, and the lowest for tension (Friedman two-way ANOVA, *p*-value = 0.067, 0.001, 0.003, and 0.060 respectively; post-hoc analysis did

not yield statistically significant results). In addition, Linyca and Jungle Tower were also ranked as the two most preferred games by the seven participants in Phase 2 (Figure 5.6).

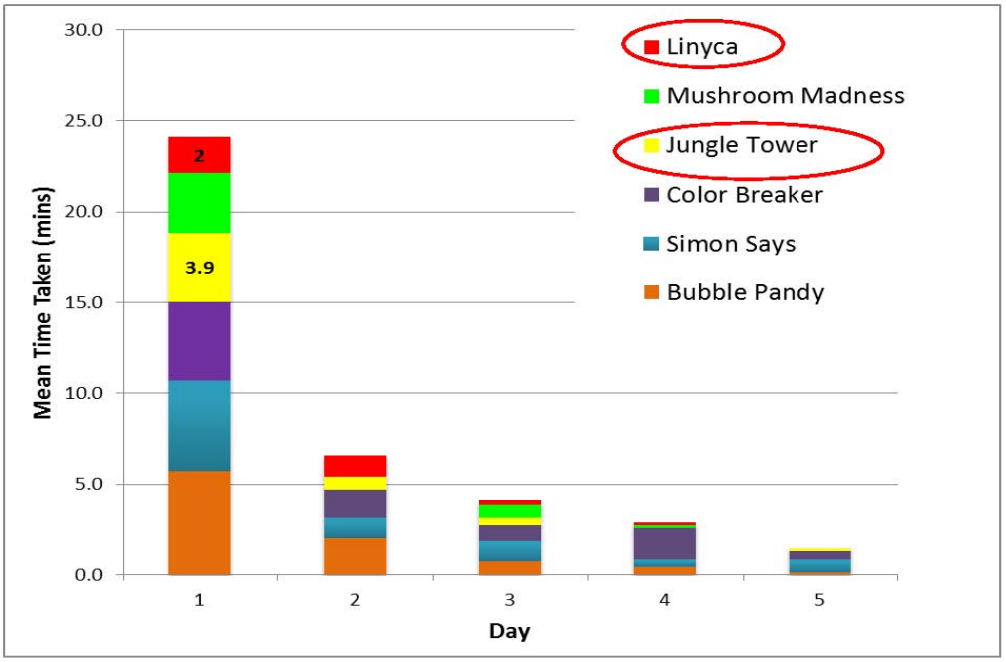


Figure 5.3 Mean time needed for instructions on how to play each computer game over 5 days in Phase 2 (n = 7)

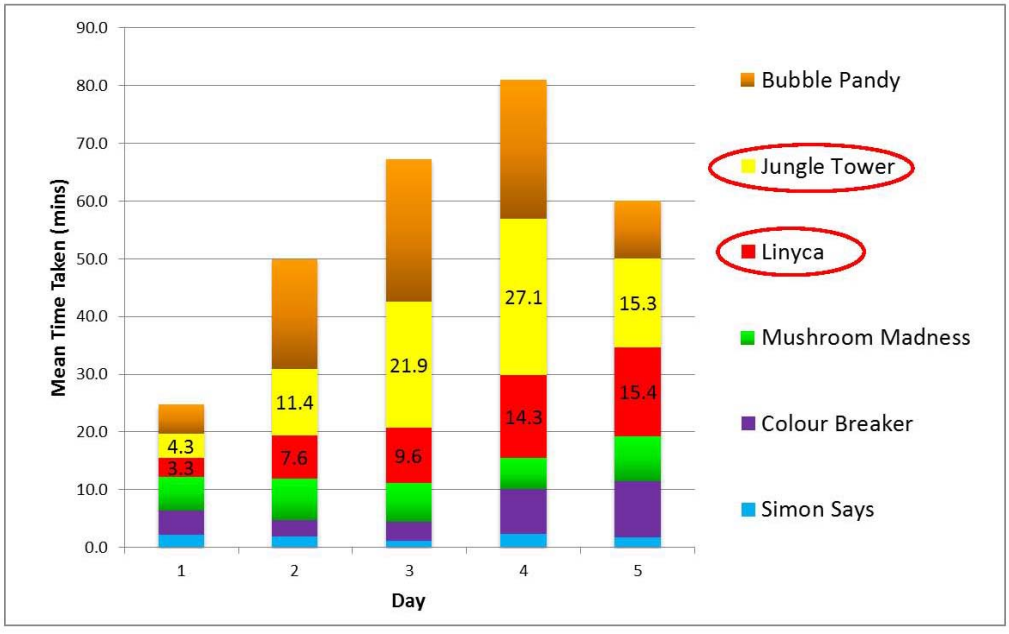


Figure 5.4 Mean playing time of each computer game over 5 days in Phase 2 (n = 7)

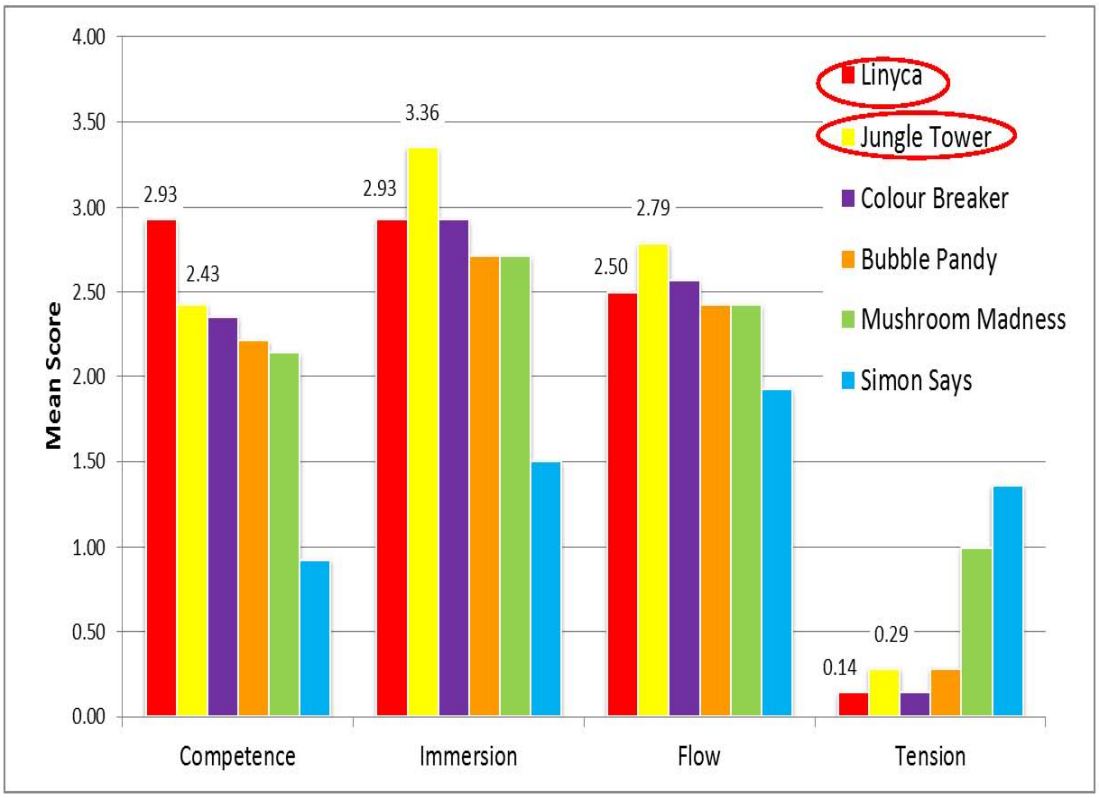


Figure 5.5 Mean score for competence, immersion, flow, and tension domains of the in-game GEQ (n = 7)

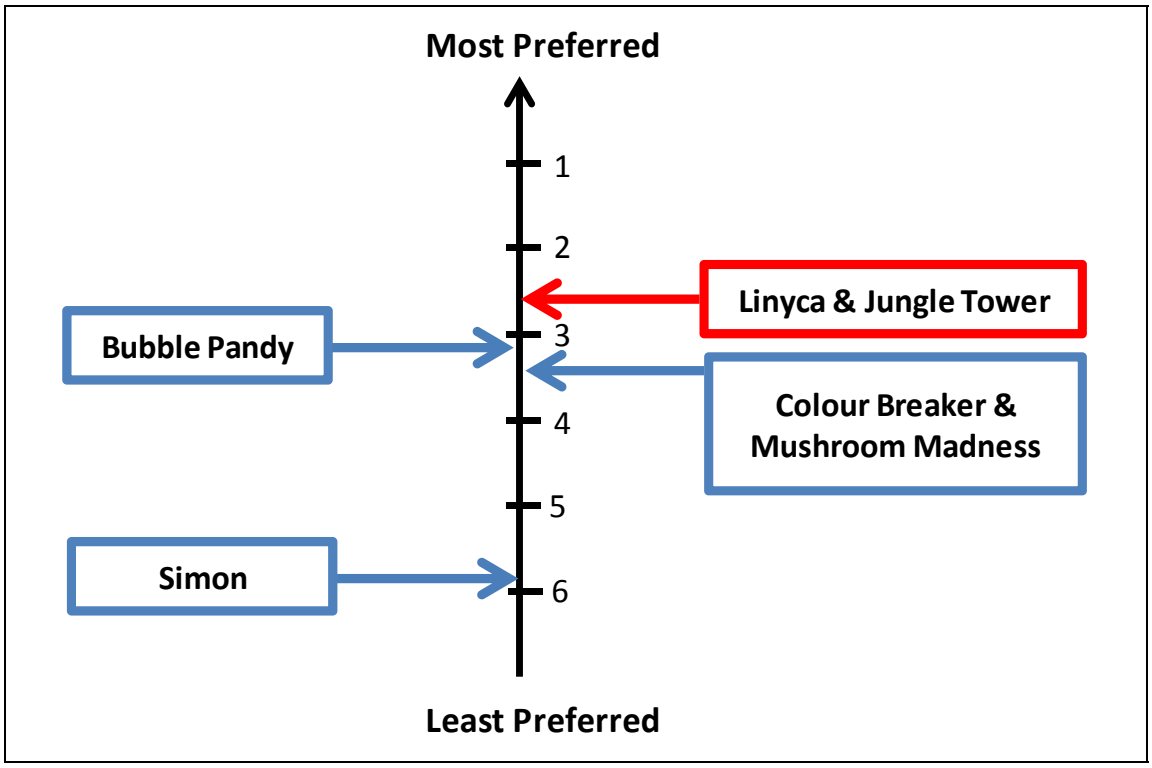


Figure 5.6 Participants' ranking for game preference (Phase 2)
Linyca and Jungle Tower had the highest mean ranks of 2.38 and 2.63 respectively. Mean scores were obtained from Friedman two-way ANOVA, *p*-value = 0.003. Post-hoc analysis did not yield statistically significant results.

Additional feedback by the participants on the games and investigators' observations are reported in Table 5.2. Although positive reactions and responses were observed for Linyca, Jungle Tower, Bubble Pandy and Mushroom Madness, the latter two were found to be inferior in accessibility to Linyca and Jungle Tower. Specifically, the objectives of Bubble Pandy seemed complicated for three participants to comprehend and the rapid clicking required during the gameplay in Mushroom Madness was problematic for five participants despite repeated coaching and practice. In addition, Simon and Colour Breaker were also deemed to be the less accessible games compared to Jungle Tower and Linyca as six participants opted not to play Simon after day one as they had difficulty understanding the game's objectives, while the time limit in Colour Breaker was a barrier for five participants who played the game slowly to achieve their target high scores. Based on these, Jungle Tower and Linyca were selected for the Phase 3 study.

Table 5.2 Participants' feedback and investigators' observations during gameplay in Phase 2

Game	Positive Feedback	Negative Feedback	Investigators' Observations
Linyca	"Easy to play." "The colours are nice."	-	Participants were very engaged by the colours and sound effects of the game and could play the game quite well.
Jungle Tower	"The game is exciting." "I want to test my skill." "It is quite challenging."	"Oh no" (when blocks toppled)	Participants laughed and smiled when the blocks toppled over.
Bubble Pandy	"Quite nice." "Very exciting."	"Not challenging." (because participant did not understand gameplay)	Some participants only clicked the mouse without shifting it.
Colour Breaker	-	"The game is difficult." "The shades of colours should be closer so that it's more challenging."	The time limit in this game was problematic as for those who played the game slowly.
Mushroom Madness	"Cute but difficult to play"	"The game is too fast." "My beating is too slow." "Not nice to play."	Some participants were excited when playing but it was challenging as the game speed was too fast for many of them.
Simon	-	"I don't understand this game." "What do I do?" "My memory is not good." "Not interesting" "Very difficult"	Majority did not understand how to play despite repeated explanations.

Improvements to the control of the computer mouse and navigation through the game website were observed within five minutes into the game play, with much initial coaxing and coaching. By Day 5, five of the seven participants managed to manipulate the computer mouse, navigate and play the games independently, without the need for verbal cues or physical interventions by the investigators. In addition, all seven participants responded that there was an increase in LS after the 5-day period (Wilcoxon signed rank test, *p*-value = 0.034) as shown in Figure 5.7.

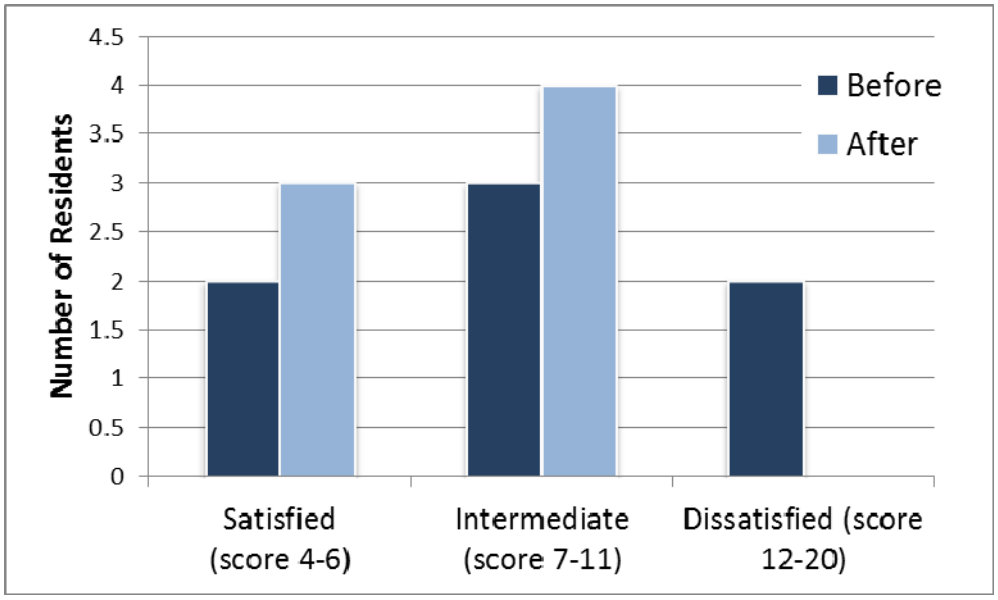


Figure 5.7 Participants' rating on LS before and after playing computer games in Phase 2 (n = 7)

5.3.3 Phase 3 – Feasibility evaluation

Five NHRs with dementia were approached and recruited successfully for the study in Phase 3. However, only four completed the study; one of them dropped out due to a lack of interest after Day 2. The demographic and clinical factors of these four participants are reported in Table 5.1. Only one was taking an antipsychotic and an antidepressant for the management of BPSD, whereas another was taking a cholinesterase inhibitor for the treatment of dementia.

The learning and playing durations for the games over the five days in Phase 3 are shown in Figures 4.26 and 4.27. On the average, the four participants required 65% more time to learn how to play Jungle Tower compared to Linyca. Although the games had to be re-introduced to the participants each day, the amount of time spent on providing instructions for the gameplay were observed to be decreasing over time for both games, among all participants (Figure 5.8). The mean duration of playing computer games among these four participants with dementia was 38 minutes per day (± 13, range 15 to 63). Interestingly, participants in Phase 3 seemed to prefer Linyca to Jungle Tower, where on the average, Linyca was played almost twice as long compared to Jungle Tower (Figure 5.9).

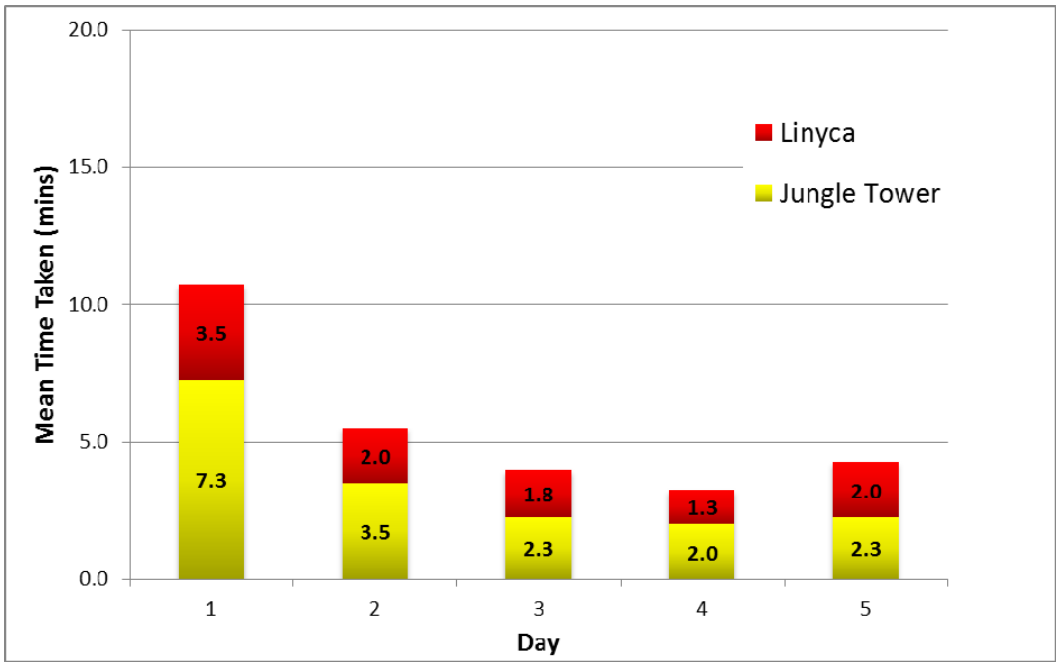


Figure 5.8 Mean time needed for instructions on how to play each computer game over 5 days in Phase 3 (n = 4)

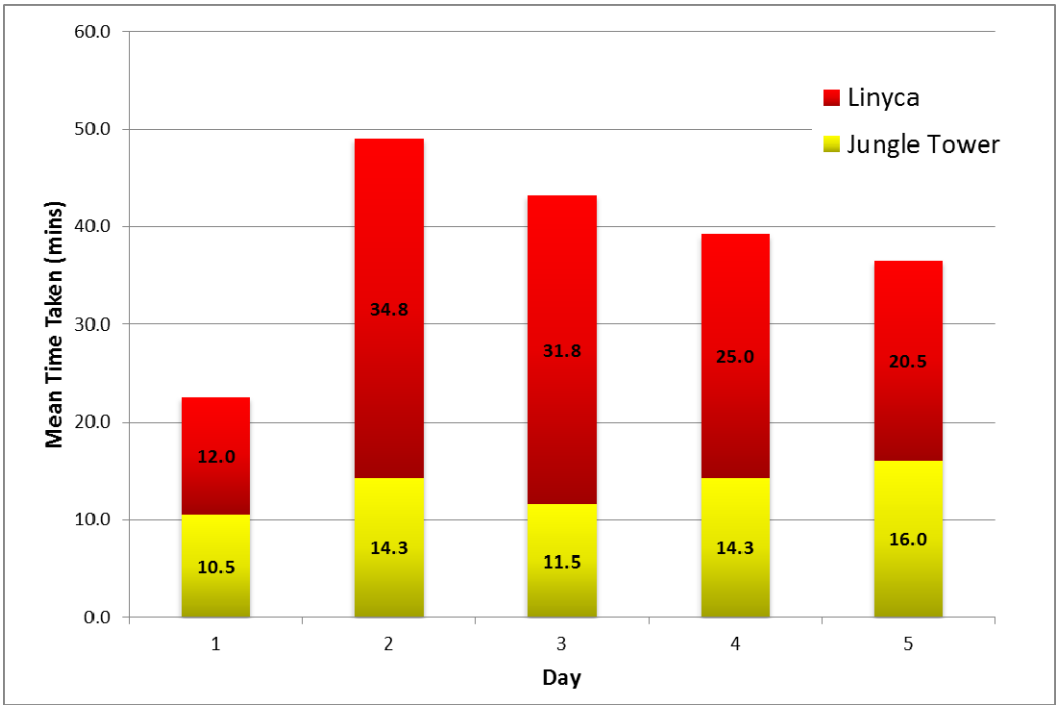


Figure 5.9 Mean playing time of each computer game over 5 days in Phase 3 (n = 4)

In terms of the errors made during interaction with the computer mouse and game interface, one participant was unable to move and click the mouse simultaneously, and required constant assistance; incidentally, he had the lowest ECAQ score of 2. Despite the inability to play the computer games as intended, this participant was observed to be fully engaged by the colours and sound effects of Linyca, which he played for an average of 22 minutes each day.

Conversely, the other three NHRs could overcome the initial difficulty in handling the computer mouse despite their motor and cognitive impairments. In addition, the ability of these three NHRs to play Linyca and Jungle Tower improved over time. Specifically, they had progressed from stacking less than 10 blocks in Jungle Tower on Day 1 to stacking between 15-20 blocks by Day 5, and moved from completing levels 4-5 in Linyca on Day 1 to levels 8-9 by Day 5. The investigators also noticed that these participants were generally able to focus their attention during the gameplay sessions, especially when playing Linyca.

As shown in Table 5.3, the computer games elicited positive responses from the participants. However, there was no significant difference in the participants' BPSD before and after the study period (mean NPI score of 4.25 ± 2.22 versus 4.00 ± 1.83 respectively; Wilcoxon signed rank test, *p*-value = 0.317).

Table 5.3 Participants' feedback and investigators' observations during gameplay in Phase 3

Game	Positive Feedback	Negative Feedback	Investigators' Observations
Linyca	"Quite interesting." "So cute." "Fun"	"So childish, this is like for kids" (one participant who thought it was too easy)	Participants were very engaged by colours and sound effects, more so than Jungle Tower
Jungle Tower	"So exciting." "Quite interesting." "Now I understand how to play."	"Oh no, tumble down" (when blocks toppled) "Not clever." (In reference to self when blocks toppled)	Participants laughed and smiled when the blocks toppled over.

5.4 Discussion

From the results reported in Section 5.3.2, it appeared that with adequate coaching coupled with suitable games, elderly NHRs were able to play computer games successfully and independently. As shown by the desirable changes in the scores of LS questionnaire of the participants in Phase 2, playing computer games seemed to improve general psychological well-being of elderly NHRs. This was in line with that reported by Jung and team who conducted a local study concerning the use of Nintendo Wii games among elderly NHRs.[280] In addition, the smiles and excitement on their peers' faces as the participants played the games in the common area also drew many curious on-lookers, which added to the social atmosphere. This led to an additional two new NHRs requesting to learn how to play the computer games, one of whom was subsequently recruited for the study in Phase 3. This effect was similar to that described by Weisman[270] and Boulay *et al*.[273] In addition, all the participants were motivated to schedule for the next day's gameplay sessions, and were always punctual. Four of the participants even continued to play computer

games after the study was completed. These observations were in line with those reported by Whitcomb, that hands-on experience can stimulate interest, resulting in positive attitude towards learning and a continued use of computers,[269] in this case, as a recreational tool.

Among the four participants reported in Section 5.3.3, the participant who had the lowest ECAQ score was unable to move and click the mouse simultaneously, hence requiring constant assistance during the gameplay. It seemed logical then that the severity of cognitive impairment may play a role in the successful use of the game controller. In addition, the participant's inability to use the mouse corresponded with that described by Boulay *et al*,[273] who related this to deficiencies in the visual-spatial processing, episodic memory and the working memory. On the other hand, the ability to overcome the initial difficulty in handling the computer mouse observed in the other three participants' may be related to the presence of preserved implicit motor learning ability in dementing diseases, thus allowing the participants to pick up procedural skills by repeated exposure and subsequent revival from implicit memory.[281]

Overall, the findings suggested that playing computer games may be a feasible diversional strategy in managing BPSD as suitable computer games such as Linyca and Jungle Tower were shown to have good accessibility and usability by the participants with dementia, and were able to arouse their interest and draw them to focus on the gameplay. Although surveys such as the GEQ and LS could not be administered among these participants, the significant positive change in the psychological well-being of participants in Phase 2, the encouraging participants' responses in Phase 3, and the examples reported by Boulay *et al*.[273] on the effects of a

Wii game on elderly with dementia, led to the conclusion that playing computer games could improve the psychological well-being of some NHRs with dementia.

As this pilot study was limited by time, resources and the sample size, the effects of playing computer games on BPSD should be further evaluated among more elderly with dementia and BPSD, with the inclusion of a control group to improve the external validity and generalizability of the results. The impact of longer periods of exposure to computer games, the feasibility of playing computer games among elderly with more advanced cognitive impairment, and the impact of this non-pharmacological intervention on pharmacological use trends in managing BPSD may be evaluated in future studies.

In addition, although the six short-listed games complied with the JACLY criteria for elder-friendly games, games such as Simon, Mushroom Madness and Colour Breaker were found to be less user-friendly by five out of the seven participants in Phase 2. Future studies could look at the development of a refinement of JACLY criteria, such as adding (1) a domain for the presence of animation and sounds that can help to illustrate game objectives and (2) quantifiable sub-domains under the domain for speed of gameplay, to define the time limits for the player to respond to cues, pause between multiple inputs, and complete each game stage levels.

5.5 Summary

In this chapter, a pilot study to determine the feasibility of using computer games as a diversional strategy in managing BPSD was conducted at a NH in three phases; which began with short-listing of suitable computer games that were elder-friendly, by using the JACLY criteria developed, followed by a further selection by NHRs without dementia, and finally the use of the selected games for testing of their

ability to engage, accessibility, and usability by NHRs with dementia. The overall findings suggest that suitable games accepted by the participants with dementia could arouse their interests, and capture their attention on the gameplay for at least 30 minutes per day during the 5-day study period. From the survey responses of the NHRs without dementia and the investigators' observations of those with dementia, the playing of computer games could plausibly lead to improved psychological well-being of the NHRs in general. Hence, it may be promising to further explore the use of computer games as a diversional strategy to manage BPSD.

Chapter 6

Conclusion

Prescribing is the first and major decision-making stage in the medication use process. Therefore, IP in the NHs can directly impact patient outcomes, especially when there is full compliance in the "administration" of medications for regular use or a lack in judicious "administration" of medications for short-term use by the NS. Interventions by pharmacists who play a primary role in the "monitoring" stage of the medication use process, were often focused on medication safety and limited in terms of improving the appropriateness of prescribing/use of medications. This is of concern as there appears to be a continuously high prevalence of IP (Chapter 2). Although the role of the pharmacists in medication review is well established and valued (Table 1.3), such interventions were often general and lacked evidence of their impact on clinical outcomes of NHRs. By leveraging on their role as the "advocator" of appropriate medication use and prescribing in the NHs, pharmacists can improve PA and bring positive impact on patient outcomes through engaging the physicians and NS in innovative inter-professional collaborative practices. Such collaborative efforts can close the gap between individual efforts made by each healthcare professional towards PA and positive patient outcomes in the medication use process (Figure 6.1). The work in this thesis demonstrated how two such innovative inter-professional collaborative interventions can be developed, implemented and evaluated in the NH setting. These interventions (Table 6.1) adds to those reported in Table 1.4.

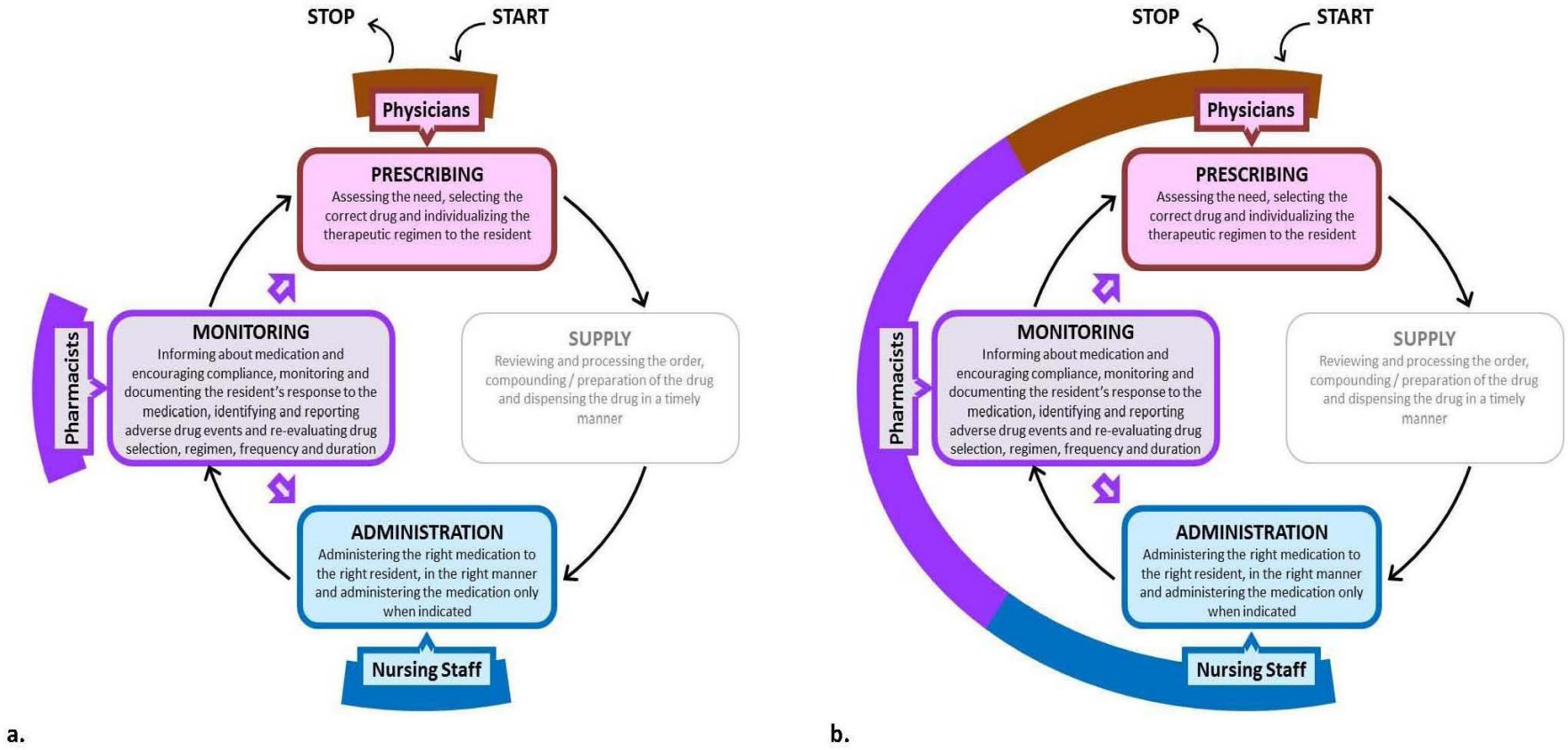


Figure 6.1 Medication use process in the NHs in Singapore and collaborative efforts between the pharmacists, physicians and NS towards PA
(a) Usual care practice. (b) By leveraging on their role as the "advocator" of appropriate medication use and prescribing in the NHs, pharmacists can improve PA and bring positive impact on patient outcomes through engaging the physicians and NS in innovative inter-professional collaborative practices such as PLEAD and PUM programs

Table 6.1 Interventions in the NHs that targeted specific drug group or disease / condition with outcomes that measure changes in medication use (as reported in this thesis)

Target Drug Groups / Condition	Intervention Type	Study Design	Health Professional Involved	Outcomes	
				Medication	Clinical
Laxatives *for relief of constipation*	**Pharmacist-Led Education on Appropriate Drug-use (PLEAD) Program** *A pharmacist-led communication program to provide education and engage health professionals in behavior changes to improve laxative use among elderly NHR*	Non-randomized Controlled Study	**Inter-professional collaborative practice** *Ph + P + NS + administrator*	NH and administrator of intervention NH decided on and were committed to the behavior changes at the target behavior change date Statistically significant increase in number of laxative prescriptions altered in intervention NH	Significant increase in bowel frequency (weekly average, maximum and minimum) of NHRs in intervention NH
Antipsychotics *for management of BPSD (agitation, aggression & psychosis)*	**Psychotropic Use Monitoring (PUM) Program** *A monitoring program to (1) identify target symptoms for appropriate treatment/management strategy, (2) monitor pharmacological therapeutic outcomes, and (3)onset of psychotropic SE*	Single group prospective study	**Inter-professional collaborative practice** *Ph + P + NS*	Increased number of dose adjustments (by 38%) after implementing PUM - 3 times increase in number of dose adjustments related to reported SE - 24% increase in number of dose adjustments related to reported BPSD / response	Lower Independent RAF rating on psychological problems after implementing PUM. Fewer AEs reported to the NH administrator after implementing PUM. More prompt identification and referral of suspected ADEs for investigation at tertiary hospital after intervention.

P = physicians; Ph = pharmacists.

To the author's knowledge, the Pharmacist-Led Education on Appropriate Drug-use (PLEAD) program for laxatives is the first intervention led by a pharmacist, which was successfully implemented in a pilot study with collaborative efforts of the NS, physicians and key administrators through behavioral changes to improve the appropriateness of laxative use and patient outcome among the elderly NHRs (Chapter 3). In conventional medication reviews, pharmacists' recommendations are communicated to fellow healthcare professionals in the team through written notes in

the NHRs' medical records, which may often be overlooked or misunderstood. By comparison, the PLEAD program provides an effective platform for raising issues and identifying gaps, educating and communicating recommendations for appropriate laxative use. Firstly, the educational nature of the workshop created a congenial/friendly learning environment which fosters open communication[282] between and among the health care professionals and administrators. Secondly, the workshop provided recommendations with references to the research findings, which facilitated the understanding by the audience on how the attitudes and behaviors of NHRs and health care professionals could impact the appropriateness of laxative use and clinical outcomes. As such, positive assertion[283] of the issues and gaps was created which enhanced situational awareness and encouraged behavioral changes among the NS and administrators. Thirdly, the discussion session at the end of the workshop also provided opportunities for the audience to seek clarification and to elicit commitment to action and behavioral changes towards appropriate laxative use by the NS. Lastly, communication of the PLEAD workshop content to the physicians through the mail delivery of the "Dear Healthcare Professional Letters" was concise and relevant. This was coupled with the efforts by the NS to bring about physician's acceptance and adoption of these recommendations. In addition, although recommendations made in conventional medication reviews and the PLEAD program are both retrospective in nature, the former is usually case-based and hence elicit actions that are once-off. In contrast, the recommendations in the PLEAD program are coupled with educational information which allows the NS and physician to relate and apply to various uncomplicated case scenarios that require laxative use, hence, they may have wide-spreading effects through eliciting actions that are both

retrospective in correcting currently identified inappropriate laxative use and prospective in preventing future incidents of inappropriate practices.

Thus, based on the results reported from the pilot study in this thesis, more NHs should be enrolled in a cluster randomized study to further evaluate the effectiveness of the PLEAD program. Through this, more elderly NHRs can also potentially benefit from this program, especially when the current capacity increases by 50% to 14,000 by 2020.[284] Updates to the program content can also be made pending on the emergence of new clinical practice evidence. There may be a need to develop PLEAD programs for other medications, which use may be influenced by beliefs and attitudes of the prescriber, NS and NHRs, such as analgesics and hypnotics.

Further to PLEAD, an Algorithm for Appropriate Laxative Use (AALU) was developed (Chapter 3). The AALU (Table 6.2) adds to the list of PA instruments reported previously in Table 1.1.

Table 6.2 Instruments for assessing PA among elderly NHRs

Country	Year Published	Instrument	Prescribing Inappropriateness Categories Assessed			Indicator Type		Type of Measures	
			Over-	Mis-	Under-	Explicit	Implicit	Process	Outcome
Singapore	2012	Algorithm for Appropriate Laxative Use (AALU)	✓	✓	✓	✓	✓	✓	

The AALU fills the gap of the other PA instruments by addressing the prescribing and use of laxatives, which are the most prevalent and commonly misused medications at the NH (Chapters 2 and 3). Compared to the PA instruments such as the NAI[38] and the Nursing Home Prescribing Indicators[40] written in the form of

algorithms that target specific pharmacological agents/groups, AALU provides a more comprehensive assessment of the PA by allowing the user to measure "under-prescribing" of laxatives for regular use and "under-use" of laxatives when necessary. Similar to the MAI, AALU allows for both explicit and implicit assessments of the PA of laxatives. While the use of MAI was mostly reported in retrospective MUE, there is potential to use the AALU as a guide for timely decision-making during the "prescribing" and "administration" stage of the laxative use process. Hence, future work can evaluate the effectiveness and impact of AALU on laxative use trends and NHR outcomes for either retrospective MUEs or prospective intervention.

Among the reported interventions that aimed to improve antipsychotic use for BPSD in the NH (Tables 1.4 and 4.1), the Psychotropic Use Monitoring (PUM) program reported in Chapter 4 is the first that synergizes the expertise of the pharmacist, NS and physician at the "monitoring" stage of the medication use process (Table 6.1). After being trained to use the Appropriate Psychotropic Prescribing (APP) scale that was developed for the PUM program, standardized and reliable (1) identification of target symptoms for appropriate treatment/management strategy, (2) monitoring for pharmacological therapeutic outcomes and (3) onset of psychotropic SE can be achieved by the NS while they carry out their usual duties. Based on timely feedback to the physicians by the NS, desirable outcomes which included increased antipsychotic dose adjustments, fewer psychiatric problems and fewer AEs among the elderly NHRs could be achieved without the need for prolonged case conferencing or lengthy medication reviews. Through the positive outcomes of the preliminary study of the PUM program and the related training in a single NH, pharmacists can play an important role as the trainer and advocator for appropriate medication use, in this case, of antipsychotics.

Therefore, applications of the PUM program and the use of the APP scale and SE monitoring list through inter-professional collaborative efforts may be an effective intervention to improve PA of antipsychotics and patient outcomes among patients with dementia at other intermediate and long-term care institutions. Such collaborative interventions and related training will become increasingly valuable with the impending need to grow and improve the quality of the healthcare professional workforce in the NHs, driven by the needs of Singapore's ageing population.[285] Future work on evaluating the PUM program in a cluster randomized study involving more NHs is needed, which will also include evaluating the application of PUM to improve the PA of other psychotropic drug classes commonly used for managing BPSD, such as antidepressants, antiepileptics, and benzodiazepines. In response to the MOH's initiatives to enhance the quality of care and support provided to patients and their caregivers in the community,[286-288] pharmacists can provide training of how to use the APP scale and PUM to caregivers such as family members and domestic helpers in the community setting. Such training may fill their expressed gap to cope with their loved ones with BPSD under their care at home,[289] through improving their understanding of dementia, reducing caregiving stress, and BPSD and equipping them with skills to play a part in appropriate pharmacotherapy treatment for their loved when necessary,[236] to achieve optimal treatment outcomes when applicable, prevent adverse outcomes from psychotropic use and defer hospitalization and/or institutionalization of their loved ones to the NH.

This thesis also explored the feasibility of using computer games as a diversional strategy to engage elderly NHRs with BPSD (Chapter 4). Outcomes from the pilot study suggest that the elderly with physical and/or mild cognitive impairment can play computer games and embrace this novelty. Further studies will be needed to

evaluate the impact of longer periods of exposure to computer games, the feasibility of this non-pharmacological intervention on NHRs with a range of cognitive impairment, and the intervention's impact on the changes in BPSD, trends of using pharmacologicals to manage BPSD and caregiver stress. In the process of this work, a JACLY criteria for elder-friendly games was developed as a screening tool for selecting suitable computer games. This criteria can be refined to better serve its original purpose or as a guide for the development of computer games for elderly with dementia and BPSD. From the outcomes in Phase 2 of the pilot study, there is also potential to evaluate the use of suitable computer games as a recreational activity in NHs, day care centers and the community setting to create an inclusive environment, promote social integration and improve the quality of life and general well-being of elderly in general.

The pharmacist has played critical role of an advocator for appropriate medication prescribing/use at the "monitoring" stage of the medication use process. Pharmacists can also provide interventions at the earlier "supply" stage to prevent the impact of IP from being carried forward to the "administration" stage. However, the current lack of infrastructure linking the medical information of the NHRs to the dispensing pharmacists at other practice settings (community or hospital) poses a challenge for interventions to be made beyond checking of skill-based medication errors in prescribing. Selected pharmacists should be allowed to gain access to the National Electronic Health Records system,[290] which is set to link information between the primary, tertiary and long-term care institutions in Singapore, to allow interventions that may improve PA to be made at the "supply" stage, and add timely advice/recommendations to improve the appropriateness of medication use during the

"administration" stage, thus preventing any consequent adverse outcomes from such "first pass" effect.

In conclusion, innovations to improve PA and direct patient outcome from the use of specific drug groups within certain diseases among the elderly NHRs in Singapore can be achieved, through inter-professional collaborative efforts, while leveraging on the pharmacists' role as the "advocator" of appropriate medication use and prescribing. The unique role of pharmacists and the dynamics of interaction with other healthcare professionals for medication management in the NH setting have also been redefined. This could prompt more pharmacists to continue to fill the gaps in medication management and encourage fostering of a stronger team-based care model in the NH that involve pharmacists.

REFERENCES

1. Medication safety. Practice guidelines & tools. Singapore: Ministry of Health; 2006 [Available from: http://www.moh.gov.sg/content/moh_web/healthprofessionalsportal/allhealthcareprofessionals/guidelines/safetyguidelinesandtools.html. Accessed on: July 24, 2012];
2. Guidelines on medication management in nursing homes. Singapore: Ministry of Health; 2005 [Available from: http://www.moh.gov.sg/content/moh_web/home/Publications/guidelines/step_down_care/2005/guidelines_on_medication_management_in_nursing_homes%20(1.02Mb).html. Accessed on: April 29, 2012];
3. Rochon PA, Gurwitz JH. Drug therapy. Lancet. 1995;346:32-6.
4. Boyd CM, Darer J, Boult C, Fried LP, Boult L, Wu AW. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases. Implications for pay for performance. JAMA. 2005;294:716-24.
5. Tinetti ME, Bogardus ST, Agostini JV. Potential pitfalls of disease-specific guidelines for patients with multiple conditions. The New England Journal of Medicine. 2004;351:2870-4.
6. Hanlon JT, Handler SM, Maher RL, Schmader KE. Chapter 104. Geriatric pharmacotherapy and polypharmacy. In: Fillit HM, Rockwood K, Woodhouse K, editors. Brocklehurst's Textbook of Geriatric Medicine and Gerontology. 7th ed. Philadelphia, PA: Saunders Elservier; 2010.
7. Avorn J, Gurwitz JH. Drug use in the nursing home. Annals of Internal Medicine. 1995;123:195-204.
8. Fick DM, Waller JL, Maclean JR, Heuvel RV, Tadlock JG, Gottlieb M, Cangialose CB. Potentially inappropriate medication use in a Medicare Managed Care population: Association with higher costs and utilization. Journal of Managed Care Pharmacy. 2001;7:407-13.
9. Simonson W, Feinberg JL. Medication-related problems in the elderly. Defining the issues and identifying solutions. Drugs & Aging. 2005;22:559-69.
10. Barber N. What constitutes good prescribing? BMJ. 1995;310:923-5.
11. Spinewine A, Schmader KE, Barber N, Hughes CM, Lapane KL, Swine C, Hanlon JT. Appropriate prescribing in elderly people: How well can it be measured and optimised? Lancet. 2007;370:173-84.
12. Buetow SA, Sibbald B, Cantrill JA, Halliwell S. Appropriateness in health care: Application to prescribing. Social Science & Medicine. 1997;45:261-71.
13. Chassin MR, Galvin RW, the National Roundtable on Health Care Quality. The urgent need to improve health care quality. JAMA. 1998;280:1000-5.
14. Ferner RE, Aronson JK. Clarification of terminology in medication errors. Definitions and classification. Drug Safety. 2006;29:1011-22.
15. Gurwitz JH. Suboptimal medication use in the elderly. The tip of the iceberg. JAMA. 1994;272:316-7.
16. Buetow SA, Sibbald B, Cantrill JA. Prevalence of potentially inappropriate long term prescribing in general practice in the United Kingdom, 1980-95: Systematic literature review. BMJ. 1996;313:1371-4.
17. Hanlon JT, Weinberger M, Samsa GP, Schmader KE, Uttech KM, Lewis IK, Cowper PA, Landsman PB, Cohen HJ, Feussner JR. A randomized, controlled trial of

a clinical pharmacist intervention to improve inapprorpiate prescribing in elderly outpatients with polypharmacy. The American Journal of Medcine. 1996;100:428-37.
18. Tamblyn RM, Huang AR, Perreault R, Jacques A, Roy D, Hanley J, McLeod P, Laprise R. The medical office of the 21st century (MOXXI): Effectiveness of computerized decision-making support in reducing inapprorpiate prescribing in primary care. Canadian Medial Association Journal. 2003;169:549-56.
19. Monane M, Matthias DM, Nagle BA, Kelly MA. Improving prescribing patterns for the elderly through an online drug utilization review intervention. A system linking the physician, pharmacist, and computer. JAMA. 1998;280:1249-52.
20. Lipton HL, Bero LA, Bird JA, McPhee SJ. The impact of clinical pharmacists' consultations on physicians' geriatric drug prescribing: A randomized controlled trial. Medical Care. 1992;30:646-58.
21. Jackson SHD, Mangoni AA, Batty GM. Optimization of drug prescribing. British Journal of Clinical Pharmacology. 2003;57:231-6.
22. Hoven JL, Haaijer-Ruskamp FM, Vander Stichele RH. Indicators of prescribing quality in drug utilisation research: report of a European meeting (DURQUIM, 13-15 May 2004). European Journal of Clinical Pharmacology. 2005;60:831-4.
23. Oborne CA, Batty GM, Maskrey V, Swift CG, Jackson SHD. Development of prescribing indicators for elderly medical inpatients. British Journal of Clinical Pharmacology. 1997;43:91-7.
24. Batty GM, Oborne CA, Swift CG, Jackson SHD. Development of an indicator to identify inappropriate use of benzodiazepines in elderly medical in-patients. International Journal of Geriatric Psychiatry. 2000;15:892-6.
25. Naugler CT, Brymer C, Stolee P, Arcese ZA. Development and validation of an improving prescribing in the elderly tool. Canadian Journal of Clinical Pharmacology. 2000;7:103-7.
26. Barry PJ, Gallagher P, Ryan C, O'Mahony DO. START (screening tool to alert doctors to the right treatment) - an evidence-based screening tool to detect prescribing omissions in elderly patients. Age and Ageing. 2007;36:632-8.
27. Zhan C, J S, Bierman AS, Miller MR, Friedman B, Wickizer SW, Meyer GS. Potentially inappropriate medication use in the community-dwelling elderly. JAMA. 2001;286:2823-9.
28. Stuck AE, Beers MH, Steiner A, Atonow HU, Rubenstein LZ, Beck JC. Inappropriate medication use in community-residing older persons. Archives of Internal Medicine. 1994;154:2195-200.
29. Beers MH, Ouslander JG, Rollingher I, Reuben DB, Brooks J, Beck JC. Explicit criteria for determining inappropriate medication use in nursing home residents. Archives of Internal Medicine. 1991;151:1825-32.
30. Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. Archives of Internal Medicine. 1997;157:1531-6.
31. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean R, Beers MH. Updating the Beers criteria for potentially inappropriate medication use in older adults. Archives of Internal Medicine. 2003;163:2716-24.
32. The American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers criteria for Potentially inappropriate medication use in older adults. Journal of the American Geriatrics Society. 2012;60:616-31.

33. Hanlon JT, Schmader KE, Samsa GP, Weinberger M, Uttech KM, Lewis IK, Cohen HJ, Feussner JR. A method for assessing drug therapy appropriateness. Journal of Clinical Epidemiology. 1992;45:1045-51.
34. Samsa GP, Hanlon JT, Schmader KE, Weinberger M, Clipp EC, Uttech KM, Lewis IK, Landsman PB, Cohen HJ. A summated score for the medication appropraiteness index: Development and assessment of clinimetric properties including content validity. Journal of Clinical Epidemiology. 1994;47:891-6.
35. MacKinnon NJ, Hepler CD. Preventable drug-related morbidity in older adults. Journal of Managed Care Pharmacy. 2002;5:365-71.
36. Higashi T, Shekelle PG, Solomon DH, Knight EL, Roth C, Chang JT, Kamberg CJ, MacLean CH, Young RT, Adams J, Reuben DB, Avorn J, Wenger NS. The quality of pharmacologic care for vulnerable older patients. Annals of Internal Medicine. 2004;140:714-20.
37. Shrank WH, Polinski JM, Avorn J. Quality indicators for medication use in vulnerable elders. Journal of the American Geriatrics Society. 2007;55:S373-S82.
38. Oborne CA, Hooper R, Li KC, Swift CG, Jackson SHD. An indicator of appropriate neuroleptic prescribing in nursing homes. Age and Ageing. 2002;31:435-9.
39. Morris CJ, Cantrill JA. Preventing drug-related morbidity - the development of quality indicators. Journal of Clinical Pharmacy and Therapeutics. 2003;28:295-305.
40. Oborne CA, Hooper R, Swift CG, Jackson SHD. Explicit, evidence-based criteria to assess the quality of prescribing to elderly nursing home residents. Age and Ageing. 2003;32:102-8.
41. Gallagher P, Ryan C, Byrne S, Kennedy J, O'Mahony DO. STOPP (Screening Tool of Older Person's Prescriptions) and START (Screening Tool to Alert doctors to Right Treatment). Consensus validation. International Journal of Clinical Pharmacology and Therapeutics. 2008;46:72-83.
42. O'Mahony D, Gallagher P, Ryan C, Byrne S, Hamilton H, Barry P, O'connor M, Kennedy J. STOPP & START criteria: A new approach to detecting potentially iappropriate prescribing in old age. European Geriatric Medicine. 2010;1:45-51.
43. McLeod PJ, Huang AR, Tamblyn RM, Gayton DC. Defining inappropriate practices in prescribing for elderly people: A national consensus panel. Canadian Medial Association Journal. 1997;156:385-91.
44. Baughan DM. Letters to the editor. Inappropriate drug prescribing. JAMA. 1995;8:456.
45. Swagery D, Brickley R. ASCP-AMDA Joint position statement on Beers criteria. Alexandria, VA: American Society of Consultant Pharmacists; 2011 [Available from: https://www.ascp.com/articles/potentially-inappropriate-medications-elderly. Accessed on: June 12, 2012];
46. Crownover BK. Implementation of the Beers Criteria: Sticks and stones - or throw me a bone. Journal of Managed Care Pharmacy. 2005;11:416-7.
47. Spinewine A, Dumont C, Mallet L, Swine C. Letters to the editor. Medication Appropriateness Index: Reliability and recommendations for future use. Journal of the American Geriatrics Society. 2006;54:720-1.
48. Weiner DK, Rudy TE. Attitudinal barriers to effective treatment of persistent pain in nursing home residents. Journal of the American Geriatrics Society. 2002;50:2035-40.
49. Brooks TR. Attitudes of medical students and family practice residents toward geriatric patients. Journal of the National Medical Association. 1993;85:61-4.

50. Burgio LD, Butler F, Engel BT. Nurses' attitudes towards geriatric behavior problems in long-term care settings. Clinical Gerontologist. 1988;7:23-34.
51. Gurwitz JH, Soumerai SB, Avorn J. Improving medication prescribing and utilization in the nursing home. Journal of the American Geriatrics Society. 1990;38:542-52.
52. Pronovost PJ, Nolan T, Zeger S, Miller M, Rubin H. How can clinicians measure safety and quality in acute care? Lancet. 2004;363:1061-7.
53. Kazandjian VA. Does appropriate prescribing result in safer care? Quality and Safety in Health Care. 2004;13:9-10.
54. Karch FE, Smith CL, Kerzner B, Mazzullo JM, Weintraub M, Lasagna L. Adverse drug reactions: A matter of opinion. Clinical Pharmacology and Therapeutics. 1976;19:489-92.
55. Curtiss FR. Medication errors, adverse medical events, and PDRM. Journal of Managed Care Pharmacy. 2002;8:400.
56. Lau DT, Kasper JD, Potter DEB, Lyles A. Potentially inappropriate medication prescriptions among elderly nursing home residents: Their scope and associated resident and facility characteristics. Health Services Research. 2004;39:1257-76.
57. Lau DT, Kasper JD, Potter DEB, Lyles A, Bennett RG. Hospitalization and death associated with potentially inappropriate medication prescriptions among elderly nursing home residents. Archives of Internal Medicine. 2005;165:68-74.
58. Perri III M, Menon AM, Deshpande AD, Shinde SB, Jiang R, Cooper JW, Cook CL, Griffin SC, Lorys RA. Adverse outcomes associated with inappropriate drug use in nursing homes. The Annals of Pharmacotherapy. 2005;39:405-11.
59. Jones JK. Assessing potential risk of drugs: The elusive target. Annals of Internal Medicine. 1992;117:691-2.
60. Raivio MM, Laurilla JV, Strandberg TE, Tilvis RS, Pitkälä KH. Use of inappropriate medications and their prognostic significance among in-hospital and nursing home patients with and without dementia in Finland. Drugs & Aging. 2006;23:333-43.
61. Hanlon JT, Fillenbaum GG, Kuchibhatla M, Artz MB, Boult C, Gross CR, Garrard J, Schmader KE. Impact of inappropriate drug use on mortality and functional status in representative community dwelling elders. Medical Care. 2002;40:166-76.
62. Klarin I, Wimo A, Fastbom J. The association of inappropriate drug use with hospitalisation and mortality. A population-based study of the very old. Drugs & Aging. 2005;22:69-82.
63. Rask KJ, Wells KJ, Teitel GS, Hawley JN, Richards C, Gazmararian JA. Can an algorithm for appropriate prescribing predict adverse drug events? The American Journal of Managed Care. 2005;11:145-51.
64. Laroche M-L, Charmes J-P, Nouaille Y, Picard N, Merle L. Is inappropriate medication use a major cause of adverse drug reactions in the elderly? British Journal of Clinical Pharmacology. 2006;63:177-86.
65. Barnett K, McCowan C, Evans JMM, Gillespie ND, Davey PG, Fahey T. Prevalence and outcomes of use of potentially inappropriate medicines in older people: Cohort study stratified by residence in nursing home or in the community. BMJ Quality & Safety. 2011;20:275-81.
66. Mamun K, Lien CTC, Goh-Tan CYE, Ang WST. Polypharmacy and inappropriate medication use in Singapore nursing homes. Annals of Academy Medicine Singapore. 2004;33:49-52.

67. Rigler SK, Jachna CM, Perera S, Shireman TI, Eng ML. Patterns of potentially inappropraite medication use across three cohorts of older Medicaid recipients. Pharmacoepidemiology. 2005;39:1175-81.
68. Piecoro LT, Brownings SR, Prince TS, Ranz TT, Scutchfield FD. A database analysis of potentially inappropriate drug use in an elderly Medicaid population. Pharmacotherapy. 2000;20:221-8.
69. Dhall J, Larrat EP, Lapane KL. Use of potentially inappropriate drugs in nursing homes. Pharmacotherapy. 2002;22:88-96.
70. Lane CJ, Bronskill SE, Sykora K, Dhalla IA, Anderson GM, Mamdani MM, Gill SS, Gurwitz JH, Rochon PA. Potentially inappropriate prescribing in Ontario community-dwelling older adults and nursing home residents. Journal of the American Geriatrics Society. 2004;52:861-6.
71. Hosia-Randell HMV, Muurinen SM, Pitkälä KH. Exposure to potentially inappropriate drugs and drug-drug interactions in elderly nursing home residents in Helsinki, Finland. Drugs & Aging. 2008;26:683-92.
72. Byrne S, Ryan C, O'Mahony DO, Weedle P, Kennedy J, Ahern E. Inappropriate prescribing in the elderly: A review of primary care and nursing home prescriptions. The International Journal of Pharmacy Practice. 2008;Supplement 1:A36-A7.
73. Cooper JW. Probable adverse drug reactions in a rural geriatric nursing home population: A four-year study. Journal of the American Geriatrics Society. 1996;44:194-7.
74. Alfred L, Golden A, Preston RA, Silverman MA, Bergman RJ. Implementation of a pharmacist-directed program to monitor adverse drug reactions. The Consultant Pharmacist. 2000;15:1032-7.
75. Nguyen JK, Fouts MM, Kotabe SE, Lo E. Polypharmacy as a risk factor for adverse drug reactions in geriatric nursing home residents. The American Journal of Geriatric Pharmcotherapy. 2006;4:36-41.
76. Gurwitz JH, Field TS, Judge J, Rochon PA, Harrold LR, Cadoret C, Lee M, White K, LaPrino J, Erramuspe-Mainard J, DeFlorio M, Gavendo L, Auger J, Bates DW. The incidence of adverse drug events in two large academic long-term care facilities. The American Journal of Medicine. 2005;118:251-8.
77. Gurwitz JH, Field TS, Avorn J, McCormick D, Jain S, Eckler M, Benser M, Edmondson AC, Bates DW. Incidence and preventability of adverse drug events in nursing homes. The American Journal of Medicine. 2000;109:87-94.
78. Avery AJ. Appropriate prescribing in general practice: Development of the indicators. Quality and Safety in Health Care. 1998;7:123.
79. Budnitz DS, Shehab N, Kegler SR, Richards CL. Medication use leading to emergency department visits for adverse drug events in older adults. Annals of Internal Medicine. 2007;147:755-65.
80. Briesacher BA, Limcangco MR, Simoni-Wastila L, Doshi JA, Levens SR, Shea DG, Stuart B. The quality of antipsychotic drug prescribing in nursing homes. Archives of Internal Medicine. 2005;165:1280-5.
81. Levenson S, Crecelius C. The use of antipsychotics in nursing home residents. Caring for the Ages. 2003;4:34-5.
82. Holloway K, Green T. Drug use evaluation (DUE) (drug utilization review). Geneva, Switzerland: World Health Organization in collaboration with Management Sciences for Health; 2003 [Available from: http://apps.who.int/medicinedocs/en/d/Js4882e/8.5.html. Accessed on: January 2, 2013];

83. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. American Journal of Hospital Pharmacy. 1990;47:533-43.
84. Stuart A. The state of the world's pharmacy: A portrait of the pharmacy profession. Journal of Interprofessional Care. 2002;16:391-404.
85. Penna RP. Pharmaceutical care: Pharmacy's mission for the 1990s. American Journal of Hospital Pharmacy. 1990;47:543-9.
86. Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. American Journal of Hospital Pharmacy. 1990;47:533-42.
87. Harrington C. Regulating nursing homes: Residential nursing facilities in the United States. BMJ. 2001;323:507-10.
88. Code of Federal Regulation. Title 42 - Public Health. Chapter IV - Centers for Medicare & Medicaid Services, Department of Health and Human Services (Continued) Volume 3 (Part 483). Requirements for States and long term care facilities. Washington, DC: U.S. Government Printing Office; [Available from: http://www.gpo.gov/fdsys/search/pagedetails.action;jsessionid=By16Pv7NTHxsD2yTpyp00LWfHQ0hGwNfhZp9vQYvwKKPXnFkVnyf!-1830174162!-744597377?collectionCode=CFR&searchPath=Title+42%2FChapter+IV&granuleId=&packageId=CFR-2002-title42-vol1&oldPath=Title+42%2FChapter+IV&fromPageDetails=true&collapse=false&ycord=357. Accessed on: April 29, 2012];
89. Roughead EE, J SS, Gilbert AL. Quality use of medicines in aged-care facilities in Australia. Drugs & Aging. 2003;20:643-53.
90. Turnham H. Federal Nursing Home Reform Act from the Omnibus Budget Reconciliation Act of 1987 or simply OBRA '87. Summary. Washington, DC: The National Long-Term Care Ombudsman Resource Center; [Available from: http://www.ltcombudsman.org/NORC-library#laws. Accessed on: April 29, 2012];
91. Briesacher B, Limcangco R, Simoni-Wastila L, Doshi J, Gurwitz J. Evaluation of nationally mandated drug use reviews to improve patient safety in nursing homes: A natural experiment. Journal of the American Geriatrics Society. 2005;53:991-6.
92. Svarstad BL, Mount JK. Chronic benzodiazepine use in nursing homes: Effects of federal guidelines, resident mix, and nurse staffing. Journal of the American Geriatrics Society. 2001;49:1673-8.
93. Lapane KL, Hughes CM, Quilliam BJ. Does incorporating medications in the surveyors' interpretive guidelines reduce the use of potentially inappropriate medications in nursing homes? Journal of the American Geriatrics Society. 2007;55:666-73.
94. Zermansky AG, Alldred DP, Petty DR, Raynor DK, Freemantle N, Eastaugh J, Bowie P. Clinical medication review by a pharmacist of elderly people living in care homes - randomised controlled trial. Age and Ageing. 2006;35:586-91.
95. Furniss L, Burns A, KCraig SKL, Scobie S, Cooke J, Faragher B. Effects of a pharmacist's medication review in nursing homes. British Journal of Psychiatry. 2000;176:563-7.
96. Stuijt CCM, Franssen EJF, Egberts ACG, Hudson SA. Appropriateness of prescribing among elderly patients in a Dutch residential home. Drugs & Aging. 2008;25:947-54.
97. Roberts MS, Stokes JA, King MA, Lynne TA, Purdie DM, Glasziou PP, Wilson DAJ, McCarthy ST, Brooks GE, de Looze FJ, Del Mar CB. Outcomes of a randomized controlled trial of a clinical pharmacy intervention in 52 nursing homes. British Journal of Clinical Pharmacology. 2001;51:257-65.

98. Crotty M, Rowett D, Spurling L, Giles LC, Phillips PA. Does the addition of a pharmacist transition coordinator improve evidence-based medication management and health outcomes in older adults moving from the hospital to a long-term care facility? Results of a randomized, controlled trial. The American Journal of Geriatric Pharmacotherapy. 2004;2:257-64.
99. Trygstad TK, Christensen D, Garmise J, Sullivan R, Wegner SE. Pharmacist response to alerts generated from Medicaid pharmacy claims in a long-term care setting: Results from the North Carolina Polypharmacy Initiative. Journal of Managed Care Pharmacy. 2005;11:575-83.
100. Schmidt IK, Claesson CB, Westerholm B, Nilsson LG. Physician and staff assessments of drug interventions and outcomes in Swedish nursing homes. The Annals of Pharmacotherapy. 1998;32:27-32.
101. Lapane KL, Hughes CM. Pharmacotherapy interventions undertaken by pharmacists in the Fleetwood phase III study: the role of process control. The Annals of Pharmacotherapy. 2006;40:1522-6.
102. King MA, Roberts MS. Multidisciplinary case conference reviews: Improving outcomes for nursing home residents, carers and health professionals. Pharmacy, World & Science. 2001;23:41-5.
103. Judge J, Field TS, DeFlorio M, LaPrino J, Auger J, Rochon PA, Bates DW, Gurwitz JH. Prescribers' responses to alerts during medication ordering in the long term care setting. Journal of the American Medical Informatics Association. 2006;13:385-90.
104. Gurwitz JH, Field TS, Rochon PA, Judge J, Harrold LR, Bell CM, Lee M, White K, LaPrino J, Erramuspe-Mainard J, DeFlorio M, Gavendo L, Baril JL, Reed G, Bates DW. Effect of computerized provider order entry with clinical decision support on adverse drug events in the long-term care setting. Journal of the American Geriatrics Society. 2008;56:2225-33.
105. Garcia RM. Five ways you can reduce inapprorpiate prescribing in the elderly: A systematic review. The Journal of Family Practice. 2006;55:305-12.
106. Burns A, Furniss L, Cooke J, Craig SKL, Scobie S. Pharmacist medication review in nursing homes: A cost analysis. International Journal of Geriatric Psychopharmacology. 2000;2:137-41.
107. Kamlesh K, Kinsella B. Effect of systematic review of medication by general practitioner on drug consumption among nursing-home residents. Age and Ageing. 2000;29:451-3.
108. Crotty M, Halbert J, Rowett D, Giles L, Birks R, Williams H, Whitehead C. An outreach geriatric medication advisory service in residential aged care: A randomised controlled trial of case conferencing. Age and Ageing. 2004;33:612-7.
109. Loeb M, Brazil K, Lohfeld L, McGeer A, Simor A, Stevenson K, Zoutmen D, Smith S, Liu X, Walter SD. Effect of a multifaceted intervention on number of antimicrobial prescriptions for suspected urinary tract infections in residents of nursing homes: Cluster randomised controlled trial. BMJ. 2005;331:669-73.
110. Naughton BJ, Mylotte JM, Ramadan F, Karuza J, Priore RL. Antibiotic use, hospital admissions, and mortality before and after implementing guidelines for nursing home-acquired pneumonia. Journal of the American Geriatrics Society. 2001;49:1020-4.
111. Monette J, Miller MA, Monette M, Laurier C, Boivin J-F, Sourial N, Le Cruguel J-PL, Vandal A, Cotton-Montpetit M. Effect of an educational intervention on optimizing antibiotic prescribing in long-term care facilities. Journal of the American Geriatrics Society. 2007;55:1231-5.

112. Colón-Emeric CS, Lyles KW, House P, Levine DA, Shenck AP, Allison J, Gorospe J, Fermazin M, oliver K, Curtis JR, Weissman N, Xie A, Saag KG. Randomized trial to improve fracture prevention in nursing home residents. The American Journal of Medicine. 2007;120:886-92.
113. Munir J, Wright RJ, Carr DB. A quality improvement study on calcium and vitamin D supplementation in long-term care. Journal of the American Medical Directors Association. 2006;7:305-9.
114. Stein CM, Griffin MR, Taylor JA, Pichert JW, Brandt KD, Ray WA. Educational program for nursing home physicians and staff to reduce use of non-steroidal anti-inflammatory drugs among nursing home residents. A randomized controlled trial. Medical Care. 2001;39:436-45.
115. Ulfvarson J, Adami J, Ullman B, Wredling R, Reilly M, von Bahr C. Randomized controlled intervention in cardiovascular drug treatment in nursing homes. Pharmacoepidemiology and Drug Safety. 2003;12:589-93.
116. Schmidt I, Claesson CB, Westerholm B, Nilsson LG, Svarstad BL. The impact of regular multidisciplinary team interventions on psychotropic prescribing in Swedish nursing homes. Journal of the American Geriatrics Society. 1998;46:77-82.
117. Kotynia-English R, McGowan H, Almeida O. A randomized trial of early psychiatric intervention in residential care: Impact on health outcomes. International Psychogeriatrics. 2005;17:475-85.
118. Dahl LJ, Wright RJ, Xiao A, Keeven A, Carr DB. Quality improvement in long term care: The Psychotropic Assessment Tool (PAT). Journal of the American Medical Directors Association. 2008;9:676-83.
119. Castle NG. Providing outcomes information to nursing homes: Can it improve quality of care? The Gerontologist. 2003;43:483-92.
120. Midlöv P, Bondesson Å, Eriksson T, Petersson J, Minthon L, Höglund P. Descriptive study and pharmacotherapeutic intervention in patients with epilepsy or Parkinson's disease at nursing homes in southern Sweden. European Journal of Clinical Pharmacology. 2002;57:903-10.
121. Hagen BF, Armstrong-Esther C, Quail P, Williams RJ, Norton P, Le Navenec C-L, Ikuta R, Osis M, Congdon V, Zieb R. Neuroleptic and benzodiazepine use in long-term care in urban and rural Alberta: Characteristics and results of an education intervention to ensure appropriate use. International Psychogeriatrics. 2005;17:631-52.
122. Eide E, Schjøtt J. Assessing the effects of an intervention by a pharmacist on prescribing and administration of hypnotics in nursing homes. Pharmacy, World & Science. 2001;23:227-31.
123. VanHaaren AM, Lapane KL, Hughes CM. Effect of triplicate prescription policy on benzodiazepine administration in nursing home residents. Pharmacotherapy. 2001;21:1159-66.
124. Monette J, Champoux N, Monette M, Fournier L, Wolfson C, Galbaud du Fort G, Sourial N, Cruguel J-PL, Gore B. Effect of an interdisciplinary educational program on antipsychotic prescribing among nursing home residents with dementia. International Journal of Geriatric Psychiatry. 2008;23:574-9.
125. Fossey J, Ballard C, Juszczak E, James I, Alder N, Jacoby R, Howard R. Effect of enhanced psychosocial care on antipsychotic use in nursing home residents with severe dementia: Cluster randomised trial. BMJ. 2006;332(7644):756-61.
126. Putman L, Wang J-T. The Closing Group: Therapeutic recreation for nursing home residents with dementia and accompanying agitation and/or anxiety. American Journal of Alzheimer's Disease & Other Dementias. 2007;22:167-75.

127. Majumdar SR, Soumerai SB. Why most interventions to improve physician prescribing do not seem to work. Canadian Medial Association Journal. 2003;169:30-1.
128. Blozid E, Born AM, Stuck AE, Benninger U, Gillmann G, Clough-Gorr KM. Reduction of inappropriate medications among older nursing-home residents. A nurse-led, pre/post-design, intervention study. Drugs & Aging. 2010;27:1009-17.
129. Trygstad TK, Christensen DB, Wegner SE, Sullivan R, Garmise JM. Analysis of the North Carolina Long-Term Care Polypharmacy Initiative: A multiple-cohort approach using propensity-score matching for both evaluation and targeting. Clinical Therapeutics. 2009;31:2018-37.
130. Lapane KL, Hughes CM, Christian JB, Daiello LA, Cameron KA, Feinberg J. Evaluation of the Fleetwood Model of long-term care pharmacy. Journal of the American Medical Directors Association. 2010;12:355-63.
131. Tamura BK, Lubimir K, Iwasaki WN, Ziegler LA, Masaki KH. Physician intervention for medication reduction in a nursing home: The polypharmacy outcomes project. Journal of the American Medical Directors Association. 2011;12:326-30.
132. Brulhart MI, Wermeille JP. Multidisciplinary medication review: Evaluation of a pharmaceutical care model for nursing homes. International Journal of Clinical Pharmacy. 2011;33:549-57.
133. Olsson IN, Curman B, Engfeldt P. Patient focused drug surveillance of elderly patients in nursing homes. Pharmacoepidemiology and Drug Safety. 2010;19:150-7.
134. Petterson E, Vernby Å, Mölstad S, Lundborg CS. Can a multifaceted educational intervention targeting both nurses and physicians change the prescribing of antibiotics to nursing home residents? A cluster randomized controlled trial. Journal of Antimicrobial Chemotherapy. 2011;66:2659-66.
135. Linnebur SA, Fish DN, Ruscin JM, Dadcliff TA, Oman KS, Fink R, Dorsten BV, Liebrecht D, Fish R, McNulty M, Hutt E. Impact of a multidisciplinary intervention on antibiotic use for nursing home-acquired pneumonia. The American Journal of Geriatric Pharmacotherapy. 2011;9:442-50.
136. Lapane KL, Hughes CM, Daiello LA, Cameron KA, Feinberg J. Effect of a pharmacist-led multicomponent intervention focusing on the medication monitoring phase to prevent potential adverse drug events in nursing homes. Journal of the American Geriatrics Society. 2011;59:1238-45.
137. Colón-Emeric CS, Schmader KE, Twersky J, Kuchibhatla M, Kellum S, Weinberger M. Development and pilot testing of computerized order entry algorithms for geriatric problems in nursing homes. Journal of the American Geriatrics Society. 2009;57:1644-53.
138. Zarowitz BJ, Erwin WG, Ferris M, Losben N, Proud T. Methotrexate safety improvement in nursing home residents. Journal of the American Medical Directors Association. 2012;13:69-74.
139. Field TS, Tjia J, Mazor KM, Donovan JL, Kanaan AO, Harrold LR, Reed G, Doherty P, Spenard A, Gurwitz JH. Randomized trial of a warfarin communication protocol for nursing homes: An SBAR-based approach. The American Journal of Medicine. 2011;124:179e1-e7.
140. Papaioannou A, Kennedy CC, Campbell G, Stroud JB, Wang L, Dolovich L, Crowther MA. A team-based approach to warfarin management in long term care: A feasibility study of the MEDeINR electronic decision support system. BMC Geriatrics. 2010;10:38.

141. Suhrie EM, Hanlon JT, Jaffe EJ, Sevick MA, Ruby CM, Aspinal SL. Impact of a geriatric nursing home palliative care service on unnecessary medication prescribing. The American Journal of Geriatric Pharmacotherapy. 2009;7:20-5.
142. Westbury J, Jackson S, Gee P, Peterson G. An effective approach to decrease antipsychotic and benzodiazepine use in nursing homes: The RedUSe project. International Psychogeriatrics. 2010;22:26-36.
143. Westbury J, Tichelaar L, Peterson G, Gee P, Jackson S. A 12-month follow-up study of "RedUSe": A trial aimed at reducing antipsychotic and benzodiazepine use in nursing homes. International Psychogeriatrics. 2011;23:1260-9.
144. Patterson SM, Hughes CM, Crealey G, Cardwell C, Lapane KL. An evaluation of an adapted U.S. model of pharmaceutical care to improve psychoactive prescribing for nursing home residents in Northern Ireland (Fleetwood Northern Ireland Study). Journal of the American Geriatrics Society. 2010;58:44-53.
145. Patterson SM, Hughes CM, Cardwell C, Lapane KL, Murray AM, Crealey G. A cluster randomized controlled trial of an adapted U.S. model of pharmaceutical care for nursing home residents in Northern Ireland (Fleetwood Northern Ireland Study): A cost-effectiveness analysis. Journal of the American Geriatrics Society. 2011;59:586-93.
146. Field TS, Rochon PA, Lee m, Gavendo L, Baril JL, Gurwitz JH. Computerized clinical decision support during medication ordering for long-term care residents with renal insufficiency. Journal of the American Medical Informatics Association. 2009;16:480-5.
147. Subramanian S, Hoover S, Wagner JL, Donovan JL, Kanaan AO, Rochon PA, Gurwitz JH, Field TS. Immediate financial impact of computerized clinical decision support for long-term care residents with renal insufficiency: A case study. Journal of the American Medical Informatics Association. 2012;19:439-42.
148. A guidebook on nursing homes. Singapore: Ministry of Health; 2004 [Available from: http://www.moh.gov.sg/content/moh_web/home/Publications/guidelines/step_down_care/2004/a_guidebook_on_nursing_homes_(1.22Mb).html. Accessed on: April 29, 2012];
149. Preparing for Silver Tsunami. Speech by Khaw Boon Wan, Minister of Health, 9th February 2009. Singapore: Ministry of Health; [Available from: http://www.moh.gov.sg/content/moh_web/home/pressRoom/speeches_d/2009/preparing_for_silver_tsunami.html. Accessed on: April 29, 2012];
150. Berwick DM. Health services research and quality of care. Medical Care. 1989;27:763-71.
151. ATC / DDD Index 2012. Oslo, Norway: WHO Collaborating Centre for Drug Statistics Methodology; [Available from: http://www.whocc.no/atc_ddd_index/. Accessed on: April 29, 2012];
152. Viktil KK, Blix HS, Moger TA, Reikvam A. Polypharmacy as commonly defined in an indicator of limited value in the assessment of drug-related problems. British Journal of Clinical Pharmacology. 2007;63:187-95.
153. MedPAC (Medicare Payment Advisory Commission). 2006b. Performance Snapshot: Rehospitalization of skilled nursing facility medicare patients. Washington, DC: The Commonwealth Fund; 2006 [Available from: http://www.commonwealthfund.org/Content/Performance-Snapshots/Nursing-Home-and-Home-Health-Care/Rehospitalization-of--Skilled-Nursing-Facility-Medicare-Patients.aspx. Accessed on: April 29, 2012];

154. International statistical classification of diseases and related health problems 10th revision. World Health Organization; [Available from: http://apps.who.int/classifications/icd10/browse/2010/en. Accessed on: April 29, 2012];
155. PCNE classification for drug-related problems v5.01. Pharmaceutical Care Network Europe; 2006 [Available from: http://www.pcne.org/dokumenter/DRP/PCNE%20classification%20V5.01.pdf. Accessed on: Jan 30, 2009];
156. Bulat T, Castle SC, Rutledge M, Quigley P. Clinical practice algorithms: Medication management to reduce fall risk in the elderly - part 4, anticoagulants, anticonvulsants, anticholinergics/bladder relaxants, and antipsychotics. Journal of the American Academy of Nurse Practitioners. 2008;20:181-90.
157. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: A systematic review and meta-analysis: I. Psychotropic drugs. Journal of the American Geriatrics Society. 1999;47:30-9.
158. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: A systematic review and meta-analysis: II. Cardiac and analgesic drugs. Journal of the American Geriatrics Society. 1999;47:40-50.
159. Gage BF, Birman-Deych E, Kerzner R, Radford MJ, Nilasena DS, Rich MW. Incidence of intracranial hemorrhage in patients with atrial fibrillation who are prone to fall. The American Journal of Medicine. 2005;118:612-7.
160. Sample size calculator. Seattle, WA: Raosoft, Inc.; [Available from: http://www.raosoft.com/samplesize.html. Accessed on: January 2, 2013];
161. Ministry of Health. Parliamentary QA. Nursing Homes. Question No: 607. Singapore: Ministry of Health; 2008 [Available from: http://www.moh.gov.sg/mohcorp/parliamentaryqa.aspx?id=19958. Accessed on: June 24, 2010];
162. Sim J, Wright CC. The Kappa statistic in reliability studies: Use, interpretation, and sample size requirements. Physical Therapy. 2005;85:257-68.
163. Liu GG, Christensen DB. The continuing challenge of inappropriate prescribing in the elderly: An update of the evidence. Journal of the American Pharmaceutical Association (Washington, DC : 1996). 2002;42:847-57.
164. Ma HM, Lum CM, Dai LK, Kwok CYT, Woo J. Potentially inappropriate medication in elderly patients in outpatient clinics. Asian Journal of Gerontology & Geriatrics. 2008;3:27-33.
165. Damestoy n, Collin J, Lalande R. Prescribing psychotropic medication for elderly patients: Some physicians' perspectives. Canadian Medial Association Journal. 1999;161:143-5.
166. Rochon PA, Stukel TA, Bronskill SE, Gomes T, Syhora K, Wodchis WP, Hillmer M, Kopp A, Gurwitz J, Anderson GM. Variation in nursing home antipsychotic prescribing rates. Archives of Internal Medicine. 2007;167:676-83.
167. Tjia J, Gurwitz JH, Briesacher B. Challenge of changing nursing home prescribing culture. The American Journal of Geriatric Pharmacotherapy. 2011;10:37-46.
168. Hughes CM, Donnelly A, Moyes SA, Peri K, Scahill S, Chen C, McCormack B, Kerse N. "The way we do things around here": An international comparison of treatment culture in nursing homes. Journal of the American Medical Directors Association. 2012;13:360-7.

169. Spinewine A, Swine C, Dhillon S, Franklin BD, Tulkens PM, Wilmotte L, Lorant V. Appropriateness of use of medicines in elderly inpatients: Qualitative study. BMJ. 2005;331:935-9.
170. Harries C, Forrest D, Harvey N, McClelland A, Bowling A. Which doctors are influenced by a patient's age? A multi-method study of angina treatment in general practice, cardiology and gerontology. Quality and Safety in Health Care. 2006;16:23-7.
171. Hirschman KB, Joyce CM, James BD, Xie SX, Karlawish JHT. Do Alzheimer's disease patients want to participate in a treatment decision, and would their caregivers let them? The Gerontologist. 2005;3:381-8.
172. Wald A. Is chronic use of stimulant laxatives harmful to the colon? Journal of Clinical Gastroenterology. 2003;36:386-9.
173. Osteoporosis. MOH Clinical Practice Guidelines. Singapore: Ministry of Health; 2009 [Available from: http://www.moh.gov.sg/content/moh_web/healthprofessionalsportal/doctors/guidelines/cpg_medical.html#2009. Accessed on: April 29, 2012];
174. Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. Clinical Geriatric Medicine. 2002;149:1628-33.
175. Rubenstein LZ, Josephson KR, Robbins AS. Falls in the nursing home. Annals of Internal Medicine. 1994;121:442-51.
176. Granek E, Baker S, Abbey H, Robinson E, Myers AH, Samkoff JS, Klein LE. Medications and diagnoses in relation to falls in a long-term care facility. Journal of the American Geriatrics Society. 1987;35:503-11.
177. Mamun K, Goh-Tan CYE, Ng LL. Prescribing psychoactive medications in nursing homes: Current practice in Singapore. Singapore Medical Journal. 2003;44:625-9.
178. Appendix A: Rome III diagnostic criteria for functional gastrointestinal disorders. Raleigh, NC: Rome Foundation, Inc; 2006 [Available from: http://www.romecriteria.org/criteria/. Accessed on: April 30, 2012];
179. Gallagher P, O'Mahony D. Constipation in old age. Best Practice & Research Clinical Gastroenterology. 2009;23:875-87.
180. Herz MJ, Kahan E, Zalevski S, Aframian R, Kuznitz D, Reichman S. Constipation: A different entity for patients and doctors. Family Practice. 1996;13:156-9.
181. Harari D, Gurwitz JH, Avorn J, Bohn R, Minaker KL. Bowel habit in relation to age and gender. Findings from the National Health Interview Survey and clinical implications. Archives of Internal Medicine. 1996;156:315-20.
182. Rao S, Go J. Update on the management of constipation in the elderly: New treatment options. Clinical Interventions in Aging. 2010;5:163-71.
183. Dijk K, Vries C, Van den Berg P, Dijkema A, Brouwers J, Van den Berg L. Constipation as an adverse effect of drug use in nursing home patients: An overestimated risk. British Journal of Clinical Pharmacology. 1998;46:255-61.
184. Robson KM, Kiely DK, Lembo T. Development of constipation in nursing home residents. Diseases of the Colon & Rectum. 2000;43:940-3.
185. Hosia-Randell H, Souminen M, Muurinen S, Pitkälä KH. Use of laxatives among older nursing home residents in Helsinki, Finland. Drugs & Aging. 2007;24:147-54.
186. Joanna Briggs Institute. Management of constipation in older adults. Best Practice 2008;12(7):1-4.

187. Müller-Lissner SA, Kamm MA, Scarpignato C, Wald A. Myths and misconceptions about chronic constipation. The American Journal of Gastroenterology. 2005;100:232-42.
188. Anti M, Pignataro G, Armuzzi A, Valenti A, Iascone E, Marmo R, Lamazza A, Pretaroli AR, Pace V, Leo P, Castelli A, Gasbarrini G. Water supplementation enhances the effect of high-fiber diet on stool frequency and laxative consumption in adult patients with functional constipation. Hepatogastroenterology. 1998;45:609-904.
189. Robinson SB, Rosher RB. Can a beverage cart help to improve hydration? Geriatric Nursing. 2002;23:208-11.
190. Kalish VB, Loven B. What is the best treatment for chronic constipation in the elderly? The Journal of Family Practice. 2007;56:1050-2.
191. Harari D. Constipation and fecal incontinence in old age. In: Fillit HM, Rockwood K, Woodhouse K, editors. Brocklehurst's Textbook of Geriatric Medicine and Gerontology 7th ed. Philadelphia, PA: Saunders Elservier; 2010. p. 909 - 25.
192. Dorfman L, Wallack L, Woodruff K. More than a message: Framing public health advocacy to change corporate practices. Health Education & Behavior. 2005;32:320-36.
193. Wolfsen CR, Barker JC, Mitteness LS. Constipation in the daily lives of frail elderly people. Archives of Family Medicine. 1993;2:853-8.
194. Petticrew M, Watt I, Brand M. What's the 'best buy' for treatment of constipation? Results of a systematic review of the efficacy and comparative efficacy of laxatives in the elderly. British Journal of General Practice. 1999;49:387-93.
195. Bradley CP. Uncomfortable prescribing decisions: A critical incident study. BMJ. 1992;304:294-6.
196. Barber N, Bradley C, Barry C, Stevenson F, Britten N, Jenkins L. Measuring the appropriateness of prescribing in primary care: Are current measures complete? Journal of Clinical Pharmacy and Therapeutics. 2005;30:533-9.
197. Wald A. Constipation in the primary care setting: current concepts and misconceptions. The American Journal of Medcine. 2006;119:736-9.
198. Ministry of Health Singapore. Singapore health facts. Health facilities. Singapore [Available from: http://www.moh.gov.sg/content/moh_web/home/statistics/Health_Facts_Singapore/Health_Facilities.html. Accessed on: January 2, 2013];
199. Chan AOO, Lam KF, Hui WM, Hu WH, Li J, Lai KC, Chan CK, Yuen MF, Lam SK, Wong BCY. Validated questionnaire on diagnosis and symptom severity for functional constipation in the Chinese population. Alimentary Pharmacology & Therapeutics. 2005;22:483-8.
200. Cheng C, Chan AOO, Hui WM, Lam SK. Coping strategies, illness perception, anxiety and depression of patients with idiopathic constipation: A population-based study. Alimentary Pharmacology & Therapeutics. 2003;18:319-26.
201. Marquis P, De La Loge C, Dubois D, McDermott A, Chassany O. Development and validation of the Patient Assessment of Constipation Quality of Life questionnaire. Scandinavian Journal of Gastroenterology. 2005;40:540-51.
202. Frank L, Flynn J, Rothman M. Use of a self-report constipation questionnaire with older adults in long-term care. The Gerontologist. 2001;41:779-86.
203. Pope C, Maysa N. Qualitative research: reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. BMJ. 1995;311:42-5.

204. Bartlett JE, Kotrlik JW, Higgins CC. Organizational research: Determining appropriate sample size in survey research. Information Technology, Learning, and Performance Journal. 2001;19:43-50.
205. Pope C, Ziebland S, Mays N. Analysing qualitative data. BMJ. 2000;320:114-6.
206. Lactulose. In: Geriatric Dosage Handbook. 14th Edition. Semla TP, Beizer JL, Higbee MD, editors. Hudson, Ohio: Lexi-Comp Inc; 2008.
207. Henderson JA, Buchwald D, Manson SM. Relationship of medication use to health-related quality of life among a group of older American Indians. Journal of Applied Gerontology. 2006;25:89S-104S.
208. Jack Jr L, Grim M, Gross T, Lynch S, McLin C. Theory in health promotion programs. In: Fertman CI, Allensworth DD, editors. Health Promotion Programs: From Theory to Practice. San Francisco, CA: Jossey-Bass; 2010.
209. Kincaid L, Figueroa ME. Communication for participatory development: Dialogue, action, and change. In: Frey LR, Cissna KN, editors. Routledge Handbook of Applied Communication Research. New York: Routledge; 2009. p. 506-32.
210. Southwell BG, Yzer MC. When (and why) interpersonal talk matters for campaigns. Communication Theory. 2009;19:1-8.
211. Lenth RV. Java applets for power and sample size [computer software]. 2009 [Available from: http://www.stat.uiowa.edu/~rlenth/Power. Accessed on: January 14, 2013];
212. Bland JM. Sample size in guidelines trials. Family Practice. 2000;17(Suppl. 1):S17-S20.
213. Hosia-Randell H, Suominen M, Muurinen S, Pitkälä KH. Use of laxatives among older nursing home residents in Helsinki, Finland. Drugs & Aging. 2007;24:147-54.
214. Gage H, Goodman C, Davies SL, Norton C, Fader M, Wells M, Morris J, Wiliams P. Laxative use in care homes. Journal of Advanced Nursing. 2010;66:1266-72.
215. Gwee KA, Setia S. Demographics and health care seeking behavior of Singaporean women with chronic constipation: implications for therapeutic management. International Journal of General Medicine. 2012;5:287-302.
216. Wong ML, Wee S, Chia HP, Gan GL, Ye HC. Sociodemographic and lifestyle factors associated with constipation in an elderly Asian Community. The American Journal of Gastroenterology. 1999;94:1283-91.
217. McCallum IJD, Ong S, Mercer-Jones M. Chronic constipation in adults. BMJ. 2009;338:b831.
218. Castledine G, Grainger M, Wood N, Dilley C. Researching the management of constipation in long-term care: Part 1. British Journal of Nursing. 2007;16:1128-217.
219. Lewis SJ, Heaton KW. Stool form scale as a useful guide to intestinal transit time. Scandinavian Journal of Gasteroenterology. 1997;32:920-4.
220. Narducci F, Bassotti G, Gaburri M, Morelli A. Twenty four hour manometric recording of colonic motor activity in healthy man. Gut. 1987;28:17-25.
221. Neuhauser D, Xi PY. Deciding whether a new test/measure is useful. Medical Care. 2008;29:685-9.
222. Asia Pacific members of Alzheimer's disease international. Dementia in the Asia Pacific region: statistical appendix. Singapore: Alzheimer's Disease Association.; 2006 [Available from: http://www.alz.org.sg/about-dementia/statistics. Accessed on: April 29, 2012];

223. Work group on Alzheimer's disease and other dementias. Treatment of patients with Alzheimer's disease and other dementias. 2nd Edition. Arlington: American Psychiatric Association; [Available from: http://psychiatryonline.org/content.aspx?bookid=28&sectionid=1679489#152238. Accessed on: April 29, 2012];
224. Worldwide cost estimate for Alzheimer's and dementia is US$315.4 billion. London: Alzheimer's Disease International; 2009 [Available from: http://www.alz.co.uk/media/090324. Accessed on: April 29, 2012];
225. Finkel SI, Costa e Silva J, Cohen G, Miller S, Sartorium N. Behavioral and psychological signs and symptoms of dementia: A consensus statement on current knowledge and implications for research and treatment. International Psychogeriatrics. 1996;8(Suppl. 3):497-500.
226. Finkel SI. Introduction to behavioural and psychological symptoms of dementia (BPSD). International Journal of Geriatric Psychiatry. 2000;15:S2-4.
227. Steinberg M, Shao H, Zandi P, Lyketsos CG, Welsh-Bohmer KA, Norton MC, Breitner JCS, Steffens DC, Tschanz JT, Cache County Investigators. Point and 5-year period prevalence of neuropsychiatric symptoms in dementia: The Cache County Study. International Journal of Geriatric Psychiatry. 2008;23:170-7.
228. Kua EH, Tan SL. Stress of caregivers of dementia patients in the Singapore Chinese family. International Journal of Geriatric Psychiatry. 1997;12:466-9.
229. Tan LL, Wong HB, Allen H. The impact of neuropsychiatric symptoms of dementia on distress in family and professional caregivers in Singapore. International Psychogeriatrics. 2005;17:253-63.
230. O'Donnell BF, Drachman DA, Barnes HJ, Peterson KE, Swearer JM, Lew RA. Incontinence and troublesome behaviors predict institutionalization in dementia. Journal of Geriatric Psychiatry and Neurology. 1992;5:45-52.
231. Margallo-Lana M, Swann A, O'Brien J, Fairbairn A, Reichelt K, Potkins D, Mynt P, Ballard C. Prevalence and pharmacological management of behavioural and psychological symptoms amongst dementia sufferers living in care environments. International Journal of Geriatric Psychiatry. 2001;16:39-44.
232. Agronin ME. Treatment of agitation and psychosis. Practical Guides in Psychiatry Alzheimer Disease and Other Dementias. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008. p. 225.
233. American Psychiatric Association. Practice guideline for the treatment of patients with Alzheimer's disease and other dementias. American Psychiatric Publishing; 2007 [Available from: http://psychiatryonline.org/guidelines.aspx. Accessed on: April 29, 2012];
234. MOH Clinical Practice Guidelines. Dementia. Singapore: Ministry of Health; 2007 [Available from: http://www.moh.gov.sg/content/moh_web/healthprofessionalsportal/doctors/guidelines/cpg_medical/2007/cpgmed_dementia.html. Accessed on: April 29, 2012];
235. Serby MJ, Roane DM, Lantz MS, Cohen AJ, Turok A, Perlis TE. Current attitudes regarding treatment and agitation and psychosis in dementia. American Journal of Geriatric Psychiatry. 2009;17:174.
236. Schultz SK. Atypical antipsychotic medications in Alzheimer's disease: Effectiveness versus expectations. American Journal of Psychiatry. 2008;165:787-9.
237. Zaccai J, McCracken C, Brayne C. A systematic review of prevalence and incidence studies of dementia with Lewy bodies. Age and Ageing. 2005;34:561-6.
238. McKeith I, Fairbairn A, Perry R, Thompson P, Perry E. Neuroleptic sensitivity in patients with senile dementia of Lewy body type. BMJ. 1992;305:673-8.

239. Leung T, Menon S. Who will look after our elderly? Singapore: Singapore Institute of International Affairs; 2011 [Available from: http://www.siiaonline.org/?q=programmes/commentary/who-will-look-after-our-elderly. Accessed on: April 29, 2012];
240. Livingston G, Johnston K, Katona C, Paton J, Lyketsos CG. Systematic review of psychological approaches to the management of neuropsychiatric symptoms of dementia. American Journal of Psychiatry. 2005;162:1996-2021.
241. Kverno KS, Black BS, Nolan MT, Rabins PV. Research on treating neuropsychiatric symptoms of advanced dementia with non-pharmacological strategies, 1998-2008: A systematic literature review. International Psychogeriatrics. 2009;21:825-43.
242. Hughes CM, Lapane KL, Mor V, Ikegami N, Jonsson PV, Ljunggren G, Sgadari A. The impact of legislation on psychotropic drug use in nursing homes: A cross-national perspective. Journal of the American Geriatrics Society. 2000;48:931-7.
243. Shorr RI, Fought RL, Ray WA. Changes in antipsychotic drug use in nursing homes during implementation of the OBRA-87 regulations. JAMA. 1994;271:358-62.
244. Ray WA, Blazer DG, Schaffner W, Federspiel CF. Reducing antipsychotic drug prescribing for nursing home patients: A controlled trial of the effect of an educational visit. American Journal of Public Health. 1987;77:1448-50.
245. Testad I, Ballard C, Brønnick K, Aarsland D. The effect of staff training on agitation and use of restraint in nursing home residents with dementia: A single-blind, randomized controlled trial. Journal of Clinical Psychiatry. 2010;71:80-6.
246. Sørensen L, Foldspang A, Gulmann NC, Munk-Jørgensen P. Determinants for the use of psychotropics among nursing home residents. International Journal of Geriatric Psychiatry. 2001;16:147-54.
247. Ray WA, Taylor JA, Meador KG, Lichtenstein MJ, Griffin MR, Fought RL, Adams ML, Blazer DG. Reducing antipsychotic drug use in nursing homes. A controlled trial of provider education. Archives of Internal Medicine. 1993;153:713-21.
248. Avorn J, Soumerai SB, Everitt DE, Ross-Degnan D, Beers MH, Sherman D, Salem-Schatz SR, Fields D. A randomized trial of a program to reduce the use of psychoactive drugs in nursing homes. The New England Journal of Medicine. 1992;327:168-73.
249. Schmidt IK, Fastbom J. Quality of drug use in Swedish nursing homes: A follow-up study. Clinical Drug Investigation. 2000;20:433-46.
250. Siegler EL, Capezuti E, Maislin G, Baumgarten M, Evans L, Strumpf N. Effects of a restraint reduction intervention and OBRA'87 regulations on psychotropic drug use in nursing homes. Journal of the American Geriatrics Society. 1997;45:791-6.
251. Meador KG, Taylor JA, Thapa PB, Fought RL, Ray WA. Predictors of antipsychotic withdrawal or dose reduction in a randomized controlled trial of provider education. Journal of the American Geriatrics Society. 1997;45:207-10.
252. Nishtala PS, McLachlan AJ, Bell JS, Chen TF. Psychotropic prescribing in long-term care facilities: Impact of medication reviews and educational interventions. American Journal of Geriatric Psychiatry. 2008;16:621-32.
253. Aalten P, de Vugt ME, Jaspers N, Jolles J, Verhey FRJ. The course of neuropsychiatric symptoms in dementia. Part I: Findings from the two-year longitudinal Maasbed study. International Journal of Geriatric Psychiatry. 2005;20:523-30.
254. Cummings JL. The neuropsychiatric inventory: Assessing psychopathology in dementia patients. Neurology. 1997;48(Suppl 6):S10-6.

255. Cummings JL. Theories behind existing scales for rating behavior in dementia. International Psychogeriatrics. 1996;8, Suppl. 3:293-300.
256. Shah A, Dalvi M, Thompson T. Behavioural and psychological signs and symptoms of dementia across cultures: Current status and the future. International Journal of Geriatric Psychiatry. 2005;20:1187-95.
257. Conn D, Thorpe L. Assessment of behavioural and psychological symptoms associated with dementia. Canadian Journal of Neurological Sciences. 2007;34 Suppl. 1:S67-71.
258. Wood S, Cummings JL, Hsu M-A, Barclay T, Wheatley MV, Yarema KT, Schnelle JF. The use of the neuropsychiatric inventory in nursing home residents. Characterization and measurement. American Journal of Geriatric Psychiatry. 2000;8:75-83.
259. Kaufer DI, Cummings JL, Ketchel P, Smith V, MacMillan A, Shelley T, Lopez OL, DeKosky ST. Validation of the NPI-Q, a brief clinical form of the neuropsychiatric inventory. The Journal of Neuropsychiatry and Clinical Neurosciences. 2000;12:233-9.
260. Chang A. Tables of sample size for correlation. [Available from: http://www.stattools.net/SSizcorr_Tab.php. Accessed on: February 6, 2013];
261. Kane JM, Aguglia E, Altamura AC, Gutierrez JLA, Brunello N, Fleischhacker WW, Gaebel W, FGerlach J, Guelfi J, Kissling W, Lapierre YD, Lindström E, Mendlewicz J, Racagni G, Carulla LS, Schooler NR. Guidelines for depot antipsychotic treatment in schizophrenia. European Neuropsychopharmacology. 1998;8:55-66.
262. Woods SW. Chlorpromazine equivalent doses for the newer atypical antipsychotics. Journal of Clinical Psychiatry. 2003;64:663-7.
263. Johanson GA, Brooks GP. Initial scale development: Sample size for pilot studies. Educational and psychological measurement. 2010;70:394-400.
264. Buckwalter KC, Grey M, Bowers B, McCarthy AM, Gross D, Funk M, Beck C. Intervention research in highly unstable environments. Research in Nursing & Health. 2009;32:110-21.
265. Landi F, Onder G, Cesari M, Barillaro C, Russo A, Bernabei R. Psychotropic medications and risk for falls among community-dwelling frail older people: An observational study. Journal of Gerontology. 2005;60A:622-6.
266. Neutel CI, Perry S, Maxwell C. Medication use and risk of falls. Pharmacoepidemiology and Drug Safety. 2002;11:97-104.
267. Annual survey on infocomm usage in households and by individuals for 2010. Singapore: Infocomm Development Authority of Singapore; 2011 [Available from: http://www.ida.gov.sg/~/media/Files/Archive/Publications/Publications_Level3/Survey2010/HH2010ES.pdf. Accessed on: February 7, 2013];
268. Nap HH, De Kort Y, IJsselsteijin W. Senior gamers: Preferences, motivations and needs. Gerontechnology. 2009;8:247-62.
269. Whitcomb GR, editor. Computer games for the elderly. CQL90 Computers and the quality of life; 1990; Washington, DC: Association for Computing Machinery.
270. Weisman S. Computer games for the frail elderly. The Gerontologist. 1983;23:361-3.
271. O'Connor CM, Smith R, Nott MT, Lorang C, Mathews RM. Using video simulated presence to reduce resistance to care and increase participation of adults with dementia. American Journal of Alzheimer's Disease & Other Dementias. 2011;26:317-25.

272. IJsselsteijn W, Nap HH, de Kort Y, Poels K, editors. Digital game design for elderly users. Future Play 2007; Toronto, Ontario: Association of Computing Machinery.
273. Boulay M, Benveniste S, Boespflug S, Jouvelot P, Riguad A. A pilot usability study of MINWii, a music therapy game for demented patients. Technology and Health Care. 2011;19:233-46.
274. Åstrand H. Design and development of an online game for older people from a usability perspective. Göteborg, Sweden: Chalmers University of Technology; 2006.
275. IJsselsteijn W, de Kort Y, Poels K, Jurgelionis A, Bellotti F, editors. Characterising and measuring user experiences in digital games. International Conference on Advances in Computer Entertainment Technology; 2007; Salzburg, Austria.
276. Koivumaa-Honkanen H, Honkanen R, Viinamäki H, Heikkilä K, Kaprio J, Koskenvuo M. Self-reported life satisfaction and 20-year mortaility in healthy Finnish adults. American Journal of Epidemiology. 2000;152:983-91.
277. Kua EH, Ko SM. A questionnaire to screen for cognitive impairment among elderly people in developing countries. Acta Psychiatrica Scandinavica. 1992;85:119-22.
278. IJsselsteijin W, van den Hoogen W, Klimmt C, de Kort Y, Lindley C, Mathiak K, Poels K, Ravaja N, Turpeinen M, Vorderer P, editors. Measuring the experience of digital game enjoyment. Proceedings of Measuring Behavior 2008 6th International Conference on Methods and Techniques in Behavioral Research Page 88-89; Maastrcht, The Netherlands: Noldus Information Technology bv.
279. Poels K, de Kort Y, IJsselsteijin W, editors. "It is always a lot of fun!" Exploring dimensions of digital game experience using focus group methodology. Proceedings of the 2007 Conference on Future Play; Toronto, Ontario.
280. Jung Y, Koay JL, Ng SJ, Wong LCG, Kwan ML, editors. Games for a better life: Effects of playing Wii games on the well-being of seniors in a long-term care facility. Proceedings of the Sixth Australasian Conference on Interactive Entertainment; 2009; Sydney, Australia: ACM.
281. van Halteren-van Tilborg IADA, Scherder EJA, Hulstijn W. Motor-skill learning in Alzheimer's disease: A review with an eye to the clinical practice. Neuropsychology Review. 2007;17:203-12.
282. O'Daniel M, Rosenstein AH. Professional communication and team collaboration. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-based Handbook for Nurses. Rockville, MD: Agency for Healthcare Research and Quality.
283. Leonard M, Graham S, Bonacum D. The human factor: The critical importance of effective teamwork and communication in providing safe care. Qualith and Safety in Health Care. 2004;13(Suppl 1):i85-i90.
284. Lee HC. More beds for community hospitals, nursing homes. Singapore: Singapore Press Holdings Limited; 2009 [Available from: http://www.moh.gov.sg/mohcorp/uploadedFiles/Web_Parts/COS/more%20beds%20for%20community%20hospitals%204.pdf. Accessed on: September 15, 2009];
285. Speech by Dr Amy Khor, Minister of State for Health. Healthcare Scholarship Award Ceremony, 21st August 2012. Singapore: Ministry of Health; 2012 [Available from: http://www.moh.gov.sg/content/moh_web/home/pressRoom/speeches_d/2012/speech-Dr-Amy-Khor-Minister-of-State-for-Health-Healthcare-Scholarship-Award-Ceremony.html. Accessed on: September 1, 2012];

286. Toh YC. Number of dementia cases set to soar. Health Minister spells out three-pronged plan to help tackle the issue. The Straits Times. May 11, 2012;Sect. Home C1.
287. Speech by Minister for Health Mr. Gan Kim Yong at the Annual Singapore Conference on Ageing (ASCA) 2012, Thursday 10 May 2012, 9.00am, Orchard Hotel. Singapore: Ministry of Health; 2012 [Available from: http://www.moh.gov.sg/content/moh_web/home/pressRoom/speeches_d/2012/speech_by_ministerforhealthmrgankimyongattheannualsingaporeconfe.html. Accessed on: September 1, 2012];
288. Mohandas V. Govt exploring options to encourage home care of elderly sick. Singapore: Channel NewsAsia. Mediacorp; February 21, 2012 [Available from: http://www.channelnewsasia.com/stories/singaporelocalnews/view/1184322/1/.html. Accessed on: September 27, 2012];
289. Profiling the dementia family carer in Singapore. Singapore: Alzheimer's Disease Association of Singapore; 2008 [Available from: http://www.alz.org.sg/sites/alz.org.sg/files/Research%20-%20Profiling%20the%20dementia%20family%20carer%20in%20Singapore.pdf. Accessed on: April 29, 2012];
290. Ministry of Health. Keynote speech by Mr Gan Kim Yong, Minister for Health, at the Economist's "Healthcare in Asia 2012" Conference, 28 March 2012, at the Fullerton Hotel Ballroom. Singapore: Ministry of Health; 2012 [Available from: http://www.moh.gov.sg/content/moh_web/home/pressRoom/speeches_d/2012/keynote_speech_by_Minister_Gan_Economists_Healthcare_in_Asia_2012_Conference_28Mar2012.html. Accessed on: July 25, 2012];

Statistics

Ageing Population[1] in Singapore

- The population of persons aged 65 years and above will increase from the 8.7% (2008) to 19% (2030).

Nursing Home Capacity

- Step-down institutional care such as NHs cater to the needs of about 3% of the elderly population.[2]
- The total number of NHs is 63. In all, they contribute 9265 beds (2010).[3] Of all the NH, 31 are run by the commercial sector, and 32 are run by Volunteer Welfare Organizations (VWO).
- The bed capacity will be increased by 50% to 14,000 by year 2020.[4]

Expenditures and Fees of NH

- NHs run by VWOs can receive 50-100% financial assistance from the government on various expenditures.[5]
- Patients who are admitted to VWO-run and some privately-run NHs through referral by the Agency for Integrated Care (AIC) and who meet the means test criteria[6] may receive 10-75% subsidies[7] for the NH fees.
- Patients can also be admitted as a full-paying patient, without any subsidy for the NH fees.

Standards of Care within NH

- Currently, up to 70% of the 4,000 formal long-term care workers are foreigners from the Philippines, Sri Lanka and Myanmar. A third of these foreign workers are registered nurses while the rest are healthcare attendants and nursing aides.[8]
- The standards of care and service of all NHs are presented in a set of guidelines that was updated in 2004.[2] The different aspects of medication management, including purchasing, storage, packaging, prescription, administration and quality assurance are covered in a separate set of guidelines updated in 2005.[9]
- The roles of the visiting physician and NS (including registered nurse, enrolled nurse, nursing aide, and health care assistant) and defined in the Guidebook on Nursing Homes[2] while that of the visiting pharmacist is spelled out in the

Guidelines on Medication Management in Nursing Homes[9]. These are summarized in the Table below.

- However, there are no regulations or enticements in place to enforce compliance by the NHs. Hence, the standard of care varies among the NHs.

Roles of Healthcare Professions
Physicians
- Provide medical care to residents - Perform medical and medication reviews (within 48 hours at first admission and at least every 6 monthly) - Involve in education and training of nurses and allied health personnel
Registered Nurse
- Provide nursing care - Develop nursing care plan and implement nursing interventions, includes evaluation of residents' response to care interventions - Supervise, educate and train NS - Prepare clinical documentation (including reporting incidents of falls, deaths, accidents, injuries, transfers to hospitals and categorization of residents and maintaining the residents' medication records)
Enrolled Nurse
- Assist registered nurse - Provide nursing care and patient assessments
Nursing Aide / Health Care Assistant
- Assists and supervises individual resident's activities of daily living - Attends to residents' complaints - Identifies and reports residents' needs to the registered nurse - Maintains accurate documentation of care given
Pharmacist
- Identify, prevent and resolve medication-related problems (at least 6 monthly) - Evaluate residents' progress toward achieving therapeutic outcomes from drug therapies and ensure that these are appropriately indicated, effective, safe and convenient - Develop policies, procedures and guidelines for the use of medicines in the facility, minimum standards and quality assurance standards - Educate NS on pharmaceutical policies and procedures, medication administration, pharmacology and drug therapy, and monitoring of drug therapy for possible adverse effects and the attainment of therapeutic objectives - Provide drug information services to health professionals of the NH

Footnotes

1. Brief on Ageing Population in Singapore. Singapore: Ministry of Community Development, Youuth and Sports; [cited September 14, 2012]; Available from: http://app1.mcys.gov.sg/Policies/ElderlySeniorsActiveAgeing/StatisticsResources.aspx

2. A guidebook on nursing homes. Singapore: Ministry of Health; 2004 [cited April 29, 2012]; Available from: http://www.moh.gov.sg/content/moh_web/home/Publications/guidelines/step_down_care/2004/a_guidebook_on_nursing_homes_(1.22Mb).html.
3. Statistics. Singapore Health Facts.Health Facilities. Singapore: Ministry of Health; [cited September 10, 2012]; Available from: http://www.moh.gov.sg/content/moh_web/home/statistics/Health_Facts_Singapore/Health_Facilities.html.
4. Lee HC. More beds for community hospitals, nursing homes. Singapore: Singapore Press Holdings Limited; 2009 [updated February 10, 2009; cited September 15, 2009]; Available from: http://www.moh.gov.sg/mohcorp/uploadedFiles/Web_Parts/COS/more%20beds%20for%20community%20hospitals%204.pdf.
5. Ling SL. Health care of the elderly in Singapore. Singapore Medical Journal. 1998;39(10):435-6.
6. Subsidies for Government-funded Intermediate Long-term Care Services. Singapore: Ministry of Health; [cited September 14, 2012]; Available from: http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies/subsidies_for_government_funded_ILTC_services.html.
7. Nursing Home. Singapore: Agency for Integrated Care; [cited September 14, 2012]; Available from: http://www.aic.sg/silverpages/careOptions/page.aspx?id=177#applying for subsidies.
8. Channel NewsAsia. Who will look after our elderly? Singapore: MediaCorp; June 13, 2011 [cited September 14, 2012]; Available from: http://news.xin.msn.com/en/singapore/article.aspx?cp-documentid=4931895.
9. Guidelines on medication management in nursing homes. Singapore: Ministry of Health; 2005 [cited April 29, 2012]; Available from: http://www.moh.gov.sg/content/moh_web/home/Publications/guidelines/step_down_care/2005/guidelines_on_medication_management_in_nursing_homes%20(1.02Mb).html.

DATA COLLECTION FORM Home: Date:

Section A – Resident's Particulars

1) **No:**

2) **Initials:**

3) **Age:**

4) **Gender: F / M ***

5) **Race: C / M / I / O ***

6) **Functional Status: Cat I / II / III / IV ***

7) **Cognition Status (AMT):**

8) **ADL:**

9) **Physical Restrain: Yes / No*** _____

10) **Diagnosed Dementia / Alzheimer's: Yes / No***

11) **Diagnosed Medical Conditions:**

* Circle where appropriate
4) F – female; M – male
5) C – Chinese; M – Malay; I – Indian; O - Others
6) Category rating on Resident Assessment Form is taken as a measure of functional status
7) AMT – Abbreviated Mental Test
8) ADL – Activities of Daily Living

Section B – Prescribing Appropriateness

12) **Medicine (IMR – current)**	13) **BNF / WHO class**	14) **Start Date /Last Mod Date**	15) **Reason for Mod**			16) **Beer**		17) **MAI**											18) **Oborne (A)**			
			Y	**N**	**U**	**T 1**	**T 2**	**i**	**ii**	**iii**	**iv**	**v**	**vi**	**vii**	**viii**	**ix**	**x**	**S**	**i**	**ii**	**iii**	**iv**

Mod = modification of drug therapy
15) Y = Yes; N = No;U = Unclear
16) T1= Inappropriate Medication defined in Table 1 of Beers Criteria
T2 = Inappropriate Medication defined in Table 2 of Beers Criteria
17) i-x) Rated as A – appropriate; B – marginal; C – inappropriate; Z – do not know / cannot determine
S) Summated Score
18) i) regularly used; ii) black triangle drugs; iii) PRN Drugs; iv) Documentation of max; v) Use generic drug name

19) **Oborne (B)**				
Indicators	**Y**	**N**	**Unclear**	**NA**
(a) Documentation of drug sensitivity status				
(b) Residents prescribed paracetamol allowing doses >4g/24hours				
(c) Residents prescribed long acting sulphonylurea				
(d) Residents prescribed ulcer-healing drug duplication				
(e) Residents prescribed short acting β2 agonist duplication (exclude regular with prn)				
(f) Appropriate Benzodiazepine prescribing (index: Benzodiazepine Rx)				
(g) Appropriate Aspirin prescribing in IHD (index: GTN Rx)				
(h) Appropriate Antithrombotics prescribing in AF (index: Digoxin or Amiodarone Rx)				
(i) Appropriate Steroid prescribing in stable airways obstruction (index: β2 agonist Rx, used > once daily)				
(j) Appropriate Neuroleptic prescribing (index: Neuroleptic Rx)				

NA = not applicable; IHD = ischemic heart disease; AF = atrial fibrillation
19B) Refer to prescribing algorithm in original reference article for (f) – (j)

20) **McLeod (A) Inappropriate Practices in Prescribing Drugs to Treat Cardiovascular Diseases for Elderly People**					
Indicator		**Present**	**Absent**	**Cannot Determine**	**NA**
a	Prescription of β-adrenergic blocking agent to treat hypertension for patients with a history of asthma or COPD				
b	Prescription of β-adrenergic blocking agent to treat angina for patients with a history of asthma, COPD or heart failure				
c	Prescription of reserpine to treat hypertension*				
d	Prescription of disopyramide to treat atrial fibrillation*				
e	Prescription of thiazide diuretic to treat hypertension for patients with a history of gout				
f	Prescription of calcium-channel blocker to treat hypertension for patients with a history of heart failure				
g	Prescription of β-adrenergic blocking agent to treat hypertension for patients with a history of heart failure				
h	Long-term prescription of β-adrenergic blocking agent to treat angina or hypertension for patients with a history of Raynaud disease				
20) **McLeod (B) Inappropriate Practices in Prescribing Psychotropic Drugs for Elderly People**					
Indicator		**Present**	**Absent**	**Cannot Determine**	**NA**
a	Long-term prescription of long-half-life benzodiazepine to treat insomnia				
b	Prescription of tricyclic antidepressant to treat depression for patients with a history of glaucoma, BPH or heart block				
c	Long-term prescription of barbiturate to treat insomnia				
d	Prescription of SSRI for patients already receiving an MAO inhibitor to treat depression				
e	Long-term prescription of long-half-life benzodiazepine to treat anxiety				
f	Long-term prescription of long-half-life benzodiazepine to treat agitation in dementia				

g	Prescription of tricyclic antidepressant to treat depression for patients with a history of postural hypotension				
h	Long-term prescription of triazolam to treat insomnia				
i	Prescription of chlorpromazine to treat psychosis for patients with a history of postural hypotension				
j	Prescription of nylidrin, niacin or pentoxifylline to treat dementia				
k	Prescription of tricyclic antidepressant with active metabolites (e.g. imipramine or amitriptyline) to treat depression				
l	Prescription of methylphenidate to treat depression				

20)
McLeod (C) Inappropriate Practices in Prescribing NSAIDs and Other Analgesics for Elderly People

Indicator		**Present**	**Absent**	**Cannot Determine**	**NA**
a	Long-term prescription of NSAIDs to treat osteoarthritis for patients with a history of peptic ulcer				
b	Prescription of phenybutazone to treat chronic osteoarthritis*				
c	Prescription of ASA to treat pain for patients already receiving warfarin				
d	Long-term prescription of meperidine or pentazocine for pain*				
e	Long-term prescription of NSAIDs to treat osteoarthritis for patients with chronic renal failure				
f	Prescription of NSAIDs to treat osteoarthritis for patients already receiving warfarin				
g	Long-term prescription of NSAIDs to treat osteoarthritis for patients with a history of heart failure				
h	Long-term prescription of piroxicam, ketorolac or mefenamic acid to treat pain				
i	Long-term prescription of NSAIDs for patients with a history of hypertension				
j	Long-term prescription of indomethacin to treat gout				
k	Long-term prescription of NSAIDs to treat osteoarthritis				

20)
McLeod (D) Inappropriate Practices in Prescribing Miscellaneous Drugs for Elderly People

Indicator		**Present**	**Absent**	**Cannot Determine**	**NA**
a	Prescription of cimetidine to treat peptic ulcer for patients already receiving warfarin				
b	Prescription of anticholinergic or antispasmodic drugs to treat irritable bowel syndrome for patients with dementia				
c	Prescription of dipyridamole to prevent stroke				
d	Long-term prescription of orally administered steroids to treat COPD for patients with a history of NIDDM				
e	Prescription of anticholinergic drugs to prevent extrapyramidal effects of antipsychotic drugs				
f	Lont-term prescription of diphenoxylate to treat diarrhea				
g	Prescription of cyclobenzaprine or methocarbamol to treat muscle spasms*				

*not applicable in the nursing home setting / drug implicated is not available in Singapore
20A) a) COPD – chronic obstructive pulmonary disease
20B) b) BPH – benign prostate hypertrophy; d) SSRI – selective serotonin-reuptake inhibitor, MAO – monoamine oxidase
20C) a) NSAID – non-steroidal anti-inflammatory
20D) d) NIDDM – non insulin-dependent diabetes mellitus

21)
ACOVE (A) – Prescribing Indicated Medication

Indicator		**Pass**	**Fail**	**NA**	**Cannot Determine**
a	PPI or misoprostol for patient with ulcer or gastrointestinal bleeding risk factors who is taking an NSAID				
b	ACE inhibitor for diabetic patient with proteinuria				
c	Calcium and vitamin D for patient with osteoporosis				
d	Daily aspirin therapy for patient with diabetes				

e	Prophylaxis for hospitalized patient at risk for stress peptic ulcer*				
f	Lipid-lowering drugs for IHD patient with LDL cholesterol level >3.4 mmol/L (>130 mg/dl) and no diet response				
g	B-blocker for patient with heart failure				
h	B-blocker for patient who had a myocardial infarction				
i	Osteoporosis treatment medication (HRT or biphosphonate or calcitonin)				
j	ACE inhibitor for patient with hypertension and renal insufficiency				
k	Medication for hypertension if no nonpharmacologic therapy response				
l	ACE inhibitor for patient with heart failure				
m	Aspirin for patient with coronary artery disease				
n	Calcium and vitamin D for patient taking long-term steroid therapy				
o	Bowel regimen to prevent constipation for patient taking opiate				
p	Antibiotics started within 8 hours after admission for pneumonia*				
q	Warfarin or aspirin, as appropriate, for patient with atrial fibrillation				

21)
ACOVE (B) – Avoiding Inappropriate Medications

Indicator		Pass	Fail	NA	Cannot Determine
a	Acetaminophen as first-line medication treatment for patient with osteoarthritis				
b	Avoid tertiary amine tricyclic, MAO inhibitor, benzodiazepine, or stimulant as first-line antidepressant				
c	Long-acting medications should be used to treat hypertension				
d	Avoid strongly anticholinergic medications if alternatives exist				
e	Avoid barbiturates unless patient has a seizure disorder				
f	Avoid meperidine*				
g	Avoid chlorpropamide				
h	Avoid first- or second-generation short-acting calcium-channel blocker for patient with heart failure				
i	Avoid β-blocker if patient has asthma				

21)
ACOVE (C) – Education, Continuity, and Documentation

Indicator		Pass	Fail	NA	Cannot Determine
a	Documentation of ulcer or gastrointestinal bleeding history and, if present, justification for NSAID use				
b	Documentation of medications prescribed by other physicians*				
c	Patient apprised of risks when NSAID started*				
d	Postdischarge outpatient record documentation of inpatient medication changes – *transcribing of medication change onto NH IMR*				
e	Drug regimen review at least annually				
f	Outpatient ophthalmology drugs continued when patient is hospitalized*				
g	Documentation of indication for newly started therapy with medication				
h	Patient education about newly started therapy with medication*				

21)
ACOVE (D) – Medication monitoring

Indicator		Pass	Fail	NA	Cannot Determine
a	Dose adjustment or drug change by week 8 if no response to antidepressant therapy				
b	Dose adjustment or drug change by week 16 if inadequate antidepressant response				
c	Potassium and creatinine level check within 1 month after starting diuretic				
d	Potassium and creatinine level check within 1 month after starting ACE inhibitor				
e	INR checked within 4 days after starting warfarin				
f	INR checked at least every 6 weeks for patient receiving warfarin				
g	Follow-up on response to newly started long-term therapy with medication within 6 months				
h	Follow-up on newly started long-term therapy with medication at next visit with same provider				
i	Electrolytes checked at least annually for patient taking diuretic				

*not applicable in the nursing home setting / drug implicated is not available in Singapore
21A) f) LDL – low-density lipoprotein i) HRT – hormone replacement therapy j) ACE – angiotensin converting enzyme
21C) d) NH – nursing home, IMR – inpatient medical record

Section C – Past Unplanned Hospital Admission / Emergency Room Visits

22) **Total incidence of unplanned hospital admissions / ER visits [1st Jul 2007 – 30th Jun 2008]:**

23)
Details of incident hospital admission / ER visit

SN	Date	H	ER	Reasons for admission	Diagnoses (Discharge Summary)	Length of Stay	Duration between current discharge and next incident	[Prior to H/ER] Presence of			H / ER Discharge Rx	Possible Medication Implicated in H / ER	Prevent -ability
								TF	PEG	UC			

Section D – Laboratory Tests

24) **Total Number of Laboratory Test Requested [1st July 2007 – 30th Aug 2008]:**

25)
Details of Laboratory Test

SN	Date	Test Items	Reasons for Request	Actions Taken

PCNE Classification for DRPs (V5.01)

Primary Domains	Sub-domains
Problems	
[P1] Adverse reaction(s)	▪[P1.1] – side effect suffered (non-allergic) ▪[P1.2] – side effect suffered (allergic) ▪[P1.3] – toxic effects suffered
[P2] Drug choice problem	▪[P2.1] – inappropriate drug (not most appropriate for indication) ▪[P2.2] – inappropriate drug form (not most appropriate for indication) ▪[P2.3] Inappropriate duplication of therapeutic group or active ingredient ▪[P2.4] Contra-indication for drug (including pregnancy/breast feeding) ▪[P2.5] No clear indication for drug use ▪[P2.6] No drug prescribed but clear indication
[P3] Dosing problem	▪[P3.1] – drug dose too low or dosage regime not frequent enough ▪[P3.2] – drug dose too high or dosage regime too frequent ▪[P3.3] – duration of treatment too short ▪[P3.4] – duration of treatment too long
[P4] Drug use problem	▪[P4.1] – drug not taken/administered at all ▪[P4.2] – wrong drug taken/administered
[P5] Interactions	▪[P5.1] – potential interaction ▪[P5.2] – manifest interaction
[P6] Other	▪[P6.1] – patient dissatisfied with therapy despite taking drug(s) correctly ▪[P6.2] – insufficient awareness of health and diseases (possibly leading to future problems) ▪[P6.3] – unclear complaints. Further clarification necessary ▪[P6.4] – therapy failure (reason unknown)
Causes	
[C1] Drug/Dose selection	▪[C1.1] – inappropriate drug selection ▪[C1.2] – inappropriate dosage selection ▪[C1.3] – more cost-effective drug available ▪[C1.4] – pharmacokinetic problems, including ageing/deterioration in organ function and interactions ▪[C1.5] – synergistic/preventive drug required and not given ▪[C1.6] – deterioration/improvement of disease state ▪[C1.7] – new symptom or indication revealed/presented ▪[C1.8] – manifest side effect, no other cause
[C2] Drug use process	▪[C2.1] – inappropriate timing of administration and/or dosing intervals ▪[C2.2] drug underused/ under-administered ▪[C2.3] drug overused/ under-administered ▪[C2.4] therapeutic drug level not monitored ▪[C2.5] drug abused (unregulated overuse) ▪[C2.6] patient unable to use drug/form as directed
[C3] Information	▪[C3.1] – instructions for use/taking not known ▪[C3.2] – patient unaware of reason for drug treatment

	▪[C3.3] – patient has difficulties reading/understanding Patient Information Form/Leaflet ▪[C3.4] – patient unable to understand local language ▪[C3.5] – lack of communication between healthcare professionals
[C4] Patient/Psychological	▪[C4.1] – patient forgets to use/take drug ▪[C4.2] – patient has concerns with drugs ▪[C4.3] – patient suspects side effects ▪[C4.4] – patient unwilling to carry financial costs ▪[C4.5] – patient unwilling to bother physician ▪[C4.6] – patient unwilling to change drugs ▪[C4.7] – patient unwilling to adapt life-style ▪[C4.8] – burden of therapy ▪[C4.9] – treatment not in line with health beliefs ▪[C4.10] patient takes food that interacts with drugs
[C5] (Pharmacy) logistics	▪[C5.1] – prescribed drug not available (anymore) ▪[C5.2] – prescribing error (only in case of slip of the pen) ▪[C5.3] – dispensing error (wrong drug or dose dispensed)
[C6] Other	▪[C6.1] – other causes; specify ▪[C6.2] – no obvious cause

Patient demographics

Reference No: _____ Patient's initials: _____

Age (in year 20 _): _____ Gender: Male / Female

Race: Chinese / Malay / Indian / Others: _____ Date of collection: _____

Functional status: Category I / II / III / IV Bartel's Index: / 100

	Rating	A	B	C	D
1	**Mobility**	Independent (0)	Requires some assistance (Physical/assistive device) (3)	Requires frequent assistance/turning in bed (10)	Requires total physical assistance (16)
2	**Feeding**	Independent (0)	Requires some assistance (3)	Requires total assistance (10)	Tube feeding (16)
3	**Toileting**	Independent (0)	Requires some physical assistance (3)	Requires commodes/bed pans/urinals (8)	Incontinent and totally dependent (16)
4	**Personal grooming & hygiene**	Requires no assistance (0)	Requires assistance for some activities/supervision (2)	Requires assistance for all activities (4)	Bed/trolley bathing (6)
5	**Treatment**	Daily medication oral/topical (1)	- Daily medication oral/topical (1) - Injection (2)	- Daily medication oral/topical (1) - Injection (2) - Physiotherapy (4)	- Daily medication oral/topical (1) - Injection (2) - Physiotherapy (4) - Special procedures at (1)pt every 5 mins
6	**Social & emotional needs**	Nil (0)	Occasionally (1)	Often (2)	Always (3)
7	**Confusion** – Loses way – Loses things – Disorientated	Nil (0)	Occasionally [1–3 times a week] (3)	Often [4–6 times a week] (8)	Always [Daily] (10)
8	**Psychiatric problems** – Hallucination – Delusions – Anxiety – Depression	Nil (0)	Mild interference in life (2)	Moderate interference in life (4)	Severe interference in life (6)
9	**Behavioural problems** – Restless – Disruptive – Uncooperative	Nil (0)	Occasionally [1–3 times a week] (3)	Often [4–6 times a week] (10)	Always [Daily] (16)
Total score					
Category					

Category 1	< 6 points	**Category 3**	25 – 48 points
Category 2	7 – 24 points	**Category 4**	> 48 points

Height: _____ Weight: _____ Fall risk: Yes / No

Allergy: _____

Physical restrain: Yes / No (if yes, specify: _____)

Diagnosed dementia / Alzheimer's disease: Yes / No

Average no. of bowel movements per week (based on 4 weeks/28days): _____

Range of the no. of bowel movements per weeks (based on 4 weeks/28days): _____

Past Medical History:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Medication list:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Class of laxative used: Bulk / Osmotic / Stimulant / Others: _____

Dosage form: Tablet / Capsule / Syrup / Suppository / Enema / Others: _____

Product administered: _____

a) Indication	⌗ Appropriate _____ _____ _____	⌗ Inappropriate _____ _____ _____	⌗ Can't tell _____ _____ _____

b) Contraindications	⌗ Yes _____ _____ _____	⌗ No _____ _____ _____

c) Precautions	⌗ Yes _____ _____ _____	⌗ No _____ _____ _____

d) Side effects(s)/ Adverse reactions	⌗ Yes _____ _____ _____	⌗ No _____ _____ _____

e) Dosage	⌗ Appropriate _____ _____ _____	⌗ Inappropriate _____ _____ _____

f) Frequency	⌗ Appropriate _____ _____ _____	⌗ Inappropriate _____ _____ _____

g) Duration of use	⌗ Appropriate ○ Regular med – to be used regularly ○ PRN med – to be used only when necessary	⌗ Inappropriate _____ _____ _____	⌗ Can't tell _____ _____ _____

h) Route of administration	⌗ Appropriate _____ _____	⌗ Inappropriate _____ _____
i) Storage	⌗ Appropriate _____ _____	⌗ Inappropriate _____ _____

j) Monitoring	⌗ N.A	⌗ Appropriate _____ _____	⌗ Inappropriate _____ _____

k) Administration - Discrepancy from prescription	⌗ Yes _____ _____ _____	⌗ No _____ _____ _____

30 October 2011

Dr XX
The XX Medical Centre

Summary of Findings and Recommendations from
Medication Utilization Reviews & Resident Interviews on
Chronic Constipation & Laxative Use among Elderly Nursing Home Residents

Dear Dr XX,

This letter is intended to share with you, one of the physicians attending to residents at St Theresa's Home, on my research findings on the prevalence of chronic constipation among elderly nursing home residents and the use of laxatives.

Research Brief
Medication utilization reviews and face-to-face interviews with residents were conducted from September 2010 to March 2011. St Theresa's Home was one of the two study sites. (The following findings are based on both nursing homes.)

Findings from Medication Utilization Reviews
Reviews were conducted for 359 medication orders of laxatives for 310 elderly nursing home residents. Of these orders, 222 were prescribed for use on a regular basis and 137 were prescribed for use on an as-needed basis.
The observations of inappropriate use of laxatives include:

- suboptimal prescribed dose, dosing frequency and/or duration of use for 275 orders
- lack of monitoring for side effects and stool outcomes for 359 orders
- lack of documentation of indication for prescribing laxatives for 242 orders

Findings from Face-to-face Interviews with Resident
A total of 77 residents were interviewed.
The observations are:

- 33 residents were identified to have chronic constipation
  - 6 of these residents were not using any laxatives
- 53 residents were using laxatives
  - 26 of these residents were not identified to have chronic constipation
- 26 residents reported the presence of frequent watery stools, and described it as "inconvenient" and "undesirable".
  - 5 of these residents were not using any laxatives.

- 19 of these residents were using lactulose on a daily basis, 11 of whom were not identified to have chronic constipation.
- 2 of these residents were using senna on an as-needed basis, and daily basis respectively.

Arising from these observations, I wish to propose the following recommendations for your kind review and advice.

Recommendations
Regular review of residents who are/not using laxatives: - Nurses to use validated questionnaires to screen residents who may need laxatives & refer them to physicians for further assessment if necessary - Nurses to chart residents' bowel frequencies and stool types for review - Pharmacists to conduct regular medication reviews and report findings to nurses and doctors
Optimal dosing of lactulose: - Residents who are ambulant should not be given lactulose. - When lactulose is required for maintenance use, the dosing frequency should not exceed twice a day, and the total daily dose should not exceed 30 ml.
Duration of use of laxatives: - Residents who need to use stimulant laxatives/macrogol on a regular basis, must be assessed every 6 months for continuous use of the laxatives. - Administration schedule for PRN laxative is recommended: ➢ Lactulose Mixture: Administer if NBO x 2/7 consecutively, stop after BO x 3/7 consecutively ➢ Senna Tablet: Administer if NBO x 3/7 consecutively, stop after BO x 3/7 consecutively ➢ Suppositories & enemas: Administer 1 dose if NBO x 4/7 consecutively
Monitor efficacy & adverse-effects of laxatives: - Use of lactulose should not produce an effect of more than 2-3 soft stools per day
Patient education - Talks on constipation, use and effects of laxatives and desired outcomes of treatment will help residents and alleviate common anxiety about bowel outputs.

Please contact me if you wish to discuss further on these medication utilization review and resident interview findings. Thank you.

Warmest Regards,

Ms Yap Kai Zhen
phaykz@nus.edu.sg
Clinical Pharmacist and PhD Student
Department of Pharmacy
National University of Singapore

cc. PhD Supervisors – Assoc Prof Chan Sui Yung and Asst Prof Joyce Lee

Physician-specific recommendations from iPURGE– Physicians' Feedback Form

Recommendations	Physician's Response
Regular review of residents who are/not using laxatives: - Nurses to use validated questionnaires to screen residents who may need laxatives & refer them to physicians for further assessment if necessary	- **Agree / Neutral / Disagree** Comments:
- Nurses to chart residents' bowel frequencies and stool types for review	- **Agree / Neutral / Disagree** Comments:
- Pharmacists to conduct regular medication reviews and report findings to nurses and doctors	- **Agree / Neutral / Disagree** Comments:
Optimal dosing of lactulose: - Residents who are ambulant should not be given lactulose.	- **Agree / Neutral / Disagree** Comments:
- When lactulose is required for maintenance use, the dosing frequency should not exceed twice a day, and the total daily dose should not exceed 30 ml.	- **Agree / Neutral / Disagree** Comments:
Duration of use of laxatives: - Residents who need to use stimulant laxatives/macrogol on a regular basis, must be assessed every 6 months for continuous use of the laxatives.	- **Agree / Neutral / Disagree** Comments:
- Administration schedule for PRN laxative is recommended: ➢ Lactulose Mixture: Administer if NBO x 2/7 consecutively, stop after BO x 3/7 consecutively ➢ Senna Tablet: Administer if NBO x 3/7 consecutively, stop after BO x 3/7 consecutively ➢ Suppositories & enemas: Administer 1 dose if NBO x 4/7 consecutively	- **Agree / Neutral / Disagree** Comments:
Monitor efficacy & adverse-effects of laxatives: - Use of lactulose should not produce an effect of more than 2-3 soft stools per day	- **Agree / Neutral / Disagree** Comments:
Patient education - Talks on constipation, use and effects of laxatives and desired outcomes of treatment will help residents and alleviate common anxiety about bowel outputs.	- **Agree / Neutral / Disagree** Comments:

Algorithms for Appropriate Laxative Use (AALU)

AALU (1): Was "when-needed" laxative used appropriately?

AALU: Part (I) Steps	Definitions of Domain Appropriateness	Significance	Description of Potentially Inappropriate Laxative Use	Remedial Actions for Failed Criterion
I	If a laxative was prescribed for use on a "when-needed" basis, daily monitoring of the resident's bowel movement frequency and stool consistency should be present. Classification of stool consistency may be based on any widely accepted scale, such as the Bristol Stool Chart.	Monitoring serves as an objective method to identify the indication for laxative use, especially among residents who are more reserved and/or have difficulty verbalising their needs. It also serves as a method to evaluate effectiveness and screen for adverse effects of laxative use.	Absence of monitoring may result in an under-identification of needs. This may lead to an under-use of the laxative, and predispose the resident to complications such as impacted stools and mechanical intestinal obstruction. Absence of monitoring of laxative use outcomes may lead to 1) over-use of laxatives, when there is no true indication for use; 2) under-use of laxatives, when desired clinical outcomes is not achieved; and 3) mis-use of laxatives, when adverse effects such as diarrhoea is not corrected.	Start daily monitoring and formal documentation of the resident's bowel frequency and stool consistency as soon as possible.
II	"When-needed" laxatives are indicated for relieving occasional constipation. <u>Recommended indications</u> (based on outcomes of bowel frequency and stool type monitoring) for "as-needed" administration of the following laxatives are: • Lactulose – no bowel movement has occurred for 2 consecutive days. • Senna & bisacodyl (oral) – when no bowel movement has occurred for 3 consecutive days. • Suppositories & enemas – when no bowel movement has occurred for 4 consecutive days.	Chronic constipation can be objectively defined as having <3 bowel movements per week. The recommended indications to administer "as-needed" laxatives are therefore based on the time needed to produce the desired pharmacological response, with the aim to produce a minimal of 3 bowel movements within a week of continual use.	Administering the laxative in the absence of constipation constitutes an over-use. This adds unnecessary cost to the resident, and may predispose the resident to avoidable adverse effects such as watery stools and abnormal increase in stool frequency. Not administering the laxative despite the presence of constipation constitutes an under-use.	
	Laxatives can be administered to residents for the purpose of relieving constipation symptoms per resident's request. However, appropriate assessment and counselling should be given at least once, prior to administering the laxative. <u>Appropriate assessment may include:</u> • Documenting the type and severity of constipation symptoms to provide a basis for evaluating treatment outcomes • Attempting to identify and correct (if possible) the contributing factors leading to constipation <u>Appropriate counselling may include:</u> • Educating the resident on non-laxative methods to relieve constipation and providing opportunities for the use of such methods • Educate the resident about the laxative's mechanism of action, appropriate indication of use, desired clinical outcomes to be expected, and the possible side-effects • Encourage the resident to report unsatisfactory clinical outcomes and side-effects from laxative use	Constipation may also be defined by the presence of subjective symptoms of constipation, such as abdominal bloating, difficulty passing bowels, hard stools, and incomplete bowel movement. These symptoms may be present without any decrease in bowel frequency.	Lack of knowledge and/or being fearful of becoming constipated may induce some residents to request for laxatives as a prophylaxis, leading to potential over-use.	Appropriate assessment and counselling should be provided to identify any myths and misconceptions held by residents towards laxative use. Knowledge and support to practice non-laxative methods to prevent constipation could then be provided to help reduce any psychological reliance on laxative, and reduce the over-use.

AALU: Part (I) Steps	Definitions of Domain Appropriateness	Significance	Description of Potentially Inappropriate Laxative Use	Remedial Actions for Failed Criterion
III	For relieving acute constipation, only one laxative should be administered at any time. If the resident was already using a laxative, which did not produce desirable outcomes, it should be discontinued upon starting the new laxative. Exceptions to this included: • Combinations for treatment of opioid-induced constipation that do not respond with one laxative • Combinations of senna with fibre-supplements	There is no evidence to support the use of more than one laxative to relieve constipation other than the exceptions stated.	Use of more than one laxative at any time without appropriate evaluation of use outcomes constitutes to potential over-use.	Reassess constipation symptoms and monitor outcomes appropriately monitoring before deciding to add or switch to a second laxative. Discontinue laxatives before starting the use of a new laxative
	When considering switching laxatives, use outcomes of the previous laxative should be evaluated at an appropriate time after starting use: • Lactulose –24-48 hours. • Senna & bisacodyl (oral) – 6-10 hours. • Suppositories & enemas – when no bowel movement has occurred for 4 consecutive days.	Some laxatives produce gradual rather than immediate results. Hence, the time needed to produce the desired pharmacological response should be considered when evaluating laxative use.		
IV & V	Laxatives prescribed for "when-needed" use should be stopped when improvement in bowel output was achieved. Recommended improvements (to prompt a discontinuation of laxative use are): • Lactulose – when bowel movement has occurred for 3 consecutive days. • Senna & bisacodyl (oral) – when bowel movement has occurred for 3 consecutive days. • Suppositories & enemas – when bowels has been cleared If laxatives need to be continued for more than a week, the physician should be alerted, especially if the maximum dos of laxative had been tried, to assess the resident for the underlying causes for the change in bowel functions, and review laxative prescription to reflect "regular" use if necessary.	Changes in bowel movements that do not respond to the maximum prescribed dose of laxatives should be assessed for underlying causes related to new onset of diseases or co-morbidities, medication-related problems, or chronic constipation that may require laxative use on a "regular" basis.	Prolonged duration of laxative use without clear indications or assessment (and removal) of underlying reversible causes constitutes to potential over-use	When desirable improvement in bowel output was not achieved with the administration of non-maximum prescribed doses of the laxative, the maximum prescribed doses should be administered and outcomes reassessed accordingly.

NUS Pharmacy Thesis

AALU (2): Was the "regular" laxative prescribed appropriately?

AALU: Part (II) Step	Definitions of Domain Appropriateness	Significance	Description of Potentially Inappropriate Laxative Use	Remedial Actions for Failed Criterion
I	Continuing laxative use daily for more than 2 weeks was considered as use on a "regular" basis. Residents who had been prescribed laxatives on a regular basis should be reassessed at least once every 3-monthly for the need to adjust or continue the laxative use.	The Ministry of Health guidelines on medication use stipulated for medication reviews to be conducted for all residents at least once every 6-monthly, and resident assessments at least once every 3-monthly.	Absence of reassessment may perpetuate inappropriate laxative use and sub-optimized resident outcomes, leading to over- , under- or mis-prescribing of laxatives.	Reminders for reassessing residents should be provided to physicians.
II	If the resident was not bed-bound, laxatives should be initiated for relieving chronic constipation only when non-pharmacological interventions do not produce desirable outcomes of bowel movements in at least 3 days per week. The presence of medical reasons that excludes the residents for a trial of non-pharmacological interventions are acceptable, and should be clearly documented.	Although evidence for specific non-pharmacological interventions had been equivocal, most clinical guidelines for constipation management advocates for a trial of interventions such as increasing hydration and dietary fiber intake before initiating treatment with laxatives, especially when these interventions are feasible.	Residents who may benefit from a trial of non-pharmacological interventions but were not offered any may have been over-prescribed with laxatives.	Trial of resident-appropriate non-pharmacological interventions to reduce the need for laxatives.
III	Recommended indications for using laxatives on a "regular" basis included: • Chronic constipation –screened using "Chronic constipation & symptom severity" questions (refer to Figure 3.2) and/or confirmed with physician assessment. • Bowel frequency of <3 days per week for at least 3 months • Constipation prophylaxis when using opioids for palliative care purposes lasting more than 2 weeks. If an indication is present, only one "regular" laxative should be used at a time. Exceptions may include: • Combinations for treatment of opioid-induced constipation that do not respond with one laxative • Combinations of senna with fibre-supplements	The "Chronic constipation & symptom severity" questionnaire may serve as a reliable screening tool for chronic constipation and its symptoms; for residents who have communication difficulties, low bowel frequency could be used to screen for the presence of indications. However, diagnoses requires confirmation by the physician. There is no evidence for supporting the use of more than laxative other than the exceptions stated.	"Regular" use of laxatives without proper indications constitutes over-prescribing.	Assess for indications for "regular" use of laxatives, prescribe laxatives for use "when-needed" if no clear indication is present.
IV	The laxative choice should be without contraindications (based on drug references such as the Geriatric Dosage Handbook).	Use of laxatives in the presence of contraindications may lead to serious adverse drug events.	Prescribing a laxative despite presence of contraindications constitutes a mis-prescribing.	Choose an alternative pharmacological agent that is patient-specific.
V	Precautions for use of the chosen laxatives should be considered. Where appropriate, precautionary monitoring should be ordered or put in place.	Use of laxatives without regards for the warning/precaution for use may lead to adverse drug events.	Absence of appropriate precautionary monitoring constitutes a mis-prescribing.	Order for the appropriate precautionary monitoring to be in place.
VI	The dose and dosing frequency should be within that recommended in the drug references (such as the Geriatric Dosage Handbook) for "regular" use.	Doses and dosing frequency that exceed the recommended may predispose the resident to unnecessary side effects. Doses and dosing frequency that is under the recommended may not produce satisfactory outcomes.	Doses and dosing frequency that deviates from the recommended may constitute to over- or under-prescribing.	Adjust the doses and dosing frequency to be within the recommendations.

AALU: Part (II) Step	Definitions of Domain Appropriateness	Significance	Description of Potentially Inappropriate Laxative Use	Remedial Actions for Failed Criterion
VII	Residents' bowel output should be monitored daily for stool type and frequency.	Adequate monitoring on laxative use outcomes provides valuable information for optimization of laxative regimen, especially for those residents who have communication difficulties.	Absence of monitoring may not allow appropriate decisions to be made during resident reassessment and medication reviews, and may perpetuate over-, under- or mis-prescribing.	Prescribers should order for daily monitoring of bowel output for residents prescribed with laxatives.
VIII	Desirable outcomes from "regular" laxative use should produce a minimum bowel movements of 3 days per week.	Therapeutically desirable outcomes can be defined as the acceptable minimal bowel frequency reported in epidemiological studies. Resident satisfaction with the prescribed laxative is related to its ability to produce bowel movements . Ensuring a minimum desirable bowel frequency may prevent adverse outcomes such as stool impaction, and bring about resident satisfaction (adding to prescribing appropriateness).	Prescribed laxatives that do not produce or maintain the minimum therapeutically desirable bowel frequency constitute to under- or mis-prescribing.	Adjust the doses and dosing frequency appropriately to produce/maintain minimum bowel movements of 3 days per week. Switch to an alternative pharmacological agent if the dose prescribed is already at the recommended maximum.
IX	The prescribed laxative should not produce undesirable adverse effects that may negatively impact residents' quality of life or cause residents to be unsatisfied with the pharmacotherapy. Common undesirable adverse effects included: • bowel frequency > 3 times a day • frequent watery stools (e.g. Type 7 on Bristol Stool Chart)	Laxative use that produces minimal or no undesirable adverse effects "maximized net individual health gains" and is thus appropriate. Resident satisfaction with the prescribed laxative is related to an absence of undesirable adverse effects such as increased bowel frequency > 3 times a day and/or the onset of watery stools. Ensuring this may prevent potential adverse drug events such as electrolyte imbalance, and bring about resident satisfaction (adding to prescribing appropriateness).	Laxative use that produces undesirable adverse effects constitute to over- or mis-prescribing.	Reduce the dose and/or dosing frequency of laxatives to one that produces desirable therapeutic outcomes with minimal/no diarrhea-like adverse effects.

(NUS Thesis Pharmacy)

Date of Training (2011)		**Duration of Session**	**Session Objectives**	**Content Outline**
Prior to Week '1'	11th Feb	1 hour	Introduction to PUM	Understand: - Role of nursing staff in the management of BPSD - Use of psychotropics in managing BPSD: o pharmacotherapy brief of all common psychotropics used o issues of concern over antipsychotic use - Significance of monitoring to improve appropriate antipsychotic use - Aim and objectives of PUM Gain ability to perform PUM - know when and how to observe, recognize, and document: o different BPSD types and symptom severity o therapeutic response to psychotropic use o psychotropic side effects - protocol for PUM intervention Case discussions
	14th – 27th Feb	2 weeks	Pilot the PUM form	Practice observation skills and documentation on PUM form
Week '1'	*28th Feb*	*Implementation of PUM*		
Week '4'	21st Mar	½ hour	Review	Case discussions
Week '8'	18th Apr	½ hour	Review and further learning	Case discussions Understand the brief etiology, clinical significance on falls, and know how to assess, recognize and manage drug-induced postural hypotension
Week '12'	16th May	1hour	Review and further learning	Case discussions Understand the brief etiology, clinical significance on falls, and know how to assess, recognize and manage extra-pyramidal side effects (EPSE)

Training for Psychotropic Use Monitoring (PUM)

Introduction Session

Significance of "**monitoring**" in "TREA**M**" for appropriate psychotropic (antipsychotic) use in managing BPSD

T – Target Symptom/s

- Identify the most pertinent symptom
- Identify the underlying cause of the pertinent symptom
- Identify the target symptom **(PUM's criteria for MBTS)** to ensure appropriate psychotropic medication use
  - E.g. antidepressants for depressive symptoms
  - E.g. anxiolytics for anxiety symptoms and sleep disturbances
  - E.g. antipsychotics for symptoms of psychosis
  - E.g. anticonvulsants for symptoms of elation

R – Reversible Causes

- Identify and resolve the (underlying) causes that are reversible
  - Pain/physical discomfort
  - Medical illness/medication
  - Stress (psychological/environmental)

E – Environment

- Identify environmental triggers
- Provide an optimal environment that can
  - Limit access to unsafe places
  - Limit aggravating situations

A – Agents

- When necessary
  - Antidepressants
  - Anxiolytics
  - Antipsychotics →
  - Anticonvulsants

QUESTIONS TO BE ANSWERED ABOUT ANTIPSYCHOTIC USE

PRE-USE: decision to start use
REASON FOR USE?
POST-USE: decision to continue/increase /decrease /stop use
EFFECTIVENESS?
SIDE EFFECTS?
ADVERSE CONSEQUENCES?

M – Monitoring

- **PUM** for antipsychotic use outcomes
  - Therapeutic effectiveness
  - Drug-induced side effects / adverse consequences

Reference:
1. American Psychiatric Association. Practice guideline for the treatment of patients with Alzheimer's disease and other dementias. 2007; http://psychiatryonline.org/guidelines.aspx, April 2012.
2. MOH Clinical Practice Guidelines. Dementia. 2007; http://www.moh.gov.sg/content/moh_web/healthprofessionalsportal/doctors/guidelines/cpg_medical/2007/cpgmed_dementia.html, April 2012.

Training for Psychotropic Use Monitoring (PUM)
Review Session 2

Postural Hypotension

= decrease of ≥ 20mmHg of systolic BP, after moving from supine to standing/sitting position (accompanied with increase in HR → **drug-induced**)

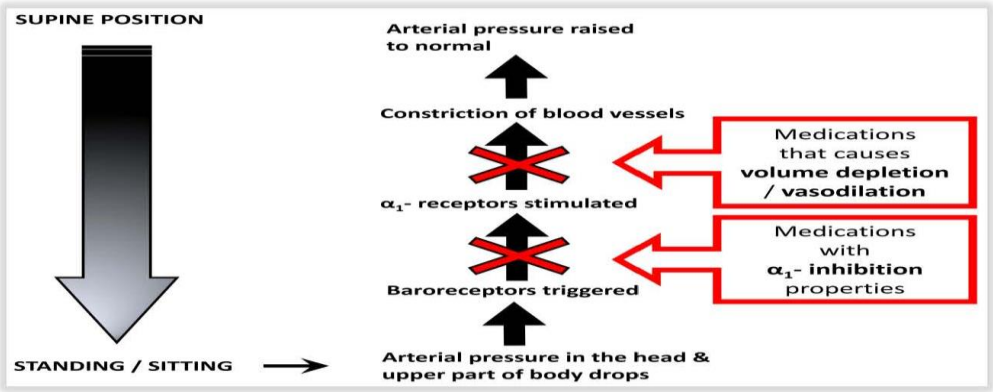


Figure 1. Brief etiology of drug-induced postural hypotension

Antipsychotics
- Clozapine ++++
- Chlorpromazine +++
- Olanzapine +++
- Quetiapine ++
- Risperidone++
- Flupentixol ++
- Zuclopentixol ++
- Trifluoperazine ++

Antidepressants
- Amitriptyline
- Nortriptyline

α1-selective Blockers - used commonly used in BPH
- Terazosin

Antihypertensives / Diuretics - usually more prominent during the first 1-2 weeks after initiation or increase in dose; especially if combination of antihypertensive is present.
Particularly:
- Enalapril / Lisinopril
- Hydrochlorothiazide / Frusemide

Antiparkinson Medications
- Levodopa – (high doses)
- Bromocriptine
- Seligiline

Reference:
1. *Micromedex® Healthcare Series* [intranet database]. Version 5.1. Greenwood Village, Colo: Thomson Reuters (Healthcare) Inc.
2. British National Formulary 61, March 2011
3. Applied Therapeutics. The Clinical Use of Drugs. 8th Edition.

Training for Psychotropic Use Monitoring (PUM)

Review Session 3

Extrapyramidal Side Effects (EPSE)

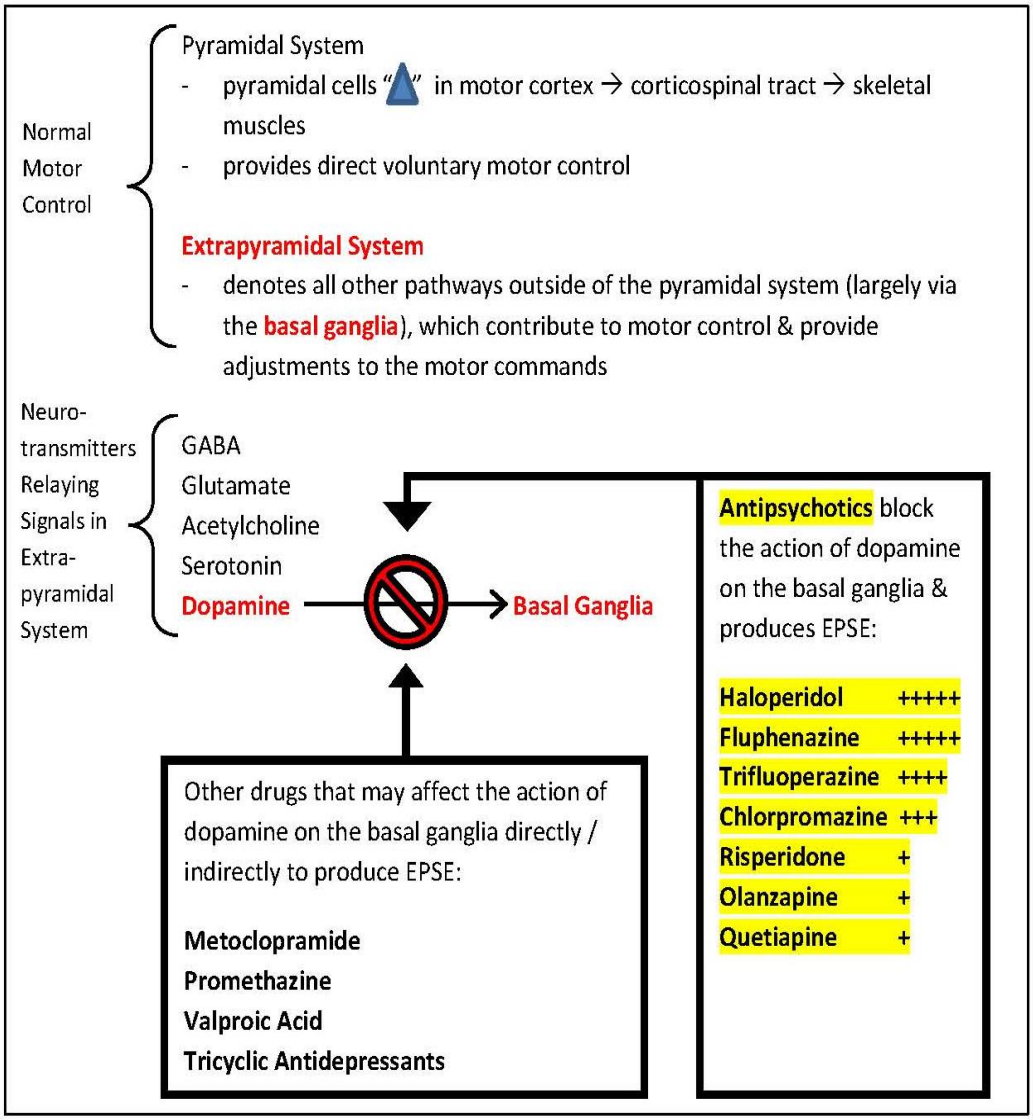


Figure 1. Etiology of EPSE (drug-induced movement disorders)

"...the presence of minimal extrapyramidal side effects seem to be associated with therapeutic improvement, excess extrapyramidal effects with less improvement." [5]

Monitoring for onset of EPSE may influence physician decisions to decrease, change or discontinue drugs to control BPSD, in order to avoid drug-related adverse consequences.

References:

1. Textbook of Medical Physiology. 9th Edition.
2. Applied Therapeutics. The Clinical Use of Drugs. 8th Edition.
3. *Micromedex® Healthcare Series* [intranet database]. Version 5.1. Greenwood Village, Colo: Thomson Reuters (Healthcare) Inc.
4. Extrapyramidal symptoms and antidepressant drugs: neuropharmacological aspects of a frequent interaction in the elderly. Molecular Psychiatry 2001;6:134-142
5. A rating scale for extrapyramidal side effects. Acta Psychiatrica Scandinavica 1970; Suppl 212:11-19

Symptom Classifications

Parkinsonism

- Tremor (involuntary rhythmic oscillation along an axis when at rest)
  - "pill rolling" tremor (between fingers and thumb)
  - may also involve limbs, head, lips, jaw/chin, and tongue
- Impaired gait/posture
  - diminished arm swing when walking
  - shuffling gait
  - freezing on turning
  - head flexed
  - stiff/stooped posture
- Postural instability
  - inability to maintain balance
- Rigidity (resistance to passive movements)
  - "lead-pipe" rigidity
  - "cogwheeling"

Fall Risks

- Reduced facial expression / speech
  (physical condition caused by rigidity and bradykinesia of facial muscles)
  - less frequent smiling, blinking, or spontaneous eye movements
  - difficulty frowning, slurred speech, lips parted (may cause salivation)
  - "staring expression"
- Bradykinesia/hypokinesia
  - slow voluntary movements

Akathisia

('restlessness' with the urge to move)
(e.g. restless movement of 1 extremity, fidgeting, changing position, rocking while standing or sitting, lifting feet as if marching on one spot, crossing & uncrossing legs while sitting, inability to sit down for long periods without pacing back)
(NB: need to distinguish from 'restless' due to anxiety or insomnia)

Dystonia

(sustained muscle contractions)
(may affect tongue, jaw – clenching/bruxism, eye – blepharospasm/oculogyration, face – grimacing, larynx – hoarseness/choked voice, pharynx, limbs, trunk – bending, neck – turning)

Dyskinesia

(movements that are repetitive, purposeless & involuntary; usually involves bucco-linguo-masticatory region)
(e.g. jaw – chewing/biting, tongue – protrusion/fly catching, lips – smacking/pursing/puckering, finger – "playing invisible guitar", may also involve arms, legs, and trunks)
(NB: Tardive dyskinesia is irreversible)

References:

1. A rating scale for extrapyramidal side effects. Acta Psychiatrica Scandinavica 1970; Suppl 212:11-19
2. Manual for the extrapyramidal symptom rating scale (ESRS). Schizophrenia Research 2005;76:247-265
3. Scales to assess efficacy and safety of pharmacologic agents in the treatment of behavioural and psychological symptoms of dementia. Journal of Clinical Psychiatry 2001;62 (suppl 21):19-22

Name: _____ * SN / EN / NA / HA Ward: _____ Date of survey: _____

Number of years working in a nursing home: _____

Number of years with experience in managing BPSD: _____

* Managing BPSD (behavioural and psychological symptoms of dementia)

The 'project' was conducted at SWAMI Home from 28th February 2011

	Not At All	Rarely	Some of theTime	Most of the Time	Always
1) How often did you have to manage BPSD among residents with dementia in your ward...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
2) How often did you look out/monitor for side effects of medications prescribed to control for BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4

NB: Always = More than once daily
Most of the time = Everyday, but not more than once a day
Some of the time = More than once a week, but not everyday
Rarely = Less than once a week

	Not At All	A Little Bit	Moderately	Quite A Bit	Extremely
3) How well could you manage BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
4) Did you feel stressful when managing BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
5) How well would you rate your knowledge on BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
6) How much did you gain from the project-related training in terms of knowledge on BPSD?	0	1	2	3	4
7) Would/Did the increase in knowledge on BPSD help you to manage BPSD better?	0	1	2	3	4
8) Would/Did the increase in knowledge on BPSD decrease your stress when managing BPSD?	0	1	2	3	4
9) Would/Did the increase in knowledge on BPSD change your attitude towards the management of BPSD?	* yes / no If yes, how? _____				
10) How well could you classify BPSD by the different domains listed in the sample monitoring form...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
11) Would/Did documentation of BPSD using the monitoring form help you to manage BPSD better?	0	1	2	3	4
12) Would/Did the documentation of BPSD using the monitoring form change your attitude towards the management of BPSD?	* yes / no If yes, how? _____				

*** Circle the appropriate option**

* Managing BPSD (behavioural and psychological symptoms of dementia)	Not At All	A Little Bit	Moderately	Quite A Bit	Extremely
13) How well would you rate your knowledge on side effects of medications prescribed to control BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
14) How well would you rate your awareness to look out/monitor for side effects of medications prescribed to control BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
15) How well would you rate your ability in recognizing side effects of medications prescribed to control BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
16) How confident are you to correctly identify side effects of medications prescribed to control BPSD...					
a) ... **before** the project?	0	1	2	3	4
b) ... **during** the project?	0	1	2	3	4
17) How much did you gain from the project-related training in terms of knowledge on side effects of medications prescribed to control BPSD?	0	1	2	3	4
18) Would/Did the increase in knowledge on side effects of medications prescribed to control BPSD help increase your awareness to look out/monitor for side effects?	0	1	2	3	4
19) Would/Did the increase in knowledge on side effects of medications prescribed to control BPSD help increase your ability in recognizing side effects?	0	1	2	3	4
20) Would/Did the increase in knowledge on side effects of medications prescribed to control BPSD help increase your confidence in correctly identifying side effects?	0	1	2	3	4
21) Would/Did setting a schedule to document side effects on the monitoring form increase your awareness to monitor for side effects?	0	1	2	3	4
22) Would/Did the increase in knowledge on side effects of medications change the way you manage BPSD?	* yes / no If yes, how? _____				
23) Would/Did the increase in knowledge on side effects of medications change your attitude towards the management of BPSD?	* yes / no If yes, how? _____				
24) Would you wish to receive/recommend the training and the use of the monitoring form to other nurses who need to manage nursing home residents with BPSD?	0	1	2	3	4

* **Circle the appropriate option**

IMPLEMENTING A MONITORING TOOL IN THE NURSING HOME TO AID PRESCRIBING OF PSYCHOTROPIC AGENTS IN RESIDENTS WITH DEMENTIA
- Physician Survey Form

Name:_____ Qualifications:_____ Medical Specialty:_____ Date of survey:_____

Feedback on Effects of Implementing the Use of the Psychogeriatric Monitoring Tool among Care Staff

0. Perception of General Trends

'During' the study (compared to 'before')...	Decreased a lot -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased a lot 3
0.1 Were there **changes in the level of disruptions/stress in caregiving** reported by the care staff due to BPSD observed among residents with dementia...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
0.2 Were there **changes in the side-effects of psychotropics** observed among residents with dementia...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							

Time period 'before' the study is from 13th September 2010 to 27th February 2011
Time period 'during' the study is from 28th February 2011 to 14th August 2011

'During' the study (compared to 'before')...	Decreased a lot -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased a lot 3
0.3.1 Were there **changes in the need to prescribe antipsychotics** to manage BPSD among residents with dementia...							
a) in the general wards?	-3	-2	-1	0	1	2	3
b) in the dementia ward?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
0.3.2 Were there **changes in the need to prescribe antidepressants** to manage BPSD among residents with dementia...							
a) in the general wards?	-3	-2	-1	0	1	2	3
b) in the dementia ward?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
0.3.3 Were there **changes in the need to prescribe mood stabilizers** to manage BPSD among residents with dementia...							
a) in the general wards?	-3	-2	-1	0	1	2	3
b) in the dementia ward?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
0.3.4 Were there **changes in the need to prescribe benzodiazepines** to manage BPSD among residents with dementia...							
a) in the general wards?	-3	-2	-1	0	1	2	3
b) in the dementia ward?	-3	-2	-1	0	1	2	3
Please elaborate:_____							

Time period 'before' the study is from 13th September 2010 to 27th February 2011
Time period 'during' the study is from 28th February 2011 to 14th August 2011

Feedback on Effects of Implementing the Use of the Psychogeriatric Monitoring Tool among Care Staff

1. Monitoring Changes in BPSD by Care Staff

'During' the study (compared to 'before')...	Decreased a lot -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased a lot 3
1.1 Were there **changes in the quality of feedback** provided by the care staff when assisting during consultation, with regards to BPSD...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
1.2 Were there **changes in the usefulness of feedback** by the care staff when assisting during consultation, with regards to BPSD...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
1.3 How did the changes in the quality of feedback affect the usefulness of the feedback during your consultation, with regards to BPSD...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							
1.4 Did you perceive any **changes in the knowledge (on BPSD)** among the care staff, based on the quality of their feedback when assisting during your consultation							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____							

Time period 'before' the study is from 13th September 2010 to 27th February 2011
Time period 'during' the study is from 28th February 2011 to 14th August 2011

Feedback on Effects of Implementing the Use of the Psychogeriatric Monitoring Tool among Care Staff

2. Monitoring Side-effects of Psychotropic Agents by Care Staff

'During' the study (compared to 'before')...	Decreased quite a bit -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased quite a bit 3
2.1 Were there **changes in the frequency of reporting side-effects** of psychotropics by the care staff when assisting during consultation...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____ _____							
2.2 Were there **changes in the frequency of correctly identifying side-effects** of psychotropics by the care staff when assisting during consultation...							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____ _____							
2.3 Did you perceive any **changes in the knowledge (on medication side-effects)** among the care staff, based on the quality of their feedback when assisting during your consultation							
a) in the **general wards**?	-3	-2	-1	0	1	2	3
b) in the **dementia ward**?	-3	-2	-1	0	1	2	3
Please elaborate:_____ _____							

Time period 'before' the study is from 13th September 2010 to 27th February 2011
Time period 'during' the study is from 28th February 2011 to 14th August 2011

Feedback on Effects of Implementing the Use of the Psychogeriatric Monitoring Tool among Care Staff

3. Perception of Factors that may Influence Trends of Prescribing Psychotropic Agents

How will an increase in the staff-reported level of disruptions/stress in caregiving...	Decreased quite a bit -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased quite a bit 3
3.1.1 ...affect your likelihood to prescribe antipsychotics to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.1.2 ...affect your likelihood to prescribe antidepressants to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.1.3 ...affect your likelihood to prescribe mood stabilizers to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.1.4 ...affect your likelihood to prescribe benzodiazepines to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3

How will a decrease in the staff-reported level of disruptions/stress in caregiving...	Decreased quite a bit -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased quite a bit 3
3.2.1 ...affect your likelihood to prescribe antipsychotics to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.2.2 ...affect your likelihood to prescribe antidepressants to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.2.3 ...affect your likelihood to prescribe mood stabilizers to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.2.4 ...affect your likelihood to prescribe benzodiazepines to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3

How will an increase in observed side-effects of...	Decreased quite a bit -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased quite a bit 3
3.3.1 ...antipsychotics affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.3.2 ...antidepressants affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.3.3 ...mood stabilizers affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.3.4 ...benzodiazepines affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3

How will a decrease in observed side-effects of...	Decreased quite a bit -3	Decreased moderately -2	Decreased a little bit -1	No Change 0	Increased a little bit 1	Increased moderately 2	Increased quite a bit 3
3.4.1 ...antipsychotics affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.4.2 ...antidepressants affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.4.3 ...mood stabilizers affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3
3.4.4 ...benzodiazepines affect your likelihood to prescribe the agent to manage the reported BPSD? Please elaborate:_____	-3	-2	-1	0	1	2	3

Elderly Cognitive Assessment Questionnaire

		Score 1 for Correct answer
MEMORY		
1. I want you to remember this number. Can you repeat after me (e.g. 4517) I shall be testing you again in 10 mins.		_____
2. How old are you?		_____
3. When is your birthday?		_____
or In what year were you born?		_____
ORIENTATION – INFORMATION		
4. What day of the week is today?		_____
What is the date today?		
5.	day	_____
6.	month	_____
7.	year	_____
8. What is this place called (e.g. clinic, hospital)? No necessity to give name of place.		_____
9. What is his/her job (e.g. nurse, doctor)?		_____
MEMORY - RECALL		
10. Can you recall the number again?		_____
	Total:	_____

SCORE

0-4 Probable cases 5-6 Borderline case 7> Normal

LS Life Satisfaction / 生活满足度 / Kepuasan Hidup

LS1 Do you feel that your life at present is:
你觉得你现在的生活
Perasaan kehidupan anda sekarang

☐ 1. very interesting	非常有趣	Sangat bermakna
☐ 2. fairly interesting	有趣	Bermakna
☐ 3. neither interesting nor boring	不好说	Sederhana
☐ 4. fairly boring	没意思	Kebosanan
☐ 5. Very boring	很没意思	Sangat kebosanan

LS2 Do you feel that your life at present is:
你感觉你现在的生活
Perasaan kehidupan anda sekarang

☐ 1. very happy	非常幸福	Sangat gembira
☐ 2. fairly happy	幸福	Gembira
☐ 3. neither happy nor sad	一般	Sederhana
☐ 4. fairly sad	惨	Dukacita
☐ 5. Very sad	非常惨	Sangat dukacita

LS3 Do you feel that your life at present is:
你感觉你现在的生活
Perasaan kehidupan anda sekarang

☐ 1. very easy	非常轻松	Sangat senang
☐ 2. fairly easy	轻松	Senang
☐ 3. neither easy nor hard	平淡	Sederhana
☐ 4. fairly hard	艰难	Susah
☐ 5. Very hard	非常艰难	Sangat susah

LS4 Do you feel that at the present moment you are:
你觉得你现在的心情如何？
Perasaan kehidupan anda sekarang

☐ 1. not at all lonely	一点也不孤独	Tidak kesunyian
☐ 2. fairly lonely	孤独	Kesunyian
☐ 3. Very lonely	很孤独	Sangat kesunyian
☐ 4. cannot say	平淡	Sederhana

In-game GEQ

Please indicate how you felt while playing the game for each of the items, on the following scale:

Not at all	Slightly	Moderately	Fairly	Extremely
0	1	2	3	4

Statement	Number
1. I was interested in the game's story	
2. I felt successful	
3. I felt bored	
4. I found it impressive	
5. I forgot everything around me	
6. I felt frustrated	
7. I found it tiresome	
8. I felt irritable	
9. I felt skilful	
10. I felt completely absorbed	
11. I felt content	
12. I felt challenged	
13. I felt stimulated	
14. I felt good	

Please check: Did you write a number in after of each statement?

Scoring Guidelines: GEQ In-Game version

The In-game Module consists of seven components, identical to the core Module. However, only two items are used for every component. The items for each are listed below. Components scores are computed as the average value of its items.

Competence: Items 2 and 9

Sensory and Imaginative Immersion: Items 1 and 4

Flow: Items 5 and 10

Tension: Items 6 and 8

Challenge: Items 12 and 13

Negative Affect: Items 3 and 7

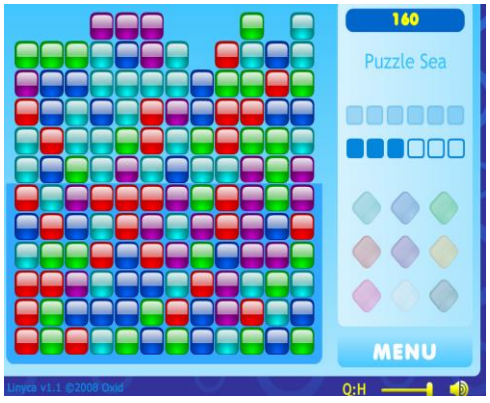
Positive Affect: Items 11 and 14

Short-listed Computer Games

Bubble Pandy

This is a puzzle bubble shooter game that requires players to shoot bubbles of similar colours into groups of three or more in order to make them disappear. The objective of this 12-level game is to burst all the bubbles before they grow towards and touch the surrounding wall. [Available at: http://juegosya.org/bubble-pandy/] Last accessed: August 2012.

Linyca

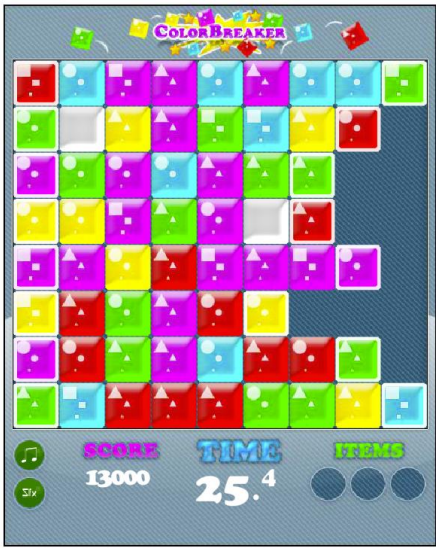


This is a relatively easy to play puzzle-type game in which the goal is to remove as many rows of coloured blocks as possible, by clicking on blocks with a matching colour in the same row; clicking on blocks without a match results in a deduction of points. Each successful blocks removed will trigger a musical tone that corresponds to its color. The resulting melody is then played back when the game is completed. [Available at: http://www.freepuzzlegames.biz/game/613/Linyca.html] Last accessed: August 2012.

Jungle Tower

This game requires the player to balance dropping blocks on a plank. The objective is to build a tower of blocks as high as possible without tipping the plank or letting any blocks fall off. [Available at: http://www.kingofgames.net/free-games/Jungle_Tower_2_The_Balancer] Last accessed: August 2012.

Colour Breaker



This is a Mahjong type of game that requires the player to click on matching coloured blocks exposed at the extreme right and left of the grid to make them explode. The objective of this game is to clear the grid of blocks as much as possible within a 60-second time limit. [Available at: http://www.fupa.com/play/Action-free-games/color-breaker.html] Last accessed: August 2012.

Mushroom Madness

This is an arcade shooter game where the player needs to protect their mushroom fields from hungry animals by using various tools such as a fly swatter to make the latter go away. [Available at: http://www.miniclip.com/games/mushroom-madness/en/] Last accessed: August 2012.

Simon

This is a memory game that requires the player to follow color (with light and sound) sequences, which gets longer in length with each correct sequence followed. A wrong input will render a game over. [Available at: http://www.free-coloring-pages.com/game/simon/index.html] Last accessed: August 2012.