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Research paper

# Factors associated with medication regimen complexity in residents of long-term care facilities



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## ABSTRACT

**Background:** Polypharmacy and multimorbidity are highly prevalent in long-term care facilities (LTCFs). However, no previous research has investigated factors associated with medication regimen complexity in older residents living in LTCFs.

**Objective:** To investigate factors associated with medication regimen complexity in LTCFs.

**Methods:** This was a cross-sectional study across six LTCFs in South Australia. Medication, clinical and diagnostic data were extracted from each residents medication and medical record. Residents' medication regimen complexity was quantified using the validated 65-item Medication Regimen Complexity Index (MRCI). Multinomial logistic regression analyses were used to compute unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for variables associated with high regimen complexity.

**Results:** There were a total of 383 participants in the study. The mean age of the participants was 87.5 (standard deviation [SD]: 6.2) years. The median MRCI was 43.5 (range: 4–113). The median number of regular and as-needed medications was 13.0 (range: 1–30). Chronic pulmonary disease (OR: 5.10, 95% CI: 2.21–11.8), diabetes (OR: 3.22, 95% CI: 1.51–6.86) and congestive heart failure (OR: 3.13, 95% CI: 1.10–8.85) were associated with high regimen complexity. Independence in activities of daily living (ADLs) (OR: 0.72, 95% CI: 0.62–0.84) and diagnosed dementia (OR: 0.34, 95% CI: 0.17–0.67) were inversely associated with high regimen complexity.

**Conclusion:** LTCF residents are at-risk of high medication regimen complexity. Diabetes, congestive heart failure and chronic pulmonary diseases were associated with high regimen complexity, whereas dementia was inversely associated with high regimen complexity.

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## 1. Introduction

Residents in long-term care facilities (LTCFs) have more complex needs than community-dwelling older people [1]. Residents are typically older, frailer, and have a high burden of multimorbidity [1–3]. A recent systematic review by Jokanovic et al. reported up to 91% of LTCF residents take five or more medications and up to 74% take nine or more medications [4]. However, polypharmacy is only one contributing factor to medication regimen complexity [2,5,6]. Additional factors include multiple dosage forms, medication scheduling, varied directions

for use (e.g. tablet crushing, need to take with or without food) and storage requirements [1,5,7,8].

Many older people and their health care professionals do not consolidate and simplify prescription regimens despite the potential for improved efficiencies. Complex medication regimens are burdensome for residents [2,9–11], and time-consuming and expensive for aged care providers. Complex medication regimens therefore have workforce implications for organizations that provide aged care. Long-term care facility staff are similarly burdened by the extra-time and skills required to safely administer complex medication regimens [1].

A study by Wimmer et al. showed that older age, comorbidity and impaired dexterity are associated with medication regimen complexity in the general older population [12]. However, to the

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best of our knowledge, no previous studies have investigated factors associated with medication regimen complexity in LTCFs. Understanding such factors is important to target interventions to reduce complexity, maintain quality of life for residents, and improve workflow for LTCF staff. The aim of this study was to investigate factors associated with medication regimen complexity in residents of LTCFs.

## 2. Methods

### 2.1. Design, setting and participants

We conducted secondary analyses of data collected from April to August 2014 as part of a cross-sectional study in six LTCFs in South Australia. The study methods have been described previously [13]. In brief, 383 permanent residents aged 65 years or older able to participate in structured assessments in English were included in the study. Residents deemed medically unstable or estimated to have less than three months to live by the facility staff were excluded from the study. Out of the 664 residents across the six LTCFs, 603 were invited to participate in the study and 220 were excluded. The final study sample comprised 383 participants. Participants were comparable to all residents in terms of age (87.5 years, standard deviation [SD]: 6.2) vs. 87.3 years, SD: 6.4,  $P=0.66$ ), sex (77.5% female vs. 78.5% female,  $P=0.90$ ) and dementia diagnosis (44.1% vs. 46.8%,  $P=0.72$ ).

### 2.2. Data collection

Trained study nurses extracted medication, clinical and diagnostic data from each resident's medication and medical record [13]. Activities of daily living (ADLs) were assessed by staff informants using the Katz ADL scale [14]. The ADL tool assesses an individual's independence with bathing, feeding, dressing, transferring, continence and toileting, and assigns points for independence with these activities. Higher scores indicate a higher level of independence. Chronic pulmonary disease was defined as either asthma or chronic obstructive pulmonary disease.

### 2.3. Medication exposure

Data on each resident's regular and as-needed medication use were extracted [13]. All prescription and non-prescription medications were categorized according to the Anatomical Therapeutic Chemical (ATC) classification system recommended by the World Health Organization (WHO) [15]. Minerals and vitamins, complementary and alternative medications were also

included. Polypharmacy was defined as use of nine or more regular medications. This definition was selected because a recent systematic review of international literature reported it was the most common definition of polypharmacy in LTCFs [4], and polypharmacy defined this way is a voluntary quality indicator for residential aged care services in some Australian states [16]. Medication regimen complexity was quantified using the validated 65-item Medication Regimen Complexity Index (MRCI) [2,5,6]. The MRCI consists of three categories relating to dosage form, dosing frequency and additional directions. Scores were summed from each category to calculate the total score, with higher MRCI scores indicating greater regimen complexity [6].

### 2.4. Statistical analyses

Data were tested for normality using histograms, box plots and Q-Q tests. Age was analyzed as a continuous variable. Data were summarized using mean and SD, and median and range. Student  $t$ -tests were used to investigate potential differences between normally distributed variables. Multinomial logistic regression analyses were performed to compute unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for factors associated with high medication regimen complexity. MRCIs were categorized into four quartiles. The first quartile comprised MRCIs from (Q1) 0–32.5, the second (Q2) from > 32.5–43.5, the third (Q3) from > 43.5–55.5, and the fourth (Q4) from > 55.5. Low complexity (MRCI: 0–32.5) was used as a reference category. Analyses were adjusted for age, sex, ADLs and comorbidities. Data were analyzed using the Statistical Package for the Social Sciences (SPSS, V.21, Chicago, Illinois, USA) and STATA.

## 3. Results

The mean age of the 383 participants was 87.5 (SD: 6.2) years. Participants were mostly female ( $n=297$ , 77.5%) and the median ADL score was 4 (range: 1–6). The most common diagnosis was dementia ( $n=169$ , 44.1%), and most participants experienced polypharmacy ( $n=243$ , 63.4%) (Table 1). The median MRCI was 43.5 (range: 4–113). The median number of regular and as-needed medications taken by participants was 13.0 (range: 1–30). The most prevalent dosing frequency for all medications was once daily (2807 medications, 54.6%) and the most prevalent dosage form was oral tablets/capsules (3718 medications, 70.4%), followed by topical creams, gels, paints and patches (455 medications, 8.61%).

In the adjusted multinomial logistic regression model, chronic pulmonary disease (OR: 5.10, 95% CI: 2.21–11.8), diabetes (OR: 3.22, 95% CI: 1.51–6.86) and congestive heart failure (OR: 3.13, 95%

**Table 1**  
Participant characteristics of the study sample.

Characteristic	Full study sample ( $n=383$ )	Q1 ( $n=94$ )	Q2 ( $n=98$ )	Q3 ( $n=94$ )	Q4 ( $n=97$ )
MRCI range	4–113	0–32.5	> 32.5–43.5	> 43.5–55.5	> 55.5
Age; mean (SD)	87.5 (6.2)	87.3 (6.2)	87.2 (5.4)	88.1 (6.1)	87.5 (6.9)
Sex female; $n$ (%)	297 (77.5)	70 (74.5)	73 (74.5)	73 (74.5)	81 (83.5)
Most common diagnoses					
Congestive Heart Failure; $n$ (%)	64 (16.7)	5 (5.32)	19 (19.4)	22 (23.4)	18 (18.6)
Cerebrovascular disease; $n$ (%)	98 (25.6)	18 (19.1)	34 (34.7)	25 (26.6)	21 (21.6)
Dementia; $n$ (%)	169 (44.1)	51 (54.3)	45 (45.9)	37 (39.4)	36 (37.1)
Chronic pulmonary disease <sup>a</sup> ; $n$ (%)	80 (20.9)	10 (10.6)	15 (15.3)	21 (22.3)	34 (35.1)
Diabetes; $n$ (%)	87 (22.7)	16 (17.0)	21 (21.4)	19 (20.2)	31 (32.0)
Any tumor; $n$ (%)	78 (20.4)	18 (19.1)	22 (22.4)	21 (22.3)	17 (17.5)
Katz ADL <sup>b</sup> ; median (range)	4 (0–6)	4 (1–6)	4 (1–6)	3 (1–6)	2 (1–6)
Polypharmacy	243 (63.4)	9 (9.6)	59 (60.2)	80 (85.1)	95 (97.9)

SD: standard deviation; MRCI: Medication Regimen Complexity Index; DSRS: Dementia Severity Rating Scale; ADL: activities of daily living; Q1: first quartile; Q2: second quartile; Q3: third quartile; Q4: fourth quartile.

<sup>a</sup> Asthma and chronic obstructive pulmonary disease.

<sup>b</sup> ADL missing for 0.013%; no missing data for age, sex, common diagnoses, polypharmacy.

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