

# **Project title: Managing Medications and how much it predicts Admission to Aged Residential Care in Older Persons without Cognitive Impairment after adjusting for Confounding Factors.**

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## **Introduction**

In order to improve health outcomes for older persons and support the government's Ageing in Place policy, further information about medication management will be considered. Early analysis of the interRAI dataset showed that medication management was a major predictor of admission to aged residential care. Medication management is one of the IADLs (instrumental activities of daily living) and is an activity that enables a person to live independently in the community. The goal of this project was to quantify how much Managing Medications predicts aged residential care admissions in older persons without cognitive impairment after adjusting for confounding factors.

## **Method**

The national interRAI dataset was used containing information from consenting individuals who had their interRAI-Home Care version 9.1 assessments conducted between September 2012 and January 2016. This dataset had been linked with aged residential care admission and mortality data. The dataset used contained 30,199 consenting individuals after exclusions were applied. Individuals were excluded for three reasons: their interRAI-HC assessment was conducted in hospital setting, they had a diagnosis of dementia or a  $CPS \geq 2$  (Cognitive Performance Score) which can indicate undiagnosed dementia, and if they had been in aged residential care for more than 30 days before their interRAI assessment was finalised. This dataset sought to include the population of frail older people without cognitive impairment living in their own home.

Medication management is section G1da and G1db of the interRAI. What it refers to is: remembering to take medications, opening bottles, giving injections and taking correction drug doses. There are 8 possible replies ranging from 'independent' to 'total dependence'. Additionally, 'adherence to' was looked at which was section M2 of the interRAI and had 4 possible replies from 'always' to 'adherent less than 80% of the time'.

Initially, exploratory data analysis and Kaplan-Meier survivor curves were used to look at the demographics of the population and survival patterns for people in each category. Then nine confounders were chosen based on medical knowledge: *mobility, vision, cognition, formal support, fatigue, pain, mode of nutrition intake, ADL score and IADL score with Medication Management removed*. A Directed Acyclic Graph (DAG) was used to give a minimal set of confounders to adjust for after the causal pathways between nine confounders, predictors and response were drawn.

The unadjusted relative risks and adjusted relative risks (or SHRs- subdistribution hazard ratios) were obtained by doing Competing Risks Regressions. This allowed us to quantify how much medication management and adherence to medications predicted admission to residential care before and after adjusting for confounders. A Competing Risks Regression was the appropriate statistical approach because there are two 'competing' events: death and entry to aged residential care (ARC).

## **Results:**

The majority of individuals were female (65%), aged between 70 and 90 (66%) and were NZ European (90%). Of the 30199 individuals, 33% had some difficulty managing their medications which totalled 9445 people.

The unadjusted and adjusted relative risks from the Competing Risks Regressions are shown in Table 1 and Table 2.

Medication management Performance	Unadjusted Relative Risk of entering ARC	Adjusted Relative Risk of entering ARC	95% Confidence Interval	
			Lower limit	Upper limit
0-Independent	1 (reference)	1 (reference)	-	-
1-Setup Help Only	1.2	1.06	0.911	1.22
2-Supervision	1.6	1.33	1.16	1.52
3-Limited Assistance	1.4	1.15	0.93	1.42
4-Extensive Assistance	1.5	1.19	0.97	1.49
5-Maximal Assistance	1.6	1.23	1.01	1.49
6-Total Dependence	1.9	1.51	1.26	1.8

Table 1. Medication management Unadjusted and Adjusted relative risks.

Adherence to Medications	Unadjusted Relative Risk of entering ARC	Adjusted Relative Risk of entering ARC	95% Confidence Intervals	
			Lower limit	Upper limit
0-Always	1 (reference)	1 (reference)		
1-Adherent 80% more of the time	1.53	1.54	1.36	1.74
2-Adherent less than 80% of time	1.72	1.70	1.23	2.34

Table 2. Adherence to Medications Unadjusted and Adjusted relative risks.

After adjusting for the nine confounders, there is still a clear increased risk of entering aged residential care as the difficulty managing medications increases. When 'independent' is set as the reference category, then those who require setup help only have a relative risk of 1.06. This means that they are 1.06 times or 6% more likely to enter ARC compared to an individual who manages their medications independently. People who are totally dependent have the highest risk of 1.51 which means that they are 51% more likely to enter ARC than a person who is independent. With adherence to medications, poorer adherence to medications is linked to an increased likelihood of entering ARC even after adjusting for those nine confounders. A person who adheres less than 80% of the time is 1.7 times or 70% more likely to enter into aged residential care.

## Discussion

Both medication management and adherence to medications are statistically significant predictors of admission to residential care ( $p$ -values  $< 0.001$ ) which means that there is evidence to support the relative risks calculated above. Had Cox Proportional hazard models been used rather than Competing Risks Regressions, the relative risk or hazard ratio would have been overestimated. The unadjusted and adjusted relative risks would have been larger than they currently are.

The effect of living arrangement (A13) and mood (E2b) was also assessed for their effect as possible confounders which resulted in little difference in the adjusted relative risks. We did not adjust for the effect of hearing but this could also be a confounder. Further study could have more of a focus on the selection of confounders and DAG analysis.

Further study could also look into the number of people in each region in the South Island that is having difficulty in managing medications. Each region has different support services running and the differences in the results for the different regions could be examined.

## Conclusion

In 33% of older people with normal cognition living at home, medication management can still be a problem. Even after adjusting for those nine confounding variables, with increasing difficulty managing medications there is a higher chance that an individual will enter aged residential care. Similarly, this is also the case for poor adherence to medications. We would recommend that HOPSLA could look into saving money (after applying cost-benefit analysis) and potentially reduce residential care by providing additional support and education for older people in managing their medications.

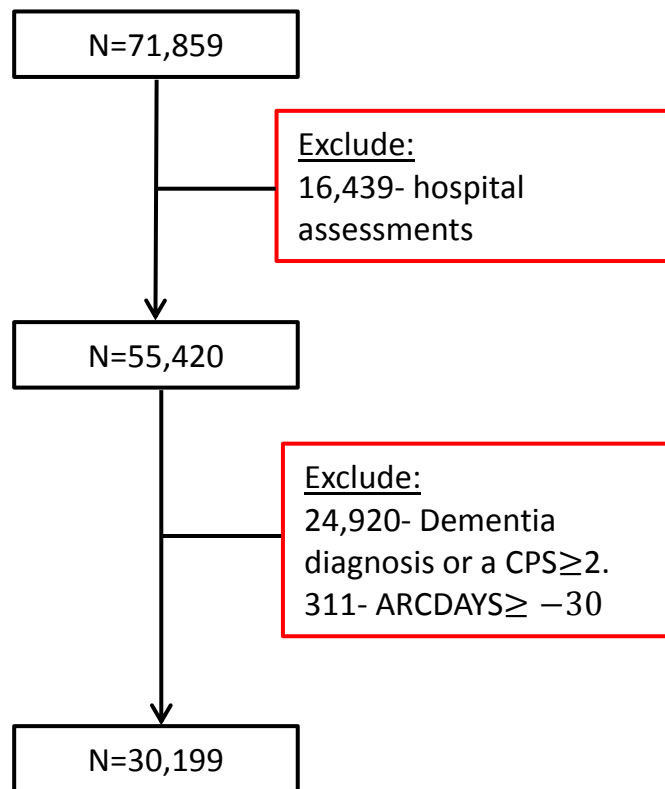


Figure 1. Exclusions applied to dataset.

	Total		Did not enter Rest Care		Entered Rest Care	
	n	percent	n	percent	n	percent
<b>Age (years)</b>						
65-70	2172	7.2%	1976	8%	196	4%
71-75	3441	11.4%	3067	12%	373	7%
76-80	5157	17.1%	4493	18%	664	12%
81-85	7337	24.3%	6103	25%	1234	23%
86-90	7267	24.1%	5710	23%	1556	29%
91-95	3879	12.8%	2795	11%	1084	20%
96-100	870	2.9%	592	2%	278	5%
101+	76	0.3%	47	0%	29	1%
<b>Sex*</b>						
Female	19756	65.4%	16244	66%	3512	64.9%
Male	10441	34.6%	8539	34%	1902	35.1%
<b>Ethnicity</b>						
European	27063	89.6%	21912	88%	5151	95.1%
Pacific	770	2.5%	729	3%	41	0.8%
Maori	1526	5.1%	1428	6%	98	1.8%
Asian	600	2.0%	514	2%	86	1.6%
Other	240	0.8%	201	8%	39	0.7%
<b>Marital Status</b>						
Never married	1189	4%	904	4%	285	5.3%
Married	10972	36%	9324	38%	1648	30.4%
Widowed	15487	51%	12421	50%	3066	56.6%
Separated	629	2%	538	2%	91	1.7%
Divorced	1697	6%	1401	6%	296	5.5%
Other	225	1%	196	1%	29	0.5%

<b>Living arrangement*</b>						
Alone	16842	56%	13478	54%	3364	62.1%
With spouse/partner	8851	29%	7575	31%	1276	23.6%
With spouse/partner and other(s)	840	3%	741	3%	99	1.8%
With child (not spouse/partner)	2771	9%	2257	9%	514	9.5%
With parent(s) or guardian(s)	15	0%	10	0%	5	0.1%
With sibling(s)	144	0%	113	0%	31	0.6%
With other relatives	461	2%	392	2%	69	1.3%
With non-relatives	275	1%	218	1%	57	1.1%

\*Sex has 2 missing observations- 2 indeterminate individuals

Table 3. Demographics of eligible participants.

<b>Medication management Performance</b>	<b>All</b>		<b>Did not enter ARC</b>		<b>Entered ARC</b>	
	<b>Frequency</b>	<b>Percent</b>	<b>n</b>	<b>Percent</b>	<b>n</b>	<b>Percent</b>
0-Independent	20347	67%	17335	85%	3012	15%
1-Setup Help Only	2242	7%	1778	79%	464	21%
2-Supervision	2434	8%	1857	76%	577	24%
3-Limited Assistance	906	3%	698	77%	208	23%
4-Extensive Assistance	1282	4%	993	77%	289	23%
5-Maximal Assistance	1117	4%	814	73%	303	27%
6-Total Dependence	1464	5%	1001	68%	463	32%
8-Activity did not occur	407	1%	308	76%	99	24%
	30199		24784		5415	

Table 4. Medication Management frequencies table and percentage of those in each category that enter ARC.

<b>Adherence to Medications</b>	<b>All</b>		<b>Did not enter ARC</b>		<b>Entered ARC</b>	
	<b>Frequency</b>	<b>Percent</b>	<b>n</b>	<b>Percent</b>	<b>n</b>	<b>percent</b>
0-Always	27219	90.1%	22496	82.6%	4723	17.4%
1-Adherent 80% more of time	2319	7.7%	1761	75.9%	558	24.1%
2-Adherent less than 80% of time	283	0.9%	207	73.1%	76	26.9%
3-No medications prescribed	376	1.2%	319	84.8%	57	15.2%
Total	30197		24783		5414	

Table 5. Adherence to Medications frequencies table and percentage of those in each category that enter ARC.

Figure 2. Kaplan Meier Survivor Curves

