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ORIGINAL ARTICLE

Comparison of hospitalised trends, treatment cost and health outcomes of fall-related hip fracture for people aged ≥ 65 years living in residential aged care and the community

R. Mitchell[1] · B. Draper[2,3] · L. Harvey[4] · M. Wadolowski[1] · H. Brodaty[2,3] · J. Close[4,5]

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Abstract

Summary This study compared hip fracture rates and health outcomes of older people living in residential aged care facilities (RACFs) to the community. The RACF resident age-standardised hospitalisation rate was five times higher than the community rate and declining. RACF residents experience overall worse health outcomes and survival post-hip fracture.

Introduction To compare hospitalisation trends, characteristics and health outcomes following a fall-related hip fracture of older people living in residential aged care facilities (RACFs) to older people living in the community.

Methods A retrospective analysis of fall-related hip fracture hospitalisations of people aged ≥ 65 years during 1 July 2008 and 30 June 2013 in New South Wales (NSW), Australia's largest populated state. Linked hospitalisation, RACF and Aged Care Assessment Appraisal data collections were examined. Negative binomial regression examined the significance of hospitalisation temporal trends.

Results There were 28,897 hip fracture hospitalisations. One-third were of older people living in RACFs. The hospitalisation rate was 2180 per 100,000 (95%CI: 2097.0–2263.7) for RACF residents and 390 per 100,000 (95%CI 384.8–395.8) for older people living in the community. The hospitalisation rate for RACF residents was estimated to decline by 2.9% annually (95%CI: − 4.3 to − 1.5). Hospital treatment cost for hip fractures was AUD$958.5 million. Compared to older people living in the community, a higher proportion of RACF residents were aged ≥ 90 years (36.1% vs 17.2%), were female (75.3% vs 71.8%), had > 1 Charlson comorbidity (37.6% vs 35.6%) and 58.2% had dementia (vs 14.4%). RACF residents had fewer in-hospital rehabilitation episodes (18.7% vs 60.9%) and a higher proportion of unplanned readmissions (10.6% vs 9.1%) and in-hospital mortality (5.9% vs 3.3%) compared to older people living in the community.

Conclusions RACF residents are a vulnerable cohort of older people who experience worse health outcomes and survival post-hip fracture than older people living in the community. Whether access to individualised hip fracture rehabilitation for RACF residents could improve their health outcomes should be examined.

Keywords Community · Hip fracture · Hospitalisation · Residential aged care

✉ R. Mitchell
r.mitchell@mq.edu.au

[1] Australian Institute of Health Innovation, Macquarie University, Level 6, 75 Talavera Road, Sydney, NSW 2109, Australia

[2] Dementia Centre for Research Collaboration, University of New South Wales, Sydney, Australia

[3] Centre for Healthy Brain Ageing, School of Psychiatry, UNSW Australia, Sydney, Australia

[4] Falls, Balance and Injury Research Centre, Neuroscience Research Australia, University of New South Wales, Sydney, Australia

[5] Prince of Wales Clinical School, University of New South Wales, Sydney, Australia

Introduction

Hip fractures are one of the most serious injuries sustained by people aged 65 years and older, often resulting in reduced ability to perform activities of daily living (ADLs), reduced health-related quality of life and higher mortality compared to the general population [1–6]. The majority of hip fractures in older age occur as a result of low-energy trauma following a fall [7]. Various health conditions, events and environmental factors can influence the risk of a fall-related hip fracture, including poor bone health, impaired vision, cognitive impairment, multiple medication use, previous falls and trip/slip hazards [1, 8].

The risk of a fall-related hip fracture is higher for older people living in residential aged care facilities (RACF) compared to older people living in the community [2, 4]. Following a hip fracture, RACF residents have been found to have, a shorter hospital length of stay (LOS), reduced access to rehabilitation and a lower return to pre-hip fracture mobility compared to older people living in the community [9–11].

Surgical intervention followed by rehabilitation is the most common form of treatment for the majority of older people who sustain a hip fracture [12]. However, not all older people receive rehabilitation, with older people living with dementia often excluded [13], despite evidence that when they receive specialised rehabilitation, their functional ability can improve [13, 14]. For older people with severe dementia, whether individualised rehabilitation will improve their overall health outcome is not straightforward.

Pre-hip fracture residential status is not usually well recorded within hospitalisation records [11], and as such, in Australia, there have been no recent population-based studies that have compared the hospitalised incidence rate, temporal trends, fall characteristics, hospital treatment cost and health outcomes for RACF residents and older people living in the community. This information will be useful to target fall hip fracture prevention measures in both settings, inform healthcare resource planning, along with the need for RACF and home-based aged care services. This study aims to compare the hospitalisation trends, characteristics, treatment cost and health outcomes following a fall-related hip fracture of older people living in RACFs to older people living in the community in New South Wales (NSW), Australia.

Materials and methods

A retrospective epidemiological analysis of older people aged ≥ 65 years who had a fall-related hip fracture and were hospitalised during 1 July 2008 and 30 June 2013 in NSW, the largest populated state in Australia with an estimated 1.2 million residents aged ≥ 65 years [15], was conducted.

Data sources

Hospitalisation data include information on all admissions from public and private hospitals in NSW. All serious long bone fractures, such as hip fractures, in NSW are likely to be admitted to hospital [16]. The hospitalisation data contains information on patient demographics, source of referral, diagnoses, external cause(s), type of hospital discharge and clinical procedures. Diagnoses and external cause codes were classified using the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM) [17]. Hip fracture operative procedures included ICD-10-AM: 47519-00, 47522-00, 47528-01, 47531-00, 49315-00, 49318-00 and 49319-00.

The RACF data collection includes information on all permanent residents, and people admitted for respite care or transitional aged care in RACF. Transitional care is short-term, restorative care aimed at optimising independence after hospitalisation and is available for up to 12 weeks [18]. The RACF data collection contains information on the type of admission, discharge status and the dates of admission and discharge. For each permanent RACF resident, an appraisal of their ability to perform ADLs (e.g. mobility, personal hygiene), their behavioural characteristics (e.g. cognition and depression) and their complex care needs (e.g. medication and health care) is conducted [19] within 2 months of admission. Cognition is assessed using the Psychogeriatric Assessment Scales-Cognitive Impairment Scale (PAS-CIS).

The Aged Care Assessment Program (ACAP) data collection includes information on living arrangements, ability to perform ADLs (e.g. physical capability, cognitive and social ability and ability to perform domestic tasks) and carer arrangements. These assessments can be conducted at any time for older people living in RACF or the community and, during the timeframe of the study, were valid for 12 months.

Record linkage

Extracts from the national RACF and ACAP data collections were linked to NSW hospitalisation data by the Australian Institute of Health and Welfare (AIHW) Data Linkage Unit using name-based probabilistic and key-based linkage using a statistical linkage key (i.e. SLK-581), respectively. The estimated match link rate (i.e. presumed true match linkage cut-off) was 97.6%, link accuracy (i.e. accepted links are presumed to be correct links) was 99.9% and the F-score (i.e. harmonic mean of the two ratios of match link rate and link accuracy) was 98.8% for the linkage of the RACF to hospitalisation data. A false match rate (i.e. lower score better), marginal trade-off (i.e. higher score better) and a measure of discriminating power (i.e. higher score better) were estimated at 1%, 5 and 90%, respectively for the linkage of ACAP to the hospitalisation data.

The RACF appraisal for permanent RACF residents that preceded and occurred closest to the date of hospitalisation was linked to the hospitalisation data. Likewise, the ACAP appraisals where community-dwelling residents had had an ACAP appraisal, these data were linked to the hospitalisation data for the appraisal that preceded and occurred closest to the date of hospitalisation.

Case identification

All hip fractures were identified using a principal diagnosis of hip fracture (ICD-10-AM: S72.0, S72.1 or S72.2) and falls

were identified using external cause codes (ICD-10-AM: W00-W19) in the hospitalisation data. The index admission was the first fall-related hip fracture during the 5-year period. A person's place of residence was identified as being in a RACF, if their hip fracture hospital admission date occurred after their RACF admission date, otherwise the person was indicated to be living in the community. Older people living in RACF could be permanent residents or living in RACF for transitional or respite care.

Identification of comorbidities and dementia

The Charlson comorbidity index was used to identify the number of comorbidities using diagnosis classifications from the hospitalisation records [20]. Dementia was excluded from the count of comorbidities to avoid collinearity. The Charlson comorbidity index was categorised by number of comorbidities into nil, 1–2 and ≥ 3 comorbidities. Dementia at the time of index hip fracture was identified using the ICD-10-AM diagnosis classifications of F00-F03, F05.1, G30 and G31 recorded in their index hospitalisation period of care in up to 50 diagnosis fields. A 12-month look back period was used for the identification of all comorbidities (i.e. to 1 July 2007).

Hospital treatment costs

Hospital treatment costs were estimated using the Australian Refined-Diagnosis Related Groups (AR-DRGs), episode of care LOS and episode of care type (i.e. acute and non-acute). Cost estimates were obtained from national and state-based hospital cost information [21, 22]. As recommended, the average daily cost per AR-DRG was multiplied by the episode of care LOS up to 120 days following the index hip fracture hospitalisation [22]. Where an episode of care exceeded 120 days, a flat rate of $200 per day was then applied [22]. All costs are in 2009–2010 Australian dollars.

Data management and analysis

All analyses were conducted using the Secure Unified Research Environment (SURE) and performed using SAS version 9.4 [23]. All hospital episodes of care related to a hip fracture were linked to form a period of care. Denominator data for the population aged ≥ 65 years by age group and sex for each year were obtained from the Australian Bureau of Statistics population estimates for NSW [24] and the number of people aged ≥ 65 years in RACFs in NSW was obtained from the National Aged Care Data Clearing House [25]. Denominator data for the number of people aged ≥ 65 years living in the community were derived by subtracting the RACF population from the total population. Age-standardised incidence rates were calculated for community-living and RACF residents with PROC STDRATE [26] using the recommended Australian residential population at 30 June 2001 as the standard population [27]. Negative binomial regression with the number of index hip fracture admissions as the dependent variable and admission year, age group and sex as independent variables with an offset of the log of the population was used to examine the statistical significance of the trend over time in hospitalisation rates during 2008–2009 to 2012–2013.

Chi-square tests of independence were used to examine characteristics of RACF residents and people living in the community. Twenty-eight-day unplanned hospital readmission was defined as readmission within 28 days if the admission was identified as 'emergency' rather than 'non-emergency/planned'. The calculation of hospital LOS included transfers between hospitals.

Logistic regression was used to examine the association of in-hospital rehabilitation and the individual characteristics of age group, gender, marital status, admission year, number of Charlson comorbidities (0, 1–2, 3+), residential location (RACF/community), dementia (yes/no), delirium (yes/no) and alcohol misuse and dependence (yes/no). Variables included in the model were factors that had previously been identified as associated with provision of rehabilitation [13, 14]. A backwards stepwise regression was used to sequentially eliminate factors from the model that did not significantly contribute to rehabilitation provision at 0.25 [28]. All two-way interactions were examined for age group, gender, marital status, admission year, dementia status, delirium status, number of Charlson comorbidities, alcohol misuse and dependence and residential location. Odds ratios (OR) and 95% confidence intervals (95%CI) were calculated.

Results

There were 28,897 fall-related hip fracture hospitalisations in 25,983 people aged ≥ 65 years in NSW during the 5-year period. There were 1439 people who were hospitalised for a subsequent hip fracture within the study timeframe. One-third (32.5%) of the hip fracture hospitalisations were of older people living in RACFs. The age-standardised fall-related hip fracture hospitalisation rate was 2180 per 100,000 (95%CI: 2097.0–2263.7) for RACF residents and 390 per 100,000 (95%CI 384.8–395.8) for older people living in the community. The fall-related hip fracture hospitalisation rate for older people residing in RACFs was estimated to decline by 2.9% per year (95%CI: − 4.3 to − 1.5, $p < 0.0001$). The decline was due to reduced hospitalisations among people aged 80–89 (− 2.6% per year; 95%CI: − 4.6 to − 0.6, $p < 0.01$) and ≥ 90 (− 3.7% per year; 95%CI: − 6.0 to − 1.4, $p < 0.002$) years. There was no significant change in the hospitalisation rate for fall-related hip fracture for older people living in the community (Fig. 1).

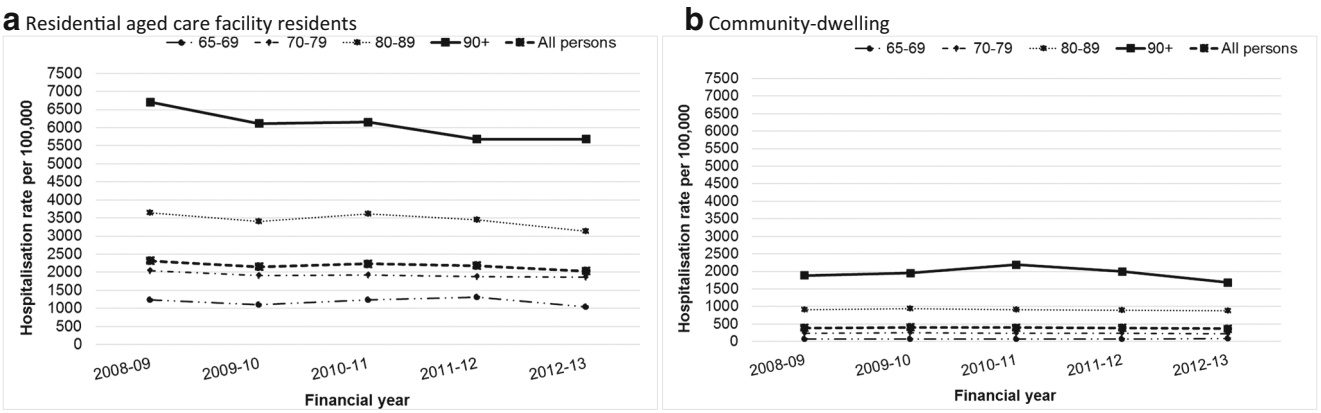

Fig. 1 Fall-related hip fracture hospitalisation rates of individuals aged ≥ 65 years by residential status, linked hospitalisation and RACF records in NSW, 1 July 2008 to 30 June 2013

Compared to older people living in the community, a higher proportion of RACF residents hospitalised for a fall-related hip fracture were aged ≥ 90 years, were female, were not married, had > 1 Charlson comorbidity and 58.2% had dementia. Almost all (94.4%) RACF residents were permanent residents, and RACF residents had double the proportion of falls involving their bed compared to older people living the community (Table 1). Both RACF and community living residents had a higher proportion of people aged 80–89 years (54.4% and 58.1%) and ≥ 90 years (33.3% and 23.2%), respectively, who had a diagnosis of dementia compared to younger age groups (65–69 years (1.0% and 2.1%) and 70–79 years (11.4% and 16.6%), respectively).

Fewer RACF residents underwent hip fracture surgery and there was a higher proportion of delirium among RACF residents identified during their hospital stay, a lower hospital LOS and higher unplanned hospital readmissions and in-hospital mortality compared to older people living in the community. Only 18.7% of RACF residents received in-hospital hip fracture rehabilitation compared to 60.9% living in the community, with in-hospital rehabilitation provision varying by age (Table 2). Of the RACF residents that received rehabilitation, 649 (11.9%) had been diagnosed with dementia.

Multivariable associations indicated significant interactions between residential location, age group and dementia status. People living with dementia aged ≥ 70 years and living in RACFs were between two to three times less likely to access in-hospital rehabilitation than people with no dementia. For people living with dementia aged ≥ 70 years living in the community, they were also less likely to access rehabilitation than people with no dementia. As older people aged, they were less likely to access in-hospital rehabilitation, irrespective of living in RACFs or the community (Table 3).

The total estimated in-hospital treatment cost for fall-related hip fractures was AUD$958.5 million for the 50-year period, an average of AUD$191.7 million per year. Only 10.1% of the estimated in-hospital treatment cost for RACF residents was for in-hospital rehabilitation compared to 23.3% for people living in the community (Table 4).

Of the 8889 permanent RACF residents who fell and fractured their hip, around one-third (35.2%) were assessed as having high care needs for ADLs, 52.8% were assessed with high behavioural care needs and 18.3% with complex health care needs. Sixty-one percent of permanent RACF residents were assessed as having moderate or severe cognitive impairment. There were 7040 (32.8%) people living in the community who had an aged care assessment conducted prior to their hip fracture. For people living in the community, limitations were predominantly identified in relation to transport (91.4%), ability to perform domestic tasks (91.2%) and social and community participation (82.2%). Eighty percent of people living in the community had a carer (e.g. relative, neighbour, friend) available to provide assistance (Table 5).

Discussion

Fall-related hip fractures among older people are a major population health issue worldwide [8]. The current study identified that at least one-third of fall-related hip fracture hospitalisations were of RACF residents, that the hospitalisation rate of RACF residents was five times higher than the rate for older people living in the community and that the hospitalisation rate for RACF residents was declining, particularly among the oldest old. The total cost of fall-related hip fracture hospitalisations was AUD$191.7 million annually, with RACF residents accounting for 22.6% of the total cost (i.e. AUD$43.3 million annually). By comparison, in the United States (US), an estimated 8% of hip fracture hospitalisations were of permanent RACF residents, with hip fracture among permanent RACF residents estimated to cost US$665 million each year [4]. In the United Kingdom (UK), an estimated 30% of hip fracture hospitalisations were of residents of residential facilities or nursing homes, with an

Table 1 Demographic and fall characteristics for fall-related hip fracture hospitalisation of individuals aged ≥ 65 years by residential status, linked hospitalisation and RACF records in NSW, 1 July 2008 to 30 June 2013

	RACF resident ($n = 9398$)		Community-dwelling ($n = 19,499$)		χ^2 (*df*)
	n	%	*n*	%	
Age group					
65–69	122	1.3	1216	6.2	1915.8 (3)*
70–79	1068	11.4	4996	25.6	
80–89	4814	51.2	9927	50.9	
90+	3394	36.1	3360	17.2	
Gender					
Male	2320	24.7	5500	28.2	39.8 (1)*
Female	7078	75.3	13,999	71.8	
Admission year					
2008–2009	1872	19.9	3683	18.9	7.6 (4)
2009–2010	1802	19.2	3932	20.2	
2010–2011	1966	20.9	3992	20.5	
2011–2012	1904	20.3	3994	20.5	
2012–2013	1854	19.7	3894	20.0	
Number of Charlson comorbidities (excluding dementia)					
Nil recorded	5864	62.4	12,575	64.5	12.0 (2)**
1–2	2883	30.7	5646	29.0	
≥ 3	651	6.9	1278	6.6	
Dementia					
No	3930	41.8	16,698	85.6	5960.6 (1)*
Yes	5468	58.2	2801	14.4	
Alcohol misuse and dependence					
No	9315	99.1	19,014	97.5	84.7 (1)*
Yes	83	0.9	485	2.5	
Marital status					
Not married	7009	74.6	11,318	58.0	940.2 (2)*
Married/defacto	2113	22.5	7898	40.5	
Not known	276	2.9	283	1.5	
Type of residential aged care					
Permanent	8869	94.4	–	–	
Respite	388	4.1	–	–	
Transitional	141	1.5	–	–	
Type of fall					
Fall on same level from slipping, tripping and stumbling	1940	20.6	9099	46.7	3527.6 (8)*
Fall involving wheelchair	79	0.8	60	0.3	
Fall involving bed	597	6.4	536	2.8	
Fall involving chair	361	3.8	601	3.1	
Fall on and from stairs and steps	29	0.3	1252	6.4	
Fall on and from ladder or scaffolding or fall from, out of or through building or structure	7	0.07	214	1.1	
Other fall from one level to another	21	0.2	157	0.8	
Other fall on same level	2533	27.0	4222	21.7	
Unspecified fall	3831	40.8	3358	17.2	

*$p < 0.0001$, **0.001

Table 2 Hospital episode and health outcomes following a fall-related hip fracture hospitalisation of individuals aged ≥ 65 years by residential status, linked hospitalisation and RACF records in NSW, 1 July 2008 to 30 June 2013

	RACF resident ($n = 9398$)		Community-dwelling ($n = 19,499$)		χ^2 (*df*)
	n	%	*n*	%	
Delirium[a]					
No	8323	88.6	17,695	90.8	33.8 (1)*
Yes	1075	11.4	1804	9.3	
Hip fracture surgery					
No	1323	14.1	2523	12.9	7.1 (1)**
Yes	8075	85.9	16,976	87.1	
In-hospital rehabilitation					
No	7645	81.4	7620	39.1	4546.4 (1)*
Yes	1753	18.7	11,879	60.9	
Received in-hospital rehabilitation by age group[b]					
65–69	18	1.0	544	4.6	400.6 (3)*
70–79	186	10.6	2844	23.9	
80–89	927	52.9	6356	53.5	
90+	622	35.5	2135	18.0	
Hospital length of stay (days)					
1–7	3644	38.8	2098	10.8	5016.6 (3)*
8–14	2267	24.1	2292	11.8	
15–21	1020	10.9	2219	11.4	
≥ 22	2467	26.3	12,890	66.1	
Unplanned hospital readmission within 28 days					
No	8403	89.4	17,733	90.9	17.2 (1)*
Yes	995	10.6	1766	9.1	
In-hospital mortality					
No	8848	94.2	18,847	96.7	100.1 (1)*
Yes	550	5.9	652	3.3	

*$p < 0.0001$

[a] Includes at admission or during hospital stay

[b] Proportion calculated of the 1753 RACF residents and 11,879 community-dwelling residents who received in-hospital rehabilitation

estimated median cost per fracture of £9429 [29]. The lower proportion of RACF residents admitted to hospital following a hip fracture in the US is likely to be due to excluding certain RACF residents with managed care plans and only including US Medicare claims [4].

Studies have shown conflicting trends as to whether fall-related hip fracture hospitalisations among RACF residents are declining or increasing [30, 31]. In Victoria, the second most populous state in Australia, an increasing trend in fall-related hip fracture hospitalisations among RACF residents, was reported during 2003–2004 to 2011–2012 [31]. In Switzerland, hip fracture hospitalisations among female RACF residents declined by 1.9% each year between 1991 and 2000 [30]. Some of the differences in trends will be accounted for by the different time periods studied, use of linked compared to unlinked hospitalisation records and different case identification methods, with the Victorian study reliant on pre-fracture residential status identified from hospitalisation records, which is likely to underestimate hospitalisations of RACF residents. If the current study relied on place of occurrence in the hospitalisation data to identify RACF residents, it would have under-enumerated fall-related hip fractures in RACFs by 1009 (10.7%) index admissions over the 5 years. There are a few possible reasons for the declining rate of hip fracture hospitalisations among RACF residents found in the Swiss and current study, including implementation of fall injury prevention strategies, use of hip protectors, better osteoporosis management and increasing body mass index among older people providing a protective effect against hip fracture [30–34]. Other high-income countries are also observing declines in overall hip fracture hospitalisations [35, 36] as the proportion of older people in their populations increases.

Within the current study, fall-related hip fracture hospitalisation rates for older people residing in RACFs and

Table 3 Multivariable logistic regression of characteristics of people aged ≥ 65 years who did not receive in-hospital rehabilitation, linked hospitalisation and RACF records in NSW, 1 July 2008 to 30 June 2013

	Multivariable logistic regression		
	Odds ratio	95% CI	Wald Chi-square (*df*)
Age group			
65–69	1		348.0 (3)*
70–79	0.49	0.42–0.58	
80–89	0.30	0.26–0.35	
90+	0.28	0.23–0.32	
Gender[a]			
Female	0.82	0.77-0.87	40.3 (1)*
Admission year			
2008–2009	1		71.5 (4)*
2009–2010	0.89	0.82–0.97	
2010–2011	0.85	0.78–0.93	
2011–2012	0.89	0.82–0.97	
2012–2013	1.17	1.07–1.27	
Residential location[b]			
Residential aged care facility resident	5.74	5.21–6.33	1233.7 (1)*
Number of Charlson comorbidities (excluding dementia)			
Nil recorded	1		27.8 (2)*
1–2	0.50	0.38–0.65	
≥ 3	0.64	0.42–0.98	
Dementia[c]	0.61	0.39–0.97	4.4 (1)***
Delirium[c]	0.92	0.84–1.01	3.0 (1)
Alcohol misuse and dependence[c]	0.66	0.55–0.80	18.6 (1)*
Marital status			
Not married	1		12.0 (2)**
Married/defacto	1.11	1.05–1.18	
Not known	1.05	0.85–1.28	
Interactions			
Age group × dementia			47.7 (3)*
Residential location × dementia			34.1 (1)*
Dementia and aged 65–69 and living in community[c]	0.62	0.39–0.97	
Dementia and aged 65–69 and living in RACF[c]	0.93	0.58–1.49	
Dementia and aged 70–79 and living in community[c]	1.33	1.13–1.57	
Dementia and aged 70–79 and living in RACF[c]	2.01	1.67–2.44	
Dementia and aged 80–89 and living in community[c]	1.99	1.80–2.20	
Dementia and aged 80–89 and living in RACF[c]	3.01	2.66–3.42	
Dementia and aged 90+ and living in community[c]	2.18	1.89–2.52	
Dementia and aged 90+ and living in RACF[c]	3.31	2.85–3.83	
Residential location × Charlson comorbidities (excluding dementia)	NR[d]		19.5 (2)*
Age group × Charlson comorbidities (excluding dementia)	NR[d]		54.0 (6)*

*$p < 0.0001$, **$p < 0.001$, ***$p < 0.05$

[a] Males are the referent group

[b] Community-dwelling is the referent group

[c] No is the referent group

[d] Not reported

Table 4 Hospital treatment costs following a fall-related hip fracture hospitalisation of individuals aged ≥ 65 years by residential status, linked hospitalisation and RACF records in NSW, 1 July 2008 to 30 June 2013

	RACF resident (n = 9398)			Community-dwelling (n = 19,499)		
	Mean	Median	Total	Mean	Median	Total
Acute care	$19,419	$14,876	$182,264,702	$27,226	$21,229	$530,450,551
Rehabilitation	$12,547	$11,239	$21,994,523	$14,547	$12,344	$172,803,521
Sub-acute care[a]	$13,972	$8397	$12,352,156	$17,457	$10,523	$38,510,102
Total	$23,059	$16,912	$216,710,381	$38,041	$32,622	$741,764,174

[a] Includes other sub-acute (psychogeriatric services, geriatric evaluation and management, maintenance services, and palliative care) care

the community increased with increasing age, as has been found elsewhere [4, 30, 37]. Compared to older people living in the community, RACF residents with a hip fracture had a higher prevalence of dementia and a fall involving their bed. Fall injury hospitalisations have been shown to be higher for older people living with dementia compared to older people with no cognitive impairment [38]. That the RACF resident pre-fracture appraisals indicated that 71.4% of residents had medium-high care needs for ADLs, providing an indication that the majority of RACF residents are reliant upon staff for assistance with ADLs, so it is not surprising that falls are occurring in their bedroom, where RACF residents would likely spend a significant proportion of their time. Being able to examine staff to resident ratios within RACFs would assist in identifying whether staff accessibility could be a factor related to falls [4]. Over 50% of the RACF residents who fell were rated as having high behavioural needs which would include agitation and aggression. Although this study did not have information about medications, it is likely that a high proportion of these residents would have been prescribed antipsychotic medication. An intervention in RACFs that target antipsychotic deprescription and non-drug management of challenging behaviour found that those deprescribed had fewer falls without any worsening of behaviour [39].

RACF residents had less hip fracture surgery, lower participation in in-hospital rehabilitation, shorter hospital LOS and a higher proportion of unplanned hospital readmissions and in-hospital mortality compared to older people living in the community. A lower proportion of RACF residents undergoing surgery and a higher proportion of unplanned hospital readmissions and mortality may be related to failing health and/or frailty [40], with pre-fracture RACF appraisals indicating that 49.3% of RACF residents had medium-high care needs for complex health care. A lower hospital LOS among RACF residents is likely related to less than 20% of RACF residents receiving in-hospital rehabilitation compared to two-thirds of older people living in community receiving rehabilitation. Reduced access to in-hospital rehabilitation and reduced hospital LOS for RACF residents have also been identified in other studies [10, 11]. This could be due to different referral pathways for RACF residents based on their ability to participate in rehabilitation.

The majority of aged care assessment conducted pre-fracture in one in three community-living older people identified limitations performing ADLs, with over two-thirds identified as having limitations with movement in and around the house. From the age of 65 years, an older person can request, or be referred, for an aged care assessment and it appears that this service may be underutilised prior to a fall-related hip fracture hospitalisation, with only one-third of community living people in the current study indicated to have had an aged care assessment pre-hip fracture. Based on the results of the health assessments, it appears that currently older individuals who are more likely to have poorer health than their peers are the individuals who have had an assessment conducted.

As one-third of fall-related hip fractures are occurring within the RACF, residents should be regularly assessed for their fall risk, particularly as their ability to ambulate changes, and fall injury prevention management strategies implemented. Future research should consider examining trajectories of older people hospitalised for a hip fracture over time to determine whether there are distinct clusters of people undergoing post-fracture recovery and to examine movement between the community and RACFs. In addition, an examination of hospital-based hip fracture rehabilitation policies for both RACF residents and older people with dementia and potential impact on an older person's health outcomes should be conducted.

The strengths of the research include that it was a population-based study involving the whole jurisdiction and that the study used linked hospital, residential and aged care assessment data collections which allowed for the identification of the individuals who were truly residing in a RACF at the time of their hip fracture and allowed for the ability to account for transfers and/or statistical discharges (e.g. movement between acute and non-acute care) of patients between hospitals. However, there are several limitations of the current study. Within each of the data collections, data validity was not able to be assessed and it is possible that there is some

Table 5 Permanent RACF appraisals and community-living aged care assessments conducted BEFORE the fall-related hip fracture hospitalisation of individuals aged ≥ 65 years, linked hospitalisation and RACF and ACAP records in NSW, 1 July 2008 to 30 June 2013

	Permanent RACF residents[a] ($n = 8889$)		Community-dwelling ($n = 7040$)	
Permanent RACF residents	*n*	%	*n*	%
Activities of daily living (dependency)				
Nil	277	3.2	–	–
Low	2052	24.0	–	–
Medium	3098	36.2	–	–
High	3018	35.2	–	–
Behaviour			–	–
Nil	753	8.8	–	–
Low	1332	15.6	–	–
Medium	1838	21.5	–	–
High	4522	52.8	–	–
Complex health care			–	–
Nil	1087	12.7	–	–
Low	3109	36.3	–	–
Medium	2684	31.3	–	–
High	1565	18.3	–	–
Cognition[2]			–	–
No or minimal impairment (PAS-CIS 0-3)	1041	12.2	–	–
Mild impairment (PAS-CIS 4-9)	2160	25.2	–	–
Moderate impairment (PAS-CIS 10-15)	2594	30.3	–	–
Severe impairment (PAS-CIS 16-21)	2650	30.3	–	–
Community-dwelling residents				
Yes, has limitations in relation to:				
Self-care	–	–	4323	67.7
Body movements (e.g. in/out chair)	–	–	1854	29.0
Movement–walking in/around home	–	–	4129	64.6
Ability to manage health conditions	–	–	4798	75.1
Perform domestic tasks	–	–	5827	91.2
Meals and meal preparation	–	–	5142	80.5
Social and community participation	–	–	5251	82.2
Transport–getting to/from places	–	–	5839	91.4
Carer available, e.g. relative, neighbour, friend (excluding paid carers)	–	–	5117	80.1

[a] There were 261 RACF residents assessed with the Resident Classification Scale version 2 with limited concordance with the current appraisal tool and 63 residents with missing information

PAS-CIS Psychogeriatric Assessment Scales-Cognitive Impairment Scale

misclassification. However, hospital auditing has identified good-to-excellent classification of principal and comorbid diagnoses classifications in Australian hospital data [41]. As only in-hospital mortality was available, long-term survival was not able to be examined. Within the hospitalisation data, only health conditions that were relevant to each hospital episode of care are reported. However, by using a 1-year look-back period, better estimates of the prevalence of chronic health conditions were obtained. An exception is delirium, which is likely to be under-reported within hospitalisation data [42, 43].

Conclusions

RACF residents are a vulnerable cohort of older people. RACF residents experience worse overall health outcomes and survival post-hip fracture than older people living in the community. Whether access to individualised hip fracture rehabilitation for RACF residents living with and without dementia could improve their health outcomes in the longer-term should be examined. Promotion of aged care assessments and access to home-based care services should be promoted for older Australians.

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Compliance with ethical standards

Ethical approval was obtained from the NSW Population and Health Services Research Ethics Committee (2008/10/108) and the Australian Institute of Health and Welfare (AIHW) Human Research Ethics Committee (2015/1/159).

Conflict of interest None.

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