BMJ open

Potentially preventable complications of urinary tract infections, pressure areas, pneumonia, and delirium in hospitalised dementia patients: Retrospective cohort study

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-002770
Article Type:	Research
Date Submitted by the Author:	21-Feb-2013
Complete List of Authors:	Bail, Kasia; University of Canberra, Faculty of Health Berry, Helen; The University of Canberra, Centre for Research and Action in Public Health Grealish, Laurie; University of Canberra, Faculty of Health Draper, Brian; University of NSW Karmel, Rosemary; Australian Institute of Health and Welfare, Data Linkage Unit Gibson, Diane; University of Canberra, Faculty of Health Peut, Ann; Australian Institute of Health and Welfare, Ageing and Aged Care
Primary Subject Heading:	Public health
Secondary Subject Heading:	Health services research, Mental health, Nursing, Surgery, Geriatric medicine
Keywords:	Dementia < NEUROLOGY, Urinary tract infections < UROLOGY, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Adult surgery < SURGERY, Adverse events < THERAPEUTICS, Delirium & cognitive disorders < PSYCHIATRY

MANUSCRIPT

Title: Potentially preventable complications of urinary tract infections, pressure areas, pneumonia, and delirium in hospitalised dementia patients: Retrospective cohort study.

Short title: Potentially preventable complications in hospitalised dementia patients.

ABSTRACT

Objectives: Identify rates of potentially preventable complications for dementia patients compared to non-dementia patients.

Design: Retrospective cohort design using hospital discharge data for dementia patients, case matched on sex, age, comorbidity and surgical status on a 1:4 ratio to non-dementia patients.

Setting: Public hospital discharge data from the state of New South Wales, Australia for 2006/07.

Participants: 426, 276 overnight hospital episodes for patients aged 50 and above (census sample).

Main Outcome Measures: Rates of preventable complications, with episode level risk-adjustment for 12 complications that are known to be sensitive to nursing care.

Results: Controlling for age and comorbidities, surgical dementia patients had higher rates than non-dementia patients of seven of the 12 complications: urinary tract infections, pressure ulcers, delirium, pneumonia, physiological and metabolic derangement (all at p <0.0001), sepsis and failure to rescue (at p<0.05). Medical dementia patients also had higher rates of these complications than did non-dementia patients. The highest rates and highest relative risk for dementia compared to non-dementia patients, in both medical and surgical populations, were found in four common complications: urinary tract infections, pressure areas, pneumonia and delirium.

Conclusion: Compared with non-dementia patients**,** hospitalised dementia patients have higher rates of potentially preventable complications that might be responsive to nursing interventions.

Article summary

1) Article Focus

- Dementia patients are vulnerable to complications of hospitalisation, which contributes to increased length of stay, mortality and higher rates of transfer to residential care.
- The extent to which specific potentially preventable complications occur for dementia patients has not been elucidated.
- This article establishes rates of preventable complications for 12 complications that are known to be sensitive to nursing care

2) Key Messages

- Hospitalised dementia patients have much higher rates of potentially preventable complications, particularly urinary tract infections, pressure ulcers, pneumonia and delirium than hospitalised non-dementia patients.
- These complications are recognised as responsive to nursing care,
- These findings warrant further exploration of the role of nursing in preventing these complications in dementia patients.

3) Strengths and Limitations.

- Study strengths include: an internationally established algorithm of patient level risk adjustment; the linked administrative data approach which captured any person with documented dementia in a hospital episode over a two year period; and a broad age range including all over 50s.

- The study is limited to one Australian jurisdiction, and has the usual limitations of hospital administrative data for the documentation of diagnoses.

MAIN TEXT

INTRODUCTION

Rates of adverse events remain a steadfast indicator of quality and safety for public hospitals [1]. Older people are known to be particularly vulnerable to complications, with a Canadian study finding that 14% of older adults experienced an adverse event while in hospital [2]. In an Australian study, complications such as urinary tract and respiratory infections, altered mental state, electrolyte disorders and pressure ulcers were more common in patients over age 70 [3]. Factors that might contribute to this include multiple chronic diseases, longer hospitalisations [4], more frequent use of invasive devices, such as urinary catheters [5], more complicated diseases, less physiological reserve, an increased risk of falls and fractures [6], and atypical presentations of illness [7].

There has been limited research into complications in dementia patients in hospital [8] but a systematic review found that dementia patients are older, require more hours of nursing care, have longer hospital stays and are more at risk of delayed discharge and functional decline during admission [5]. To date, most study cohorts have been recruited from medical wards [5]. In a Taiwanese retrospective cohort study, Hu et al. found that dementia patients who underwent surgery had a significantly higher overall postoperative complication rate and also a higher incidence of postoperative complications that were less likely to be identified in their initial stage [9]. These included acute renal failure, pneumonia, septicaemia, stroke and urinary tract infection. These potentially preventable complications have been demonstrated to be sensitive to nursing – that is, associated with modifiable characteristics of the nursing work environment, such as registered nurse skill mix and nurse burnout – in both Europe [10] and America [11]. More information regarding the rates of potentially preventable complications that may be sensitive to nursing care for hospitalised dementia patients to confirm these findings internationally, would be useful for decisions related to resource allocation in health care.

METHODS

This study was nested in the Australian Hospital Dementia Services Project [12] using New South Wales (NSW) hospital discharge data from the 2006/07 financial year for all public hospital overnight discharges (less than 90 days length of stay) for episodes of care for people aged 50 and above. An episode of hospital care may end with a change of care type within a hospital (e.g. acute to rehabilitation), transfer to another hospital or discharge from hospital. Consequently, a stay in hospital may include several episodes of care: on average there were 1.18 episodes per stay [13]. Dementia patients were identified via a person identifier as ever having dementia documented as a principal or additional diagnosis in any hospital stay over a 2-year period, offering a high capture rate and minimising selection bias [13]. NSW is Australia's most populous state with a diverse population from metropolitan to remote areas and a range of hospital- and/or community-based dementia services. In 2007, 942,100 people or 13.7% of NSW residents were aged 65 years and over [14]. Consequently, NSW provides both system and population diversity.

Dementia patients were case-matched on age group, sex, surgical status and Charlson comorbidities on a ratio of one dementia patient to four non-dementia patients. The Charlson Index is widely used to limit confounding influence of comorbidities on the prediction of 1-year mortality [15]. The Index accounts for diabetes, hemi- or paraplegia, any cancer, HIV/AIDS and major cardiovascular, renal, rheumatic, peptic ulcer and liver diseases and its predictive validity in older people is comparable to self-report [16]. Dementia is usually also included in Charlson indexing but was excluded for the purpose of comorbidity matching in this study. Where there were insufficient controls to achieve four non-dementia patients for each dementia patient, 'bootstrapping' was utilised, where matching controls were randomised and then used more than once. This maximises the use of the existing population of cases and controls and maintains the benefits of the 1:4 ratio [17]. This procedure was primarily necessary in the 85+ age group.

Using an internationally valid patient-level risk-adjusted patient outcome algorithm, the 'Needleman algorithm' [18-20] (see Table 1), twelve potentially preventable complications that are sensitive to nursing care were examined. The algorithm has been used in Australia, New Zealand, Belgium and the United States over the last 20 years and has been translated from ICD9 to ICD10 [19]. Patients are grouped according to medical or surgical status using Australian Refined Diagnosis Related Groups (AR-DRG) V5.2 code, which incorporates the International Classification of Diseases, Australian Modification (ICD-10-AM) 5th Edition [21], where surgery is inclusive of 'other' procedures such as gastroscopy and intubation. The Needleman algorithm utilises administrative data to exclude patients who are at risk of developing a particular condition due to their underlying aetiology. In this way, the episodes of complications examined are less likely to have occurred from patient risk, and more likely to be related to hospitalisation. For example, patients who have paralysis as a primary or secondary diagnosis are less mobile than other patients and are therefore excluded from the complication 'pressure ulcer'; patients with a primary or secondary diagnosis of any kidney or bladder condition are excluded from the complication 'urinary tract infection'. Consequently, each complication has a different sample size, based on exclusions and inclusions. Surgical and medical cohorts are analysed separately.

The statistical package SAS EG 9.2 was used. Pearson's Chi-square test of independence demonstrated the magnitude of association and goodness-of-fit of the relative risk (RR) between dementia and non-dementia patients, where the RR was calculated using residuals adjusted for sample size and the 1:4 case–to-control ratio. Missing data were rare in the variables used in this analysis. Diagnosis information was missing in less than 0.2% and sex for less than 0.001% of records for 2006–07; AR-DRG data were always present. The dataset was extracted from the source administrative data based on age (50+) and so patient age is never missing in this analysis. Because of the very low level of missing data, records with missing information were excluded from analysis where relevant.

Table 1. Needleman Algorithm (only 4 of the 12 complications shown for readability)

Compli-cation	Inclusion Criteria Any Secondary diagnosis of:	Exclusion Criteria Any Primary Diagnosis or Major Diagnostic Category (MDC) of:
Urinary Tract Infection	Urinary tract infection, non specified site. Infection and inflammatory reaction due to implant, prosthesis, graft in urinary system	Urinary tract infection, non specified site. Infection and inflammatory reaction due to implant, prosthesis, graft in urinary system Streptococcal sepsis, other sepsis Bacterial infection, unspecified Kidney and Urinary Tract (MDC) Female Reproductive System (MDC) Pregnancy, Childbirth and Puerperium (MDC) Newborn and other Neonates (Perinatal Period) MDC) **Any Primary or Secondary Diagnosis of:** Pregnancy Abortion
Pressure Ulcer	Decubitus ulcer and pressure area	Decubitus ulcer and pressure area Skin, Subcutaneous Tissue and Breast (MDC) **Any Primary or Secondary Diagnosis of**: Hemi/quadriplegia
Pneu-monia	Pneumonitis due to solids and liquids Post procedure respiratory disorder, unspecified Other post procedural respiratory disorders Hypostatic pneumonia, unspecified Pneumoniahaemophilus influenze, bacterial pneumonia Other bacterial pneumonia Bacterial pneumonia, unspecified Bronchopneumonia, unspecified Other pneumonia, organism unspecified Pneumonia, unspecified	Viral pneumonia, not elsewhere classified Pneumonia due to streptococcus pneumoniae due to flu, bacterial pneumonia Other bacterial pneumoniae Bacterial pneumonia, unspecified Pneumonia due to mycoplasma pneumoniae due to other infectious organisms In diseases classified elsewhere Bronchopneumonia, unspecified Other pneumonia, organism unspecified Pneumonia, unspecified Influenza Influenza, virus not identified Pneumonitis due to food and vomit Post procedural respiratory disorder, unspecified Other post procedural respiratory disorders Hypostatic pneumonia, unspecified Respiratory system (MDC) **Any Primary or Secondary Diagnosis of**: Immunodeficiency Systemic autoimmune disease, unspec HIV
Delirium	Coma, unspecified Stupor, semi coma	Coma, unspecified Stupor, semi coma

	Delirium, unspecified Other specified dissociative (conversion) disorders Adjustment disorders Reaction to severe stress, unspecified	Delirium, unspecified Other specified dissociative (conversion) disorders Adjustment disorders Reaction to severe stress, unspecified Nervous System (MDC) Mental Diseases and Disorders (MDC) Alcohol/Drug Use or Induced Mental Disorders (MDC)

RESULTS

There were 44,488 (10.44%) hospital episodes for dementia patients in NSW over the period 2006-07, compared to 381,788 for non-dementia patients. Surgery was much less common in dementia patients (12%) than in non-dementia patients (27%). The average surgical dementia patient age was 81 with a Charlson index of 1.04 (indicating most dementia patients had one comorbidity in addition to dementia), whereas the average surgical non-dementia patient age was 68 with a lower Charlson index of 0.89. Dementia patients had more hospital episodes with potentially preventable complications than did non-dementia patients, and this difference was higher in the surgical population.

Table 2 shows the results for medical and surgical patients. Medical dementia patients (that is, those who did not undergo surgery) had higher rates of delirium (RR 2.83), urinary tract infections (RR 1.79), pressure ulcers (RR 1.61), pneumonia (RR 1.37) (all at $p<0.0001$), as well as sepsis (RR 1.34) and failure to rescue (death following sepsis, shock, gastrointestinal bleeding, deep vein thrombosis or pneumonia) (RR 1.24) (at $p<0.05$), compared to non-dementia patients. There was no significant difference between medical dementia and non-dementia patients for shock or gastro-intestinal bleeding. Deep vein thrombosis/pulmonary embolism was the only complication to show slightly (but statistically significant) higher rates in *non-dementia* patients (RR 0.82) (at $p<0.05$).

Surgical dementia patients had higher rates of delirium (RR 3.10), urinary tract infection (RR 2.88), pressure ulcers (RR 1.84), pneumonia (RR 1.66) and physical or metabolic derangement (RR 1.87) (all at $p<0.0001$), as well as gastro-intestinal bleeding (RR 1.68) (at $p<0.05$), compared to non-dementia

patients. There was no significant difference in rates of sepsis, shock, surgical wound infection, pulmonary failure or failure to rescue in dementia compared to non-dementia patients.

Compared to medical dementia patients, surgical dementia patients had significantly higher relative risks (at $p<0.05$) of urinary tract infections (RR1.09), pressure ulcers (RR1.24) and pneumonia (RR1.42), but not of delirium. In non-dementia patients, medical patients were more likely to get a urinary tract infection than were surgical patients (RR 0.71 at $p<0.0001$); there were no other significant differences. Dementia was consequently a more informative indicator of risk of preventable complications than was surgery for these four common complications. Separately, while noting that dementia patients were much less likely than were non-dementia patients to undergo surgery, surgical procedures carried more risk of preventable complications for dementia than for non-dementia patients.

The strongest findings of the study (at $p<0.0001$), with the greatest differences in rates of dementia and non-dementia patients, for surgical and medical cohorts, were related to four common complications: urinary tract infections, pressure ulcers, pneumonia and delirium. Fourteen per cent of surgical dementia patients suffered a urinary tract infection while in hospital, which was 2.8 times higher than surgical non-dementia patients. Seven per cent suffered a pressure ulcer, 1.84 times higher than non-dementia patients. Seven per cent also suffered pneumonia, 1.66 times the rate of non-dementia patients and 5% suffered delirium, which was 3.1 times higher than for non-dementia patients. These infections and complications were not likely to be related to the person's admitted diagnosis, and were thus more likely to be nosocomial or hospital-acquired, and therefore potentially preventable.

Table 2. Population, samples, percentage rates and relative risks of potentially preventable complications in the over 50 age group from NSW public hospital episode data 2006-07.

Prevent-able compli-cation	Patient population	Percentage of patient episodes with the complication (1)				Relative risk of dementia patients with the complication compared to non dementia patients (2)			
		Medical		Surgical		Medical		Surgical	
		Sample	%	Sample	%	Sample	RR (CI)	Sample	RR(CI)
Urinary Tract Infection	Dementia	36,075	13.4	4,854	14.7	58223^	1.79**	7,680	2.88**
	Non-Dementia	146,813	7.9	18,986	5.6		(1.70-1.90)		(2.45-3.40)
	All >50	182,888	9.0	23,840	7.4				
Pressure Ulcer	Dementia	25,832	5.9	4,007	7.3	38,480	1.61**	5,904	1.84**
	NonDementia	89,074	3.8	13,493	4.1		(1.46-1.77)		(1.46-1.31)
	All >50	114,906	4.2	17,500	4.9				
Pneumonia	Dementia	36,875	4.8	5,106	6.8	59,523	1.37**	8184	1.66**
	NonDementia	150,118	3.5	20,497	4.2		(1.26-1.48)		(1.36-2.02
	All >50	186,993	3.8	25,603	4.7				
Deep Vein Thrombosis	Dementia	39,104	0.8	5,154	1.4	62,459	0.82*	8,245	1.14
	NonDementia	155,882	1.0	20,609	1.2		(0.69-0.97)		(0.78-1.68)
	All >50	194,986	0.9	25,763	1.2				
Gastro-intestinal Bleeding	Dementia	30,035	1.1	2,702	3.8	50,246	1.01	5,405	1.68*
	NonDementia	131,088	1.1	16,215	2.3		(0.85-1.19)		(1.22-2.31)
	All >50	161,123	1.1	18,917	2.5				
Sepsis	Dementia	25,365	1.9	4,469	10.6	39,218	1.34*	6,595	1.25
	NonDementia	94,631	1.4	15,100	3.1		(1.15-1.57)		(0.96-1.64)
	All >50	119,996	1.6	19,569	4.9				
Shock & Cardiac Arrest	Dementia	31,021	0.6	2,793	1.3	51,256	1.09	5,521	0.93
	NonDementia	132,194	0.5	16,431	1.3		(0.86-1.37)		(0.58-1.50)
	All >50	163,215	0.6	19,224	1.3				
Delirium	Dementia	37,933	4.0	5,155	4.4	61,307	2.83**	8,251	3.10**
	NonDementia	154,805	1.5	20,636	1.5		(2.54-3.15)		(2.31-4.15)
	All >50	192,738	2.0	25,791	2.1				
Surgical wound infection	Dementia	-	-	5,158	0.1	-	-	8,253	1.12
	NonDementia	-	-	20,633	0.0				(0.48-2.63)
	All >50	-	-	25,791	0.0				
Pulmonary failure	Dementia	-	-	2,870	2.0	-	-	5,628	0.98
	NonDementia	-	-	16,660	1.7				(0.81-1.19)
	All >50	-	-	19,530	1.7				
Phys/ met derange-ment	Dementia	-	-	2,881	11.5	-	-	5,644	1.87**
	NonDementia	-	-	16,699	6.5				(1.55-2.25)
	All >50	-	-	19,580	7.3				
Failure to Rescue#	Dementia	2597	28.2	561	22.3	3745	1.24*	778	0.86
	NonDementia	8336	24.1	1647	25.0		(1.02-1.33)		(0.61-1.20)
	All >50	10933	25.1	2208	24.3				

DISCUSSION

These findings demonstrate that hospitalised dementia patients have higher rates of complications than hospitalised non-dementia patients, controlling for current comorbidities, and that these rates of complications are significantly higher in dementia patients who have surgery. These findings support previous nationwide, cohort designed Taiwanese findings that dementia patients have higher rates of post-operative complications than non-dementia patients [9]. The highest rates and highest relative risk for dementia patients, for both medical and surgical patients, are for urinary tract infections, pressure ulcers, delirium and pneumonia. This new finding of high rates of four very common preventable complications for dementia patients offers avenues for intervention and prevention. Three key design features of this new Australian study give credibility to the findings: (i) the comprehensive linked approach over two years of administrative data to better identify dementia patients[13], (ii) the patient-level risk-adjustment model to better capture in-hospital complications[18] and (iii) the inclusion of 50-65 year olds with dementia who are known to have varied characteristics compared to other aged populations [8].

Evidence is mounting for associations between poorer nursing work environments and higher rates of patient complications (see Table 3) and demonstrates that, for the four key complications found for dementia patients in the present study, these complications may be modifiable. Nursing interventions for preventing or mitigating these common complications involve mobility, hydration, hygiene, patient education and reassurance in a context of nursing surveillance, assessment, early intervention and advocacy. Nurses more than any other healthcare professional are able to recognise, interrupt, evaluate and correct health care errors [22]. Specifically, in relation to urinary tract infections, it is argued that higher levels of engaged and educated nurses better enable sterile techniques for catheter insertion, time-consuming toileting programs and management of hygiene and hydration [20 23]. In relation to pneumonia, nurses are responsible for (or at least instrumental in) many of the necessary clinical practices, such as encouraging flu vaccination, hand washing, pain relief, mobilisation and pulmonary

hygiene for reducing pneumonia [23]. In relation to delirium, simple preventative measures, such as verbal reorientation, correcting sensory deficits, improving mobilisation, improving hydration, decreased use of sleeping and pscychoactive medications and restraints [24], are primarily initiated, maintained and reinforced by nurses in acute settings. In relation to pressure areas, patient positioning and skin care are the primary domain of nurses more than any other profession, and their actions in relation to hydration, nutrition, mobility and pain relief are also accepted to have significant impact on the prevention of pressure ulcers [25]. The development of complications can be set in motion by a seemingly innocuous first event (for example, a urinary tract infection can develop from dehydration which can start with something as simple as a missed cup of morning tea). This has been termed 'cascade iatrogensis' and is a helpful concept in understanding the link between unmet nursing care needs and potentially preventable complications [26 27].

Table 3. Evidence of association between the four key complications and nursing work environments

Study	Sample	Location & Data Timeframe	Characteristics of nursing work environments (Independent variable)	Patient Complication (Dependent variable)
Cimiotti et al 2012 [28]	161 hospitals 1,571,068 patients 7076 nurses	USA 2006	Lower levels of burnt out nurses	Lower rates of urinary tract infection
Needleman et al 2001 [18]	799 hospitals 6 million+ patients	USA 1997	Higher levels of total nurse staffing	Lower rates of urinary tract infection
Cho et al 2003 [29]	232 hospitals 124,204 patients	USA 1997	Higher proportions of RNs	Lower rates of pneumonia
Kovner et al 2002 [30]	187 hospitals	USA 1990-96	Higher RN hours per patient day	Lower rates of pneumonia
Pappas et al 2008 [31]	2 hospitals 3200 patients	USA 2007	Higher RN hours per patient day	Lower rates of pneumonia
Kane et al 2007 [11]	Systematic review 96 studies	USA 2006	Higher proportions of RN per patient day	Decreased odds ratio of hospital acquired pneumonia
Twigg et al 2010 [32]	3 hospitals 236,454 pts 150,925 nurses	Australia 2000-04	Refined staffing model	Lower rates of pneumonia Lower rates of delirium
Schubert et al 2008 [33]	8 hospitals 779 pts 1338 nurses	Switzlerand 2003-04	Implicit care rationing	Predicted higher levels of pressure ulcers
Horn et al 2005 [34]	82 RACF 1376 residents	USA 1996-97	Higher RN direct time per resident per day	Lower rates of pressure ulcers
Pekkarinen et al 2008 [35]	66 RACF 724 nurses	Finland 2002	Increased time unit pressure	Higher rates of pressure ulcers
Hickey et al 2004 [36]	35 RACF Patient Assessment Files Staffing Data	USA 1998-1999	Lower skill mix (less RNs)	Higher rates of pressure ulcers

"Burnt out": where workers emotionally and cognitively detach from work as a way to cope with demands

"Implicit care rationing": where nurses withhold or fail to carry out necessary nursing tasks due to inadequate time, staffing level and/or skill mix

"Time unit pressure": as a measure of nursing working conditions

"RN": Registered Nurse – a graduate from a University or college nursing program who has met national licensing conditions

"RACF" : Residential Aged Care Facility
"Refined staffing model": which developed categories of nurse staffing based on patient complexity, intervention levels, high dependency beds, emergency/elective patient mix and patient turnover
"USA": United States of America

These findings highlight the need to view nursing as an intervention rather than as a labour cost in terms of the nursing work environment's impact on patient outcomes. Despite hospitals spending approximately 1/3rd of their budget on ward nursing [37], "administrative data sets have not been designed to capture a great deal of information about nurses" [23]. Staffing data in Australia are limited to hospital level aggregate data for a whole year, without differentiation of types of nurses (for example, Registered Nurse or unlicensed personnel), or state level data by the nurse's postcode of residence. Better hospital nursing data would enable research investigating associations between nurse staffing and patient outcomes, as well as opportunities for systemic benchmarking [9 38].The USA has a more systemic approach to data collection in relation to nursing care but many of the data items are restricted to specific locations (for example, intensive care units). Recommendations have been made that the minimum data sets in America be expanded so that urinary tract infection and pneumonia are measured in all at-risk hospitalised patients [23]. The present study would support this policy. We would also suggest that future acute dementia care intervention studies consider controlling for relevant nursing characteristics.

The four key complications identified here have some of the highest dollar costs for hospitals. For example, though urinary tract infections and pneumonias have relatively low per-case costs, their large volume means that they have the greatest system financial impact in Australia [3]. If we want to reduce the cost and occurrence of preventable complications in hospitalised dementia patients, we need to better understand relationships between nursing work environments and patient outcomes. In order to increase this understanding, we need better data collection strategies for quality benchmarking and research. These data collection strategies need to include (a) screening and documentation of dementia

patients in hospital, (b) minimum nursing work environment characteristics, such as appropriate ratios of registered nurse staffing and skill mix and management of workload/pressure and burnout/retention, and (c) rates of the common complications of urinary tract infections, pressure ulcers, pneumonia and delirium.

CONCLUSION

Dementia patients have higher rates of potentially preventable complications while in hospital than do non-dementia patients, even when controlling for age, sex, surgery and comorbidities. The highest rates, and largest differences in rates, for dementia patients compared to non-dementia patients are seen in urinary tract infections, pneumonia, pressure ulcers and delirium. These complications have been specifically associated with aspects of nursing work environments, including staffing skill mix of Registered Nurses, and workload measures, such as burnout and time pressure. Modifying aspects of the nursing work environment may reduce or prevent these complications in hospitalised dementia patients (and, indeed, in other patients). Improving hospital data collection strategies for the identification of dementia patients and key nursing characteristics would enable benchmarking and research in order to improve the care, and cost of care, for this burgeoning population.

Contributors: DG, BD, RK, and AP devised the idea of the Hospital Dementia Services study, designed the methods, raised funding and conducted the analysis. KB was responsible for implementing the nested study reported here and carrying out all the analyses. HB and LG supervised this nested study. HB, RK, and BD provided statistical advice. KB prepared the first draft of the manuscript and all authors contributed to each section of the final draft of the manuscript. KB is guarantor.

Competing interests: All authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: KB is supported by a PhD Scholarship funded by the Dementia Collaborative Research Centre – Assessment and Better Care, University of New South Wales as part of an Australian Government Initiative. The Hospital Dementia Services Project was funded by the National Health and Medical Research Council (ID465701). Support has been receieved by employing organistions from Alzheimers Australia in regard to commissioned work using data collected in the course of the Hospital Dementia Services Project. No other declarations are made regarding other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: Obtained from the NSW Population and Health Services Research Ethics Committee (HREC/08/CIPHS/49 and 2008/11/109) the Australian Institute of Health and Welfare Ethics Committee**,** the University of NSW and University of Canberra Human Research Ethics Committees (08-85).

Reporting guidelines: This observational cohort study fulfils the STROBE criteria, and a STROBE checklist is included in the submission.

Data sharing: Statistical code and technical appendix available from the corresponding author. Dataset inquiries can be made to the Australian Institute of Health and Welfare via the corresponding author.

REFERENCES

1. Australian Patient Safety Foundation. Iatrogenic injury in Australia. Adelaide, 2001.
2. Ackroyd-Stolarz S, Guernsey JR, MacKinnon NJ, Kovacs G. Adverse events in older patients admitted to acute care: a preliminary cost description. *Healthcare management forum / Canadian College of Health Service Executives = Forum gestion des soins de sante / College canadien des directeurs de services de sante* 2009;22(3):32-6.
3. Purpora C, Blegen MA. Horizontal violence and the quality and safety of patient care: a conceptual model. *Nursing research and practice* 2012;2012:306948-48.
4. Lang PO, Zekry D, Michel JP, Drame M, Novella JL, Jolly D, et al. Early markers of prolonged hospital stay in demented inpatients: a multicentre and prospective study *J. Nutr. Health Aging* 2010;14(2):141-47.

5. Mukadam N, Sampson EL. A systematic review of the prevalence, associations and outcomes of dementia in older general hospital inpatients. *International Psychogeriatrics* 2011;23(3):344-55.
6. Brennan TA, Leape LL, et al. Incidence of adverse events and negligence in hospitalised patients - results of the Harvard Medical Practice Study. *New England Journal of Medicine* 1991;324(6):370-76.
7. Mitty E. Iatrogenesis, Frailty, and Geriatric Syndromes. *Geriatric Nursing* 2010;31(5):368-74.
8. Draper B, Karmel R, Gibson D, Peut A, Anderson P. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. *International Psychogeriatrics* 2011;23(10):1649-58.
9. Hu C-J, Liao C-C, Chang C-C, Wu C-H, Chen T-L. Postoperative adverse outcomes in surgical patients with dementia: a retrospective cohort study. *World J. Surg.* 2012;36(9):2051-8.
10. Aiken LH, Sermeus W, Van den Heede K, Sloane DM, Busse R, McKee M, et al. Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *British Medical Journal* 2012;344.
11. Kane RL, Shamliyan TA, Mueller C, Duval S, Wilt TJ. The association of registered nurse staffing levels and patient outcomes - Systematic review and meta-analysis. *Medical Care* 2007;45(12):1195-204.
12. Australian Institute of Health and Welfare. The Hospital Dementia Services Project: a study description. . In: 67 CnA, editor. Canberra: AIHW, 2011.
13. Australian Institute of Health and Welfare. Deriving key patient variables: a technical paper for the Hospital Dementia Services project. Canberra: AIHW, 2012.
14. Australian Bureau of Statistics. Publication 3235.0 - Population by Age and Sex, Regions of Australia, 2007. , 2007.
15. Quan HD, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Medical Care* 2005;43(11):1130-39.
16. Susser SR, McCusker J, Belzile E. Comorbidity information in older patients at an emergency visit: self-report vs. administrative data had poor agreement but similar predictive validity. *Journal of Clinical Epidemiology* 2008;61(5):511-15.
17. Wacholder S, Silverman DT, et al. Selection of controls in case-control studies. 3. Design Options. *Am. J. Epidemiol.* 1992;135(9):1042-50.
18. Needleman J, Buerhaus P, Potter V, Mattke S, Stewart M, Zelevinsky K. Nurse staffing and patient outcomes in hospitals. Nashville: Harvard School of Public Health, 2001.
19. McCloskey BA, Diers DK. Effects of New Zealand's health reengineering on nursing and patient outcomes. *Medical Care* 2005;43(11):1140-46.
20. Duffield C, Roche, M, O'Brien-Pallas, L, Diers, D, Aisbett, C, King, M, Aisbett, K, Hall, J, . Glueing it together: Nurses, their work environment and patient safety. Sydney: University of Technology, 2007.
21. Department of Health and Ageing. Classifications: Australian Refined Diagnosis Related Groups (AR-DRGs). 2012.
22. Rothschild J, Hurley A, Landrigan C, Cronin J, Martell-Wal-drop K, Foskett C, et al. Recovery from medical errors: the critical care nursing safety net. *Journal of Quality and Patient Safety* 2006;32(2):63-72.
23. Naylor MD. Advancing the science in the measurement of health care quality influenced by nurses. *Medical Care Research and Review* 2007;64(2):144S-69S.
24. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly persons - Predictive model and interrelationship with baseline vulnerability. *Jama-Journal of the American Medical Association* 1996;275(11):852-57.
25. Padula CA, Osborne E, Williams J. Prevention and early detection of pressure ulcers in hospitalized patients. *Journal of wound, ostomy, and continence nursing : official publication*

of The Wound, Ostomy and Continence Nurses Society / WOCN 2008;35(1):65-75; discussion 76-8.
26. Rothschild JM, Bates DW, Leape LL. Preventable medical injuries in older patients. *Arch. Intern. Med.* 2000;160(18):2717-28.
27. Thornlow DK, Anderson R, Oddone E. Cascade iatrogenesis: Factors leading to the development of adverse events in hospitalized older adults. *International Journal of Nursing Studies* 2009;46(11):1528-35.
28. Cimiotti. Nurse staffing, burnout, and health care-associated infection (vol 40, pg 486, 2012). *American Journal of Infection Control* 2012;40(7):680-80.
29. Cho SH, Ketefian S, Barkauskas VH, Smith DG. The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nursing Research* 2003;52(2):71-79.
30. Kovner C, Jones C, Zhan C, Gergen PJ, Basu J. Nurse staffing and postsurgical adverse events: An analysis of administrative data from a sample of US hospitals, 1990-1996. *Health Services Research* 2002;37(3):611-29.
31. Pappas SH. The cost of nurse-sensitive adverse events. *Journal of Nursing Administration* 2008;38(5):230-36.
32. Twigg D, Duffield C, Bremner A, Rapley P, Finn J. The impact of the nursing hours per patient day (NHPPD) staffing method on patient outcomes: A retrospective analysis of patient and staffing data. *International Journal of Nursing Studies* 2010.
33. Schubert M, Glass TR, Clarke SP, Aiken LH, Schaffert-Witvliet B, Sloane DM, et al. Rationing of nursing care and its relationship to patient outcomes: the Swiss extension of the International Hospital Outcomes Study. *International Journal for Quality in Health Care* 2008;20(4):227-37.
34. Horn SD, Buerhaus P, Bergstrom N, Smout RJ. RN staffing time and outcomes of long-stay nursing home residents - Pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care. *American Journal of Nursing* 2005;105(11):58-70.
35. Pekkarinen L, Sinervo T, Elovainio M, Noro A, Finne-Soveri H. Drug use and pressure ulcers in long-term care units: do nurse time pressure and unfair management increase the prevalence? *Journal of Clinical Nursing* 2008;17(22):3067-73.
36. Hickey EC, Young GJ, Parker VA, Czarnowski EJ, Saliba D, Berlowitz DR. The effects of changes in nursing home staffing on pressure ulcer rates. *J. Am. Med. Dir. Assoc.* 2004;6(1):50-53.
37. Watts J, Richardson J, Segal L. Comparing National Public Hospital Cost Data Collections for use in Performance Reporting. . In: Evaluation. TCfHP, editor. West Heidelberg Victoria. , 2000.
38. Schilling P, Goulet JA, Dougherty PJ. Do Higher Hospital-wide Nurse Staffing Levels Reduce In-hospital Mortality in Elderly Patients with Hip Fractures: A Pilot Study. *Clinical Orthopaedics and Related Research* 2011;469(10):2932-40.

Australian Government
Australian Institute of Health and Welfare

BULLETIN 110 • NOVEMBER 2012

People with dementia in hospitals in New South Wales 2006–07

Summary

The Hospital Dementia Services Project is an innovative study that uses linked data to explore how hospital-based aged care and dementia services in New South Wales in 2006–07 influenced outcomes for people with dementia.

This bulletin examines the hospital experiences of the 252,700 people aged 50 and over who stayed for at least one night in a New South Wales public hospital in 2006–07. All hospital stays that ended in 2006–07 are included to allow a complete analysis of patients' hospital care, comprising 408,500 multi-day stays and 252,400 same-day stays. Data for this analysis are person-based hospital stay data that allow both patient-level and stay-level analyses of hospital use by people with and without dementia.

Slightly more than 8% of patients (20,800 people) were identified as having dementia. Like the general population, the prevalence of dementia among patients in the study increased with age, with the rate rising from less than 1% of those aged 50–59 to 28% among the very old (90+). Consequently, patients with dementia tended to be older than those without the condition (median age of 83.7 versus 70.7), and were more likely to be female (60% versus 51%). To allow for these demographic differences, comparisons between patients with and without dementia use age-sex standardised estimates where applicable.

Greater use of hospitals

People with dementia had much higher hospitalisation rates than those without dementia: in New South Wales, 26% of people with dementia aged 50 and over had at least one overnight stay in a public hospital ending in 2006–07, compared with 12% of people without dementia. Also, patients with dementia:

- were more likely to have more than one multi-day stay in a year (62% versus 43%)
- had longer multi-day stays (mean of 18.3 days versus 9.1 days), and these stays were more likely to involve either a change in care type or a transfer between hospitals (18% versus 13%).

bulletin 110

Different reasons for hospitalisation

Compared with people without dementia, people with dementia were more likely to be admitted because of:

- non-dementia mental and behavioural disorders or conditions of the nervous system (14% versus 5%)
- injury or poisoning (14% versus 11%), particularly head and limb injuries.

Their admission was less likely to be caused by neoplasms (4% versus 10%) or circulatory diseases (13% versus 19%).

Different destinations

People with dementia were less likely than others to return to living in the community on discharge (59% versus 88%), and more likely either to return to living in residential care, to enter residential care on discharge from hospital, or to die in hospital.

Contents

1 Background

There is substantial evidence that the hospitalisation of older people can be associated with a range of poor outcomes, including deconditioning and exacerbation of a range of physical conditions (Creditor 1993; Covinsky et al. 2003). Older patients are also more likely than younger patients to experience preventable adverse events (Thomas & Brennan 2000). A number of studies have found an association between cognitive impairment and functional decline during hospitalisation (Sager et al. 1996; McCusker et al. 2002). Also, patients with dementia are more likely to experience hospital-related (nosocomial) infections and treatment complications (Torian et al. 1992; Foreman & Gardner 2005), with patient-related adverse events in hospital also being associated with cognitive impairment and delirium (Watkin et al. 2012). Hospitalisation can entail multiple bed moves, which may cause distress and exacerbate confusion, agitation, and behavioural problems (Cunningham 2006). Large and unfamiliar hospital environments are associated with patient disorientation and anxiety (Cunningham 2006; Fleming et al. 2003), while the organisational focus on efficient, cure-oriented treatment often means the particular needs of people with dementia are not well met (Cunningham 2006; DADHC & NSW Health 2002).

The mean length of stay (LOS) for all Australian hospital episodes has previously been estimated at 8.6 days, compared with 19.6 days for episodes with any diagnosis of dementia and 30.1 days with a principal diagnosis of dementia (AIHW 2007:186). The relatively high casemix complexity of patients with dementia contributes to longer hospital stays and this has an impact on patient physical and mental state (King et al. 2006; Nichol et al. 2000; ACEMA 2002).

The Hospital Dementia Services (HDS) Project is an innovative study that explores how hospital-based aged care and dementia services influenced outcomes for people with dementia who used a public hospital in New South Wales in 2006–07. It is a mixed methods study involving:

- linking existing administrative data sets to create a data set containing information on the paths patients take in hospitals and into residential aged care
- a survey of all New South Wales public hospitals about hospital-based aged care and dementia-specific services
- follow-up site visits in selected locations to obtain qualitative data on operational aspects of different hospital-based service models for patients with dementia (Box 1.1; also see AIHW 2010; AIHW 2011 for more details).

Box 1.1: HDS Project

The HDS Project is a mixed methods study that explores how hospital-based aged care and dementia services influence outcomes for people with dementia who were admitted to a public hospital in New South Wales. It is a 3-year project funded through the National Health and Medical Research Council, and involves a team of researchers from the Australian Institute of Health and Welfare (AIHW), University of Canberra, and University of New South Wales.

Objectives

The overarching objective is to inform health practitioners, health and aged care policy makers and planners, and consumers about the influence of system-level factors on care outcomes for hospital patients with dementia. Outcomes of interest include hospital admission rates, length of stay in hospital, and care outcomes such as falls, complications, and discharge rates to residential aged care.

Project design

The project consists of four streams.

Stream 1 describes hospital stay and patient accommodation outcomes for patients with dementia, and compares them with those of other older public hospital patients. This is based on analysis of linked data from existing administrative data sets (New South Wales hospital, residential aged care, and Aged Care Assessment Program data); analyses focus on older patients (50+) discharged from New South Wales public hospitals in 2006–07. Data are linked according to procedures approved by relevant ethics committees and follows the protocol developed and used extensively at the AIHW (AIHW 2006).

Stream 2 describes aged care and dementia-specific services in New South Wales in 2006–07 through a survey of all public hospitals and follow-up site visits in selected locations (see AIHW 2010 for forms). This stream also involves the collection of information to describe aged care programs at the regional level.

In **Stream 3**, the materials collected in Streams 1 and 2 are integrated to explore system-level outcomes for people with dementia who are admitted to hospital and the factors that influence the outcomes.

Throughout the project the research team is disseminating and discussing study progress and results with policy advisers, health practitioners and service planners through seminars and conference presentations, as well as publications (**Stream 4**).

Expert panel and partners

The research is guided and informed by an expert panel comprising of representatives of dementia service consumers, aged care providers, health service planning staff, and key researchers. Project partners and collaborators are New South Wales Health, Alzheimer's Australia, Alzheimer's New South Wales, the Aged and Community Services Association of New South Wales and the Australian Capital Territory, the Benevolent Society, the University of Queensland, and La Trobe University.

Source: AIHW 2010; see also AIHW 2011.

This bulletin examines completed hospital stay data for people with and without dementia. Hospital data extracted for this project means patients' stay histories within and across hospitals can be examined. This enables the hospital experiences of people with and without dementia to be compared. Analyses use both patient-level and stay-level data. Aspects examined include hospitalisation rates, age profiles, length of stay, cause of admission, principal procedure in hospital, destination on discharge from hospital, and re-admission. Because the age and sex profiles of those hospitalised with and without dementia differ, where appropriate, age-sex standardisation has been used to enable comparisons.

2 Data

Hospital use data for the HDS Project were extracted from the New South Wales Admitted Patient Data Collection (APDC) and included all hospital episodes ending between 1 July 2005 and 30 June 2007. The data extract contained a unique patient identifier derived by the New South Wales Centre for Health Record Linkage (CHeReL 2009). Using this identifier, data from the full 2 years were used to identify complete hospital stays ending in 2006–07 and whether the patient had dementia.

2.1 Scope of hospital data

People

The analysis population is people aged 50 and over by 1 July 2006 who had a completed hospital stay in 2006–07 that included at least one night in a New South Wales public hospital. Just over 252,700 people—termed HDS patients—on the APDC data set met these conditions.

Hospital stays

The analysis of hospital stays included all stays for HDS patients that ended in 2006–07. Stays in both public and private hospitals in New South Wales were included to allow a complete analysis of the hospital experience of HDS patients, and these stays may or may not have included a night in hospital.

For this analysis, a hospital stay is defined as the period from admission into the hospital system to discharge from the system, or death in hospital. It can:

- start and end on the same day (a same-day stay), or include at least one night in hospital (a multi-day stay)
- include one or more transfers between hospitals (that is, a multi-episode stay)
- include changes in care type within a hospital (that is, a multi-episode stay)
- include a visit to one hospital while admitted to another.

This approach is different from previous analyses of hospital care that have generally been episode based (AIHW: Karmel et al. 2007; AIHW 2008).

Examples of various types of stays and visits are illustrated in Figure 2.1. The derivation of completed hospital stay data from the New South Wales APDC episode-based extract is described in AIHW 2012b. Overall, HDS patients had 660,962 completed stays ending in 2006–07, comprising 408,539 multi-day stays and 252,423 same-day stays. Just 1.2% (4,991) of multi-day stays included a visit to another hospital, with an average of 1.4 visits per stay with a visit (a total of 6,887 hospital visits).

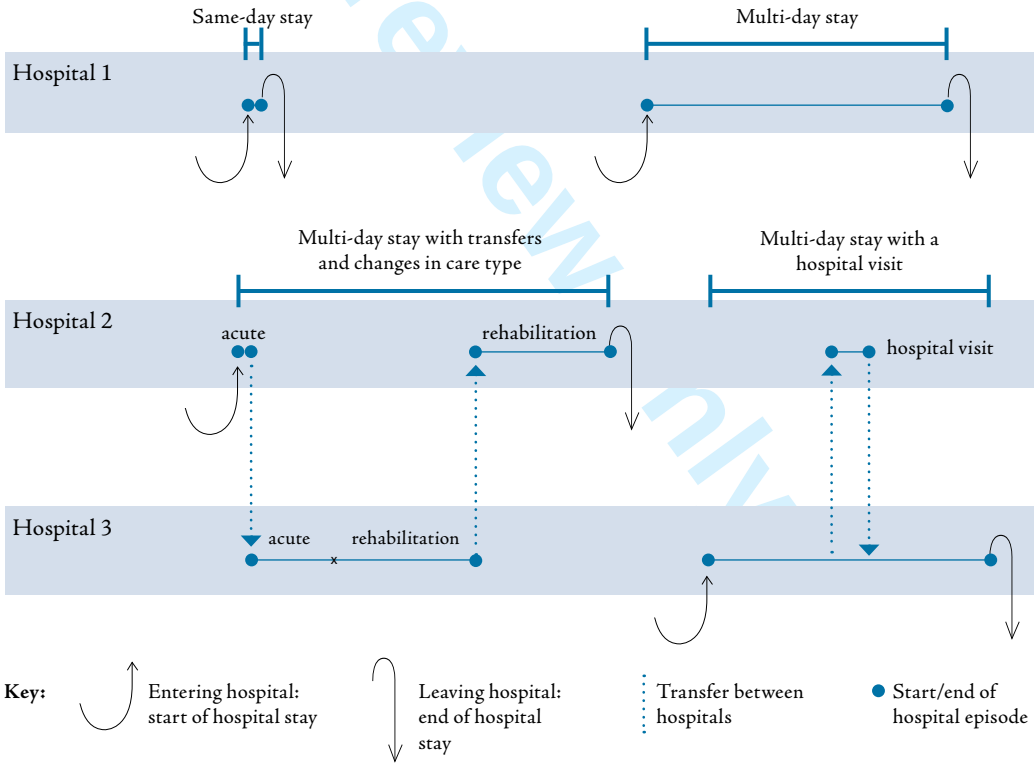


Figure 2.1: Examples of the relationship between hospital episodes and stays

Because HDS patients must have at least one multi-day stay, the pattern of same-day and multi-day stays for the study cohort is different from that for all New South Wales patients. Across all New South Wales hospital patients aged 50 and over in 2006–07, same-day episodes accounted for half of the hospital episodes, compared with 38% for HDS patients. Therefore, most of the analysis of hospital stays focuses on multi-day stays for HDS patients.

People with dementia

The New South Wales APDC can record up to 55 diagnoses as contributing to the care provided during an episode in hospital. For the HDS Project, patients were identified as having dementia if it was recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. Diagnoses in the APDC data are coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (NCCH 2000). The codes used to identify people with dementia are in Table A1.

It is likely that dementia is underestimated in the hospital patient population due to a combination of poor recognition by medical staff, deficiencies in medical records, and because the condition, like other pre-existing conditions, may not be recorded on the hospital admission data if it does not affect the care provided or resource use during the hospital stay. On the other hand, for the HDS Project, patients were identified as having dementia if a dementia condition was reported for any of their New South Wales hospital episodes ending between 1 July 2005 and 30 June 2007. Consequently, it is possible that, in this study, people with dementia who had more or longer stays were more likely to have been identified as having the condition. These two factors have opposing effects. It is also possible that some cases of delirium were misdiagnosed as dementia. Nevertheless, because of the large scale of the study, it is expected that patterns seen in hospital use for HDS patients with and without dementia are robust.

2.2 Statistical significance and standardisation of results

Age-sex standardisation has been used where appropriate to enable comparisons between people with and without dementia. In general, 5-year age groups have been used for standardisation, except for the youngest (50–59) and oldest groups (90+). Where the classification of interest may have small numbers in some categories, broader age groups have been used; this is indicated in the table notes. Percentages and means have been directly standardised using the age-sex distribution of all patients or stays (as relevant) contributing to a table.

The significance of differences between results for people with and without dementia across age groups has been examined using standardised figures. Because of the large number of comparisons being made, only differences with high statistical significance are discussed (> 99.9%).

3 People in hospital

The median age of HDS patients was 72.1, and just over half were women (Table A2). Female patients tended to be older than male patients.

Patients with dementia tended to be older than those without the condition (median age of 83.7 versus 70.7). The distribution pattern across age groups for all male and female patients was noticeably different, and also for those with and without dementia. These differences in age-sex profiles emphasise the importance of standardisation when comparing the hospital experience of people with and without dementia. Consequently, the discussion focuses on standardised figures, where relevant; both standardised and unstandardised numbers are presented in tables as the latter show the situation in hospitals.

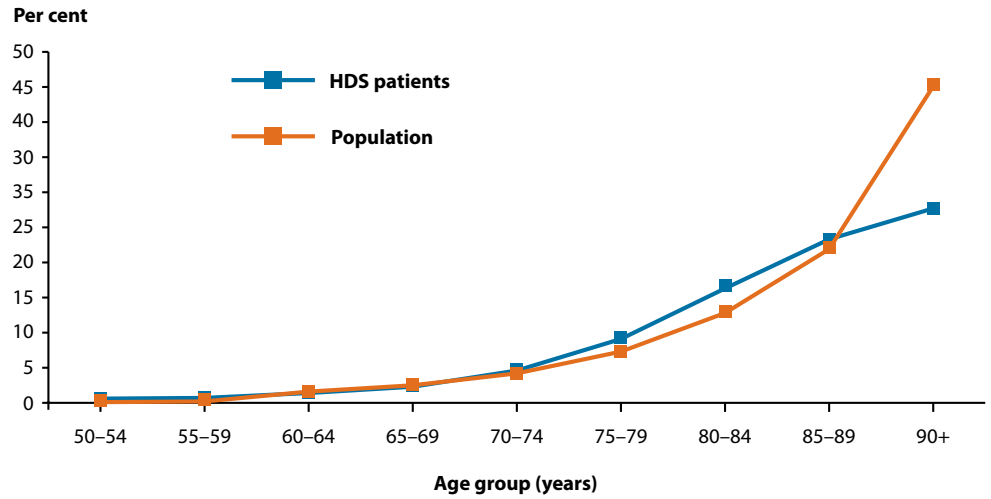
3.1 Dementia prevalence

Just over 8% of HDS patients (20,800 people) were identified as having dementia (Table A2). Like the general population, the prevalence of dementia among HDS patients increased with age, from less than 1% for patients aged 50–59 to 28% among the very old (90+). As would be expected for a group of people using health services, the estimated prevalence of dementia among patients for both sexes was generally higher than that for the general population, except for patients aged 90 and over (Figure 3.1).

For the oldest age group (90+) the estimated prevalence in the hospital population was well below population prevalence estimates. There are three possible causes for this difference: failure to identify dementia, reporting practices of diagnoses, and aversion to admit very old people with dementia.

Dementia may be less likely to be identified when present in very old patients due to high levels of frailty. Second, even when identified, it may be considered less important than other health conditions in determining hospital treatment among this group, especially among those with less severe dementia. Consequently, dementia may be less likely to be reported as a condition affecting hospital care. That other health conditions were likely to be determining hospital treatment in this age group is supported by the length of stay analysis in Section 4.6.

Finally, very old people with dementia may be less likely to be admitted into hospital. One reason could be that for some old frail people with severe dementia, there may have been a decision not to seek active treatment that could potentially be traumatic for the person for little perceived gain. Alternatively, medical practitioners may exclude very old people with dementia from some procedures that may be provided to others without dementia.



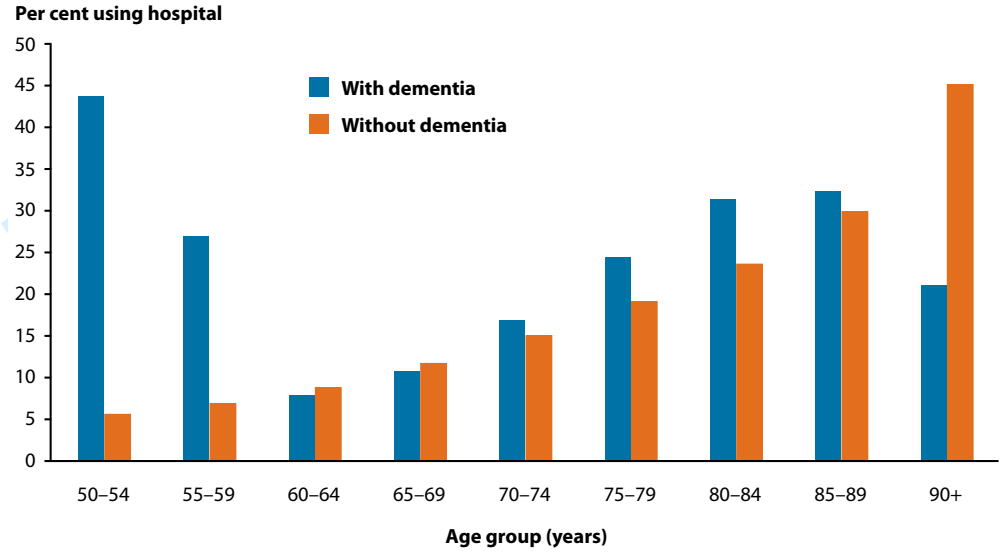
Source: Table A2.

Figure 3.1: Prevalence of dementia in HDS patients and Australian population (per cent)

3.2 Use of hospitals

By comparing the HDS patient age-sex profile with estimates for the population of New South Wales, we can estimate the proportion of the population that used a public hospital in 2006–07. Overall, it is estimated that 12% of people aged 50 and over living in New South Wales in 2006 had a multi-day stay in a New South Wales public hospital that ended in 2006–07 (Table 3.1). As expected from general hospital use statistics (AIHW 2008), older people were much more likely than younger people to have been in hospital (6% of 50–54 year olds versus 34% of people 90+).

People with dementia were more likely to have spent time in a New South Wales public hospital than other people—26% of those aged 50 and over with dementia had a multi-day stay, compared with 12% of people without dementia. However, this pattern varied with age. Young people with dementia (aged 50–59) were much more likely to be hospitalised than their counterparts without dementia; on the other hand, hospitalisation rates for people with dementia were slightly lower than those for people without dementia for people aged 65 to 69, mainly due to lower hospitalisation rates for women with dementia. (Figure 3.2, Table 3.1). For people aged 70 to 89, those with dementia were again more likely to have a period in hospital; however, among the very old (90+), the HDS estimates suggest that people with dementia had lower hospitalisation rates than people without dementia. This last result reflects the relatively low rate of identification of dementia among very old hospital patients noted in the previous section, and so may underestimate the use of hospitals by very old people with dementia; estimates for people aged 85–90 may be similarly affected. Note that the overall estimate of hospital use by people with dementia presented here is different from the HDS-based estimate published in Draper et al. 2011, due to both a difference in scope and the use of updated estimates of population prevalence.



Source: Table 3.1.

Figure 3.2: Proportion of people with a multi-day stay in a public hospital by dementia status, New South Wales, 2006–07 (per cent)

Table 3.1: Patients: people aged 50+ with at least one night in a public hospital in New South Wales in 2006–07, by age and dementia (per cent)

	With dementia			Without dementia			All		
Age group	Male	Female	All	Male	Female	All	Male	Female	All
50–54	40.6	51.9	43.7	6.0	5.3	5.6	6.0	5.4	5.7
55–59	22.6	36.3	26.9	7.4	6.4	6.9	7.5	6.4	6.9
60–64	9.9	5.9	7.9	9.6	8.0	8.8	9.6	7.9	8.8
65–69	12.7	9.0	10.7	12.8	10.6	11.7	12.8	10.6	11.6
70–74	19.5	14.5	16.8	16.4	13.7	15.0	16.6	13.7	15.1
75–79	27.6	22.0	24.4	20.7	17.8	19.1	21.2	18.1	19.5
80–84	35.0	29.4	31.4	24.8	22.7	23.6	26.0	23.6	24.6
85–89	36.5	30.5	32.3	30.8	29.4	29.9	31.9	29.6	30.4
90+	25.5	19.8	21.1	45.1	45.1	45.1	37.8	33.0	34.3
Total	**26.4**	**22.6**	**24.0**	**11.8**	**11.2**	**11.5**	**12.3**	**11.8**	**12.0**
Standardised (per cent)	**24.4**	**26.9**	**25.7**	**12.2**	**11.9**	**12.1**	..	..	..
HDS patients (number)	**8,304**	**12,489**	**20,793**	**114,769**	**117,157**	**231,926**	**123,073**	**129,646**	**252,719**
NSW population (number)	**31,429**	**55,147**	**86,575**	**969,962**	**1,047,143**	**2,017,106**	**1,001,391**	**1,102,290**	**2,103,681**

Note: Population numbers are estimated resident population at 30 June 2006 for New South Wales from ABS Australian demographic statistics series (for example, ABS 2008). Population with and without dementia was estimated using age-sex dementia prevalence rates reported in AIHW 2012a. Hospitalisation rate uses number of HDS patients (with/out dementia) divided by the estimated population for New South Wales. HDS patients are assumed to be residents of New South Wales.

3.3 Types of dementia

The type of dementia could be determined from the hospital data for less than half (42%) of patients with dementia (Table 3.2). Younger people were more likely to have their dementia type specified, with 75% of those aged 50–64 having a specifically identified form. Among people with a specified dementia type, Alzheimer disease was the most common type reported at 39%, compared with 17% for Vascular dementia—the second most common type. However, people aged 50–64 were less likely than older people to have a diagnosis of either Alzheimer disease or Vascular dementia, and much more likely to have Other degenerative dementia or Other dementia.

Table 3.2: Patients with dementia: type of dementia by age, HDS patients, 2006–07 (per cent)

Type[(a)]	50–64	65–74	75–84	85+	Total	Total
All patients identified with dementia (type specified and unspecified)			**Per cent**			
Alzheimer disease	11.1	16.2	18.4	14.4	16.2	3,375
Vascular dementia	7.9	9.8	8.0	5.5	7.1	1,483
Parkinson and/or Lewy bodies	4.6	8.5	6.8	3.4	5.4	1,132
Dementia with delirium	1.7	2.1	3.5	4.3	3.6	752
Other degenerative dementia	40.7	10.6	4.6	3.1	5.9	1,232
Other dementia	5.0	1.2	0.7	0.3	0.7	147
Mixed diagnoses	3.8	4.8	3.3	1.8	2.8	588
Unspecified	25.2	46.9	54.7	67.3	58.1	12,084
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**20,793**
Total (number)	**759**	**2,201**	**9,062**	**8,771**	**20,793**	..
Patients with type of dementia specified at least once						
Alzheimer disease	14.8	30.5	40.7	44.1	38.8	3,375
Vascular dementia	10.6	18.4	17.6	17.0	17.0	1,483
Parkinson and/or Lewy bodies	6.2	15.9	15.0	10.3	13.0	1,132
Dementia with delirium	2.3	3.9	7.8	13.1	8.6	752
Other degenerative dementia	54.4	19.9	10.2	9.4	14.1	1,232
Other dementia	6.7	2.3	1.4	0.8	1.7	147
Mixed diagnoses	5.1	9.0	7.3	5.4	6.8	588
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**8,709**
Total (number specified)	**568**	**1,169**	**4,107**	**2,865**	**8,709**	..

(a) Type of dementia was derived from all diagnoses reported for a patient in any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. See Table A1 for dementia type definitions.

Note: Percentages may not sum to 100% due to rounding.

3.4 Number of stays per person

Two-thirds of all HDS patients (66%) had just one multi-day hospital stay ending in 2006–07; that is, their stay with a night in a public hospital leading to inclusion in the study (Table A3); just 6% had four or more. In addition, one-quarter had at least one same-day stay in a hospital during the year, with the majority (69%) having just the one stay. However, the high average number of same-day stays among those with such a stay (4.1) indicates that some HDS patients had many same-day stays.

Considering the 12 months before the end of a patient's final multi-day stay in 2006–07, people with dementia were more likely than others to have had more than one multi-day stay ending in the 12 months (62% versus 43%) (Table A4). The disparity between people with and without dementia was much more marked among younger people. This variation is reflected in the average number of stays per person: the standardised mean number of multi-day stays over 12 months was 2.5 for people with dementia, compared with 1.9 for people without dementia.

HDS patients with dementia were less likely to have a same-day stay in 2006–07 than those without the condition (21% versus 25%) (Table A3). However, among those with a same-day stay, there was no statistically significant difference between patients with and without dementia for either the proportion of people with only one stay or the average number of same-day stays. This suggests that among people who had same-day stays, the use patterns for such stays were similar for the two groups.

4 Features of hospital stays

Overall, HDS patients completed 408,500 multi-day stays and 252,400 same-day stays in 2006–07. As anticipated from the preceding analysis, a relatively high proportion of stays for people with dementia was for multi-day stays (71% versus 61% for people without dementia) (Table A5).

Table 4.1: Multi-day hospital stays, by number of episodes and transfers and dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
Number	With dementia	Without dementia	Total	With dementia	Without dementia
Episodes[b] in the stay					
1	80.1	87.0	86.4	*81.7	86.7
2	14.5	10.2	10.6	*13.3	10.4
3+	5.3	2.8	3.0	*5.0	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Existence of hospital transfer					
Without transfer	86.7	89.3	89.1	*87.1	89.2
With transfer	13.3	10.7	10.9	*12.9	10.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**	..	..
Hospital-to-hospital transfers in the stay, for stays with more than one episode					
0	33.2	17.4	19.6	*29.8	18.3
1	52.3	67.1	65.1	*53.9	66.3
2	10.8	12.3	12.1	12.3	12.2
3+	3.7	3.3	3.3	4.0	3.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**7,581**	**47,973**	**55,554**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

(b) A hospital episode is a period in hospital of a particular care type in a particular hospital. A hospital stay is the period from admission into the hospital system to discharge from the system, or death in hospital.

Note: Percentages may not sum to 100% due to rounding.

Fourteen per cent of multi-day stays included a change in care type and/or a transfer between hospitals; four-fifths of these (11% of multi-day stays) included a transfer between hospitals (Table 4.1). People with dementia were more likely than others to have stays with such changes: 18% of stays for patients with dementia included a change in care type or hospital transfer compared with 13% for other patients. The majority of these changes were due to within-hospital changes in care type. However, dementia patients were a little more likely than others to be transferred between hospitals (13% versus 11%). These findings are important given that multiple bed moves may cause distress and exacerbate cognition-based problems for people with dementia (Cunningham 2006).

4.1 Hospital sector

The bulk of the multi-day stays for the HDS cohort (90%) were entirely within the public sector, which is not surprising given the scope of the study (Table A6). Just less than 4% of multi-day stays included time in both public and private hospitals. People with dementia were more likely than others to be treated solely in a public hospital (94% versus 90% of multi-day stays were within public hospitals).

4.2 Region

In 2006, health service provision in New South Wales was grouped regionally into eight Area Health Services (Figure 4.1). There was great variation in the number of HDS multi-day hospital stays provided across these regions, ranging from 23,000 in 2006–07 in Greater Western to 79,000 in South Eastern Sydney/Illawarra (Table 4.2).

The prevalence of patients with dementia in hospital stays varied across the regions, ranging from 8% to 10% (standardised to allow for different age/sex profiles of patients), compared with 9% across all multi-day stays.

Source: NSW Department of Health 2007:263,273.

Figure 4.1: Area Health Services in New South Wales

Table 4.2: Multi-day hospital stays, by Area Health Service of admission and dementia status, for HDS patients 2006–07 (per cent)

Area Health Service of admitting hospital	Dementia status				Dementia prevalence	
	With dementia	Without dementia	Total	Number	Observed	Standardised[(a)]
Greater Southern	7.0	7.7	7.6	31,145	8.6	*8.3
Greater Western	4.5	5.8	5.6	23,032	7.4	*7.9
Hunter/New England	13.7	13.4	13.4	54,807	9.5	*9.8
North Coast	8.6	9.7	9.6	39,052	8.4	*8.3
Northern Sydney/Central Coast	17.3	14.2	14.5	59,302	11.1	9.4
South Eastern Sydney/Illawarra	19.4	19.3	19.3	78,742	9.4	9.1
Sydney South West	18.1	17.7	17.7	72,412	9.5	*10.3
Sydney West	11.4	12.3	12.2	49,833	8.7	*9.9
Total	**100.0**	**100.0**	**100.0**	..	**9.3**	..
Total number	**38,097**	**370,228**	**408,325**	**408,325**	..	..

* Significantly different at .001 level when comparing with the state average of 9.3%.

(a) Age-sex standardised to enable comparisons across regions. The standard distribution was derived from all HDS stays.

Note: 214 admissions had invalid data for derivation of Area Health Service. Percentages may not sum to 100% due to rounding.

4.3 Care type

Few multi-day stays (3% overall) started with sub-acute care such as rehabilitation or palliative care; however, patients with dementia were more likely to be admitted for this type of care than others. By the end of their stay, 8% of patients were receiving sub-acute care because of changes in care type over the course of the hospital stay, and again people with dementia were more likely to be the recipients (13%) (Table 4.3). This reflects the relatively high proportion of stays for dementia patients that had more than one episode of care.

Table 4.3: Multi-day hospital stays, by care type on admission and on discharge, by dementia status, for HDS patients 2006–07

	Observed			Standardised[a]	
Care type	With dementia	Without dementia	Total	With dementia	Without dementia
On admission					
Acute care	96.0	97.4	97.3	95.4	*97.3
Sub-acute[b]	4.0	2.6	2.7	4.6	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,095**	**370,210**	**408,305**	..	..
On discharge					
Acute care	85.5	92.8	92.1	86.6	*92.5
Sub-acute	14.5	7.2	7.9	13.4	7.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,076**	**370,171**	**408,247**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.
(b) Sub-acute care includes rehabilitation, palliative care, geriatric evaluation and management, psychogeriatric care, and maintenance care.

Note: Table excludes cases with missing care type (234 on admission, 292 on discharge).

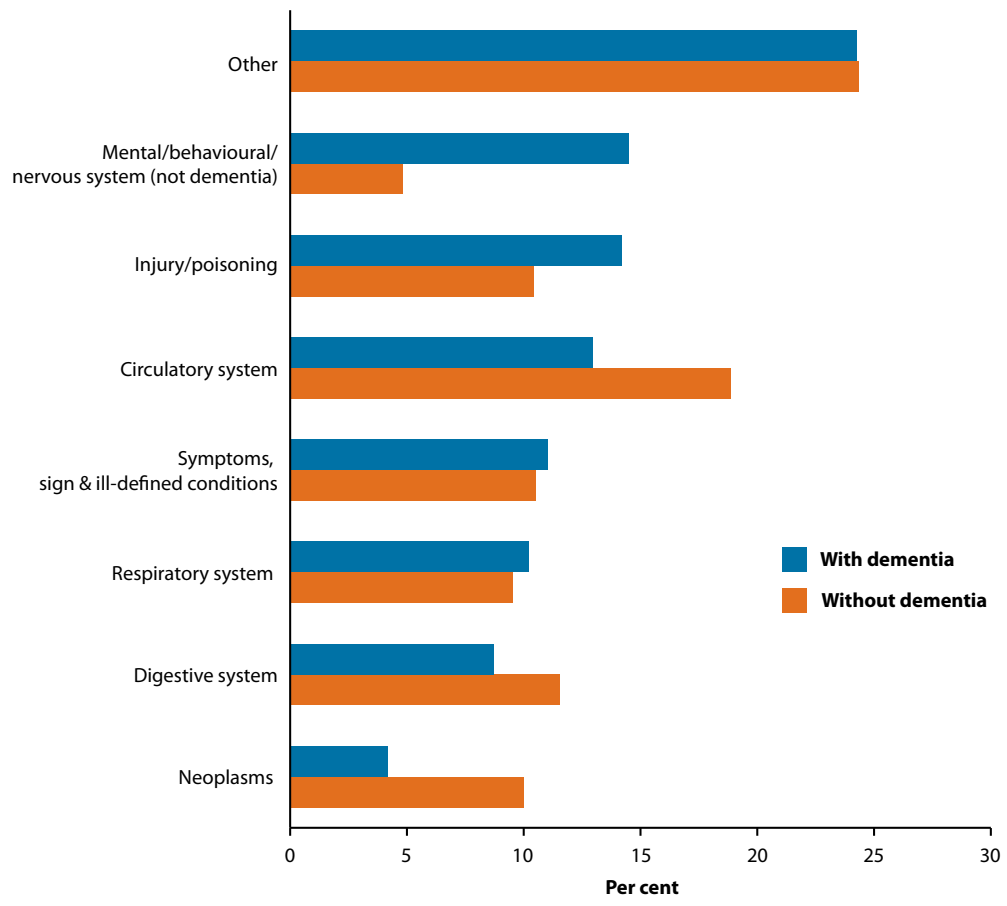
4.4 Principal diagnosis

The principal diagnosis for a hospital episode is the one chiefly responsible for the hospitalisation. Up to 54 other diagnoses could also potentially be recorded per episode of care on the APDC—a maximum of 48 was observed. Dementia was rarely reported as principal diagnosis, being recorded for less than 1% of multi-day stays for HDS patients (Table A7). Even for patients with dementia, dementia was the principal diagnosis for only 6% of multi-day stays.

People with and without dementia had different reasons for being admitted to hospital (Figure 4.2, Table A7). Diseases of the circulatory system were the most common principal diagnoses for people without dementia (19%), with a number of other health conditions accounting for about 10% of admissions each (neoplasms, diseases of the respiratory and digestive systems, injuries and poisonings, and ill-defined/unidentified conditions). In contrast, for people with dementia, injuries and poisonings were the most common reason for admission to hospital (14%, excluding stays with dementia as the principal diagnosis) with circulatory system diseases the second most common (13%). Also, together non-dementia mental and nervous system disorders accounted for almost 14% of admissions for people with dementia compared with less than 5% for people without dementia. As was the case for people without dementia, respiratory system diseases and ill-defined/unidentified conditions were the cause of about 10% of admissions each, but neoplasms were less likely (4% of admissions for people with dementia).

Among the less common principal diagnoses (included in the 'Other' group in Figure 4.2), people with dementia were more likely than others to have a principal diagnosis of infection, an endocrine condition, or a factor influencing health status. On the other hand, people without dementia were more likely to have a principal diagnosis relating to blood disorders, eye or ear conditions, or to the musculoskeletal system.

Although relatively uncommon as a principal diagnosis, delirium (not reported as superimposed on dementia) was much more likely to be reported as the principal diagnosis for people with dementia (1%) than for people without dementia (0.2%). Moreover, two-fifths of patients reported with a principal diagnosis of delirium not reported as superimposed on dementia had dementia. This relationship between dementia and delirium has been noted in other analyses of HDS data, with many people identified as having delirium also having dementia, especially among very old patients (Draper et al. 2011).

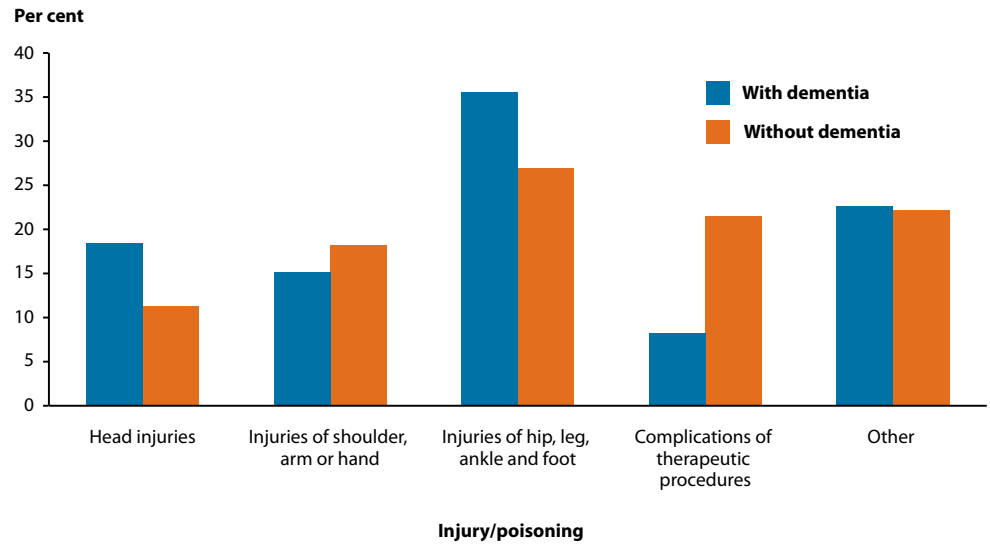


Source: Table A7.

Figure 4.2: Selected principal diagnoses (excluding dementia) on admission by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent)

Hospitalisations due to injury may be avoidable through injury prevention practices, and this analysis suggests that this could be particularly important for people with dementia. Looking more closely at injuries, people with dementia had a different injury profile leading to hospitalisation than people without dementia (Table A8, Figure 4.3). Overall, people with dementia were more likely than others to be hospitalised due to head or limb injuries and less likely because of medical complications.

Among people hospitalised because of fractures, hip and leg injuries dominated, but were more likely for people with dementia. For other injuries, head injuries were the most common among those with dementia, while medical complications were pre-eminent among people without dementia.



Source: Table A8.

Figure 4.3: Type of injury or poisoning reported as principal diagnosis, by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent)

4.5 Principal procedure

When coding the procedures provided to a patient in an episode of care, a priority system is used by APDC coders to establish the order in which procedures are recorded in the data set. This priority is based on relevancy to principal diagnosis and therapeutic nature, as follows:

Priority 1—Procedure performed for treatment of principal diagnosis.

Priority 2—Procedure performed for treatment of additional diagnosis.

Priority 3—Diagnostic or exploratory procedure related to principal diagnosis.

Priority 4—Diagnostic or exploratory procedure related to additional diagnosis.

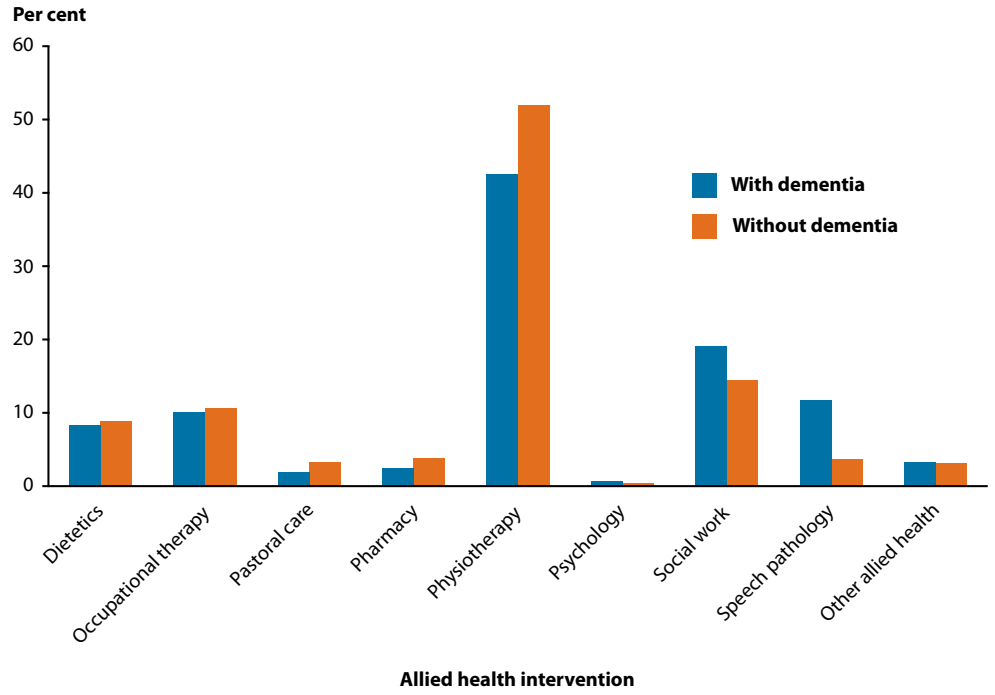
In addition, surgical procedures are coded higher than non-surgical procedures. All significant procedures are coded where they are either surgical in nature, carry a procedural risk, carry an anaesthetic risk, or require special facilities or equipment, or specialised training. The principal procedure is the procedure recorded as the first one on the APDC for an episode of care (NCCH 2010: standard 0016).

An episode of care may not always include a procedure as defined above; for example, in an admission for observation after a health episode (such as a fall or chest pain), or where multiple disorders complicate diagnosis and treatment. For both people with and without dementia, about one-quarter of multi-day hospital stays for HDS patients did not have any procedures reported against the admitting episode (Table 4.4).

In multi-day stays with a reported principal procedure, people with dementia were much more likely than others to receive either allied health or imaging services as their principal procedure (about two-thirds of stays combined, compared with two-fifths). Further, two-thirds of the imaging services for people with dementia were computerised tomography (CT scan) of the brain, while less than half of those for people without dementia were CT brain scans.

Other principal procedures reported for a reasonable proportion of patient stays included those relating to the cardiovascular system (8%), digestive system (12%), and musculoskeletal system (10%). These procedures were less likely to have been performed for patients with dementia because of the dominance of allied health and imaging services. Nevertheless, while overall procedures of the musculoskeletal system were more common among people without dementia, procedures of the pelvis or hip were more common in stays for people with dementia.

Physiotherapy was the most common allied health service provided (51% of stays with a principal procedure in allied health) (Figure 4.4, Table A9). Among stays that included use of allied health, while often provided, physiotherapy was less common among patients with dementia. In contrast, social work and speech pathology were more commonly provided as the principal allied health procedure for patients with dementia compared with those without the condition. Procedures provided to similar proportions of patients with and without dementia included dietetics (9% of stays with an allied health principal procedure) and occupational therapy (10%).



Source: Table A9.

Figure 4.4: Type of allied health intervention reported as principal procedure, by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent, stays with allied health intervention as the principal procedure)

Table 4.4: Multi-day hospital stays, principal procedure after admission by dementia status, for HDS patients, 2006–07

Principal procedure (ICD-10-AM blocks)	Observed			Standardised[(a)]	
	With dementia	Without dementia	Total	With dementia	Without dementia
With a procedure reported					
Procedures on nervous system (1–86)	0.8	1.7	1.6	1.5	1.7
Procedures on endocrine system (110–129)	—	0.5	0.4	0.1	*0.5
Procedures on eye and adnexa(160–256)	0.4	1.2	1.1	0.3	*1.2
Procedures on ear and mastoid process (300–333)	—	0.2	0.1	—	*0.2
Procedures on nose, mouth and pharynx (370–422)	0.2	0.7	0.7	0.3	*0.7
Dental services (450–490)	0.1	0.1	0.1	0.1	0.1
Procedures on respiratory system (520–569)	1.2	2.5	2.4	1.8	2.5
Procedures on cardiovascular system (600–767)	2.2	9.0	8.3	2.7	*8.7
Procedures on blood and blood-forming organs (800–817)	0.2	0.6	0.6	0.2	*0.6
Procedures on digestive system (850–1011)	5.4	13.1	12.3	6.6	*12.8
Procedures on urinary system (1040–1129)	2.2	3.6	3.4	2.7	*3.5
Procedures on male genital organs (1160–1203)	0.4	1.6	1.5	0.5	*1.6
Gynaecological procedures (1240–1299)	0.2	1.6	1.4	0.3	*1.5
Procedures on musculoskeletal system (1360–1579)	8.2	9.6	9.5	6.7	*9.5
Procedures on pelvis/hip (1476–1493)	5.6	2.5	2.8	3.7	*2.6
Dermatological and plastic procedures (1600–1718)	2.2	2.6	2.6	1.8	*2.7
Procedures on breast (1740–1759)	0.1	0.8	0.7	0.2	*0.8
Chemotherapeutic and radiation oncology procedures (1786–1799)	—	0.3	0.2	—	*0.3
Non-invasive, cognitive and other interventions, nec (1820–1922, not 1916)	8.4	8.2	8.2	8.4	8.2
Allied health (1916)	35.0	20.7	22.1	33.1	*21.5
Imaging services (1940–2016)	32.8	21.5	22.6	32.8	*21.8
Computerised tomography of brain (1952–1957)	23.1	8.3	9.8	23.2	*8.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**29,281**	**266,776**	**296,057**	..	..
All					
With procedure	76.8	72.3	72.7	75.8	72.5
None given	23.2	27.7	27.3	24.2	27.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,121**	**368,842**	**406,963**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes
1. Table is based on first episode in a stay and excludes cases with missing principal procedure (1,576).
2. Percentages may not sum to 100% due to rounding.

nec not elsewhere classified.

4.6 Elapsed length of stay

The elapsed length of a hospital stay is the number of days between the dates of admission into, and discharge from, the hospital system. This is different from the 'bed days' measure used in analyses based on hospital episodes (AIHW 2008) as all changes in care type and transfers between hospitals are combined and no adjustment is made for absences on hospital leave or hospital visits.

On average, people with dementia had longer stays than people without dementia. The mean elapsed time in hospital—or elapsed length of stay (ELOS)—for stays for people with dementia was twice that for people without dementia: 18.3 compared with 9.1 days. More than half of all multi-day stays for people with dementia lasted at least 1 week, compared with just over one-third for people without dementia (Table 4.5). The mean and median ELOS presented here for people with dementia are shorter than earlier estimates of bed days based on hospital episodes (AIHW 2007:186). This is despite amalgamation of transfers. The reason is that all stays for people with dementia are included in the calculations, and not just those which included a diagnosis of dementia (see AIHW 2012b for examination of this issue).

Table 4.5: Multi-day hospital stays, by elapsed time in hospital and dementia status, for HDS patients, 2006–07 (per cent)

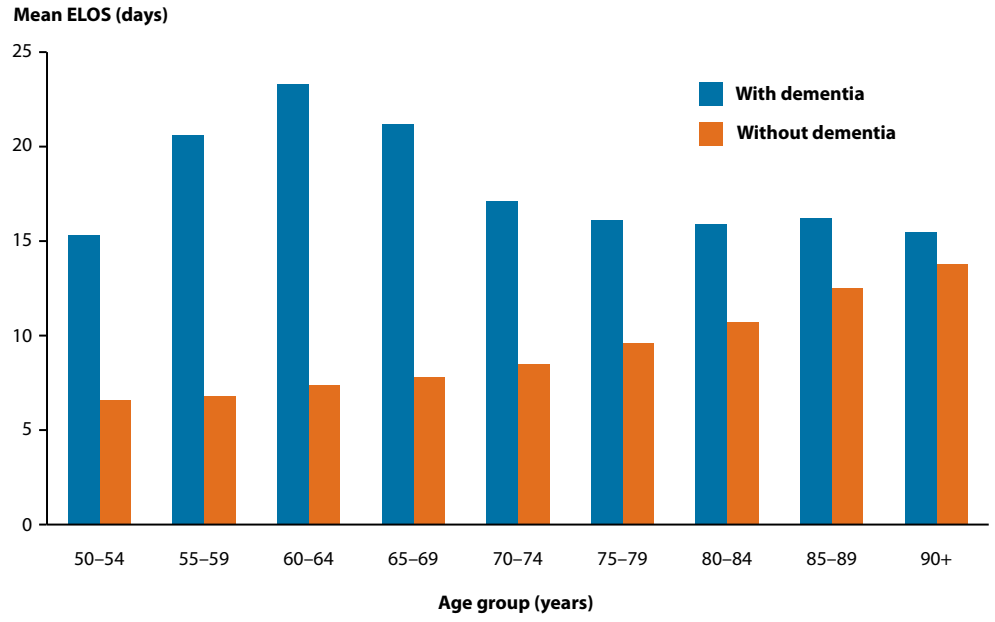
	Observed			Standardised[(a)]	
ELOS	With dementia	Without dementia	Total	With dementia	Without dementia
1 to 2 days	20.8	34.9	33.6	*22.5	34.3
3 to 6 days	24.7	29.7	29.2	*24.6	29.6
1 to < 5 weeks	43.7	31.1	32.2	*40.8	31.6
5 to < 13 weeks	9.0	3.8	4.3	*9.4	4.0
>=13 weeks	1.8	0.5	0.7	*2.6	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**	..	..
Mean (days)	16.5	8.9	9.6	*18.3	9.1
Median (days)	7	4	4	‡7	4
90th percentile (days)	36	20	21	‡39	20

* Significantly different at .001 level when comparing patients with and without dementia.

‡ Not specifically tested, but distribution significantly different within each age group (see Table A10).

(a) Age-sex standardised. The standard distribution was derived from multi-day HDS stays.

People with dementia had longer mean ELOSs within all age groups (Figure 4.5). In general, mean ELOS increased with age for people without dementia; however, for people with dementia, ELOS peaked in the 60–64 age group, levelling off after 75 years of age. Closer examination of ELOS median and 90th percentile patterns showed that the high mean ELOS for younger people was driven by a small proportion with very long stays (Table A10). There are likely to be a number of factors contributing to this finding. A higher proportion of younger people with dementia are admitted due to behavioural problems, and at site visits associated with the project it was noted that both community and residential services to support such patients were difficult to access. Also, the greater differentiation in dementia type seen for younger patients suggests that more time may be spent on assessment and diagnosis for younger patients with dementia. In addition, it is possible that some of the younger patients had complex medical comorbidity affecting ELOS, and that for older patients with dementia, other health conditions were determining hospital treatment.



Source: Table A10.

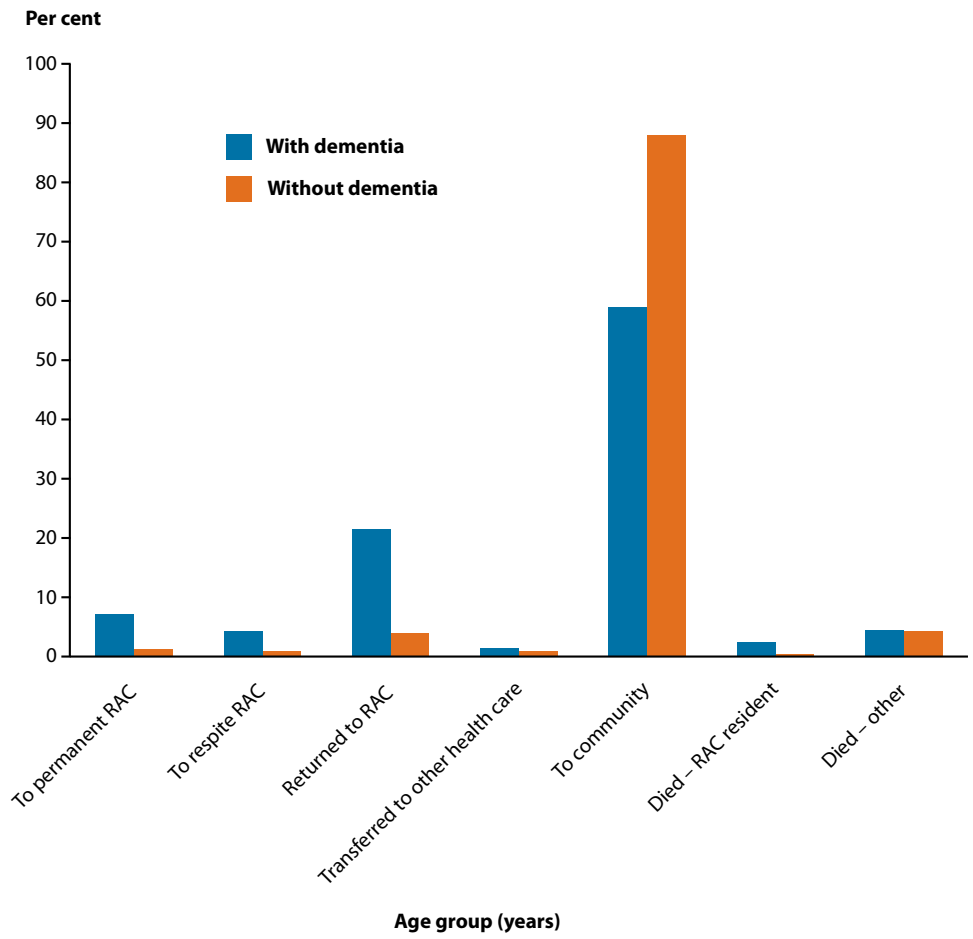
Figure 4.5: Mean ELOS for multi-day stays, HDS patients, 2006–07

4.7 Destination on discharge

APDC records contain data on destination on discharge. However, there are limitations with these data as people returning to their usual residence are recorded as going to their own accommodation, irrespective of whether that accommodation is in the community or an institution. Also, in practice, hospital coding does not always differentiate between people going back to residential care and those moving into such care from hospital; that is, a person's 'usual residence' upon which the coding is based is not consistently that before or after the hospital stay (AIHW: Karmel & Rosman 2007). To overcome these shortcomings, data linkage between hospital stay and residential aged care (RAC) service use data has been used to identify post-hospital destination more reliably and in more detail (see AIHW 2012b).

The differences in the destination mix for patients with and without dementia are stark (Figure 4.6) (Table A11). Patients with dementia were much more likely to transfer to residential care on leaving hospital (11% versus 2%); nearly two-thirds of these admissions were to permanent RAC, compared with just over one-half of those for people without dementia. In addition, patients with dementia were more than 5 times more likely than others to be returning to their home in permanent care (22% versus 4%). Even after allowing for different age-sex profiles, stays for patients with dementia were more likely to end in death than others (7% versus 5%). Patients with dementia who died in hospital were more likely to have been aged care residents than patients without dementia who died in hospital.

Despite the relatively large proportions of dementia patients going to residential care, about half (48% observed, 59% standardised) of patients with dementia returned to live in the community when they left hospital.



Source: Table A11.

Figure 4.6: Discharge destination following multi-day stays, HDS patients, 2006–07 (per cent)

4.8 Re-admission

Re-admissions into hospital were examined by looking at stays that ended in the first 6 months of 2006–07 and identifying re-admissions within 3 months. This was done to allow for re-admission into long hospital stays, noting that relatively few hospital stays (1%) were longer than 3 months (Table 4.5). However, people with dementia were more likely to have long stays than others, so under-identification of re-admissions is likely to be slightly higher for people with dementia.

As expected from their higher average numbers of stays per person (Table A3), patients with dementia were more likely to have a re-admission within 3 months than others. This was true both for any re-admission and for re-admission to another multi-day stay (Table A12 and Table 4.6).

Overall, 45% of people with dementia had a re-admission into another multi-day stay within 3 months of a multi-day stay, compared with 32% of people without dementia (Table 4.6). Among those who were re-admitted, 11% were readmitted within a day of discharge and, overall, 60% were re-admitted within 4 weeks; patients with and without dementia had similar re-admission patterns in terms of time between discharge and re-admission.

Table 4.6: Re-admission to a multi-day stay after a multi-day hospital stay, by time to re-admission and dementia status, hospital stays ending in 1 July 2006 – 31 December 2006 for HDS patients (per cent)

	Observed			Standardised[(a)]	
Days to next admission	With dementia	Without dementia	Total	With dementia	Without dementia
With a re-admission within 3 months					
Same day	8.5	7.2	7.4	8.0	7.3
Next day	3.9	3.5	3.6	4.0	3.5
2 to 7 days	15.4	16.2	16.1	15.5	16.1
8 to 28 days	30.7	32.4	32.2	31.8	32.4
29 to 91 days	41.4	40.7	40.8	40.7	40.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**8,038**	**60,197**	**68,235**	..	..
All					
With a re-admission within 3 months	39.9	31.8	32.6	*45.1	32.0
Next admission later, or never	60.1	68.2	67.4	54.9	68.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**20,170**	**189,349**	**209,519**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

4.9 Conclusion

In New South Wales in 2006–07, people with dementia were more likely than others to have spent at least one night in public hospital. Hospital stays for people with dementia were characterised by more transfers between hospitals and more changes in care type—possibly involving moves between wards. Such moves are potentially problematic for a group with heightened sensitivity and reaction to changes in environment.

People with and without dementia also had different reasons for being admitted into hospital: people with dementia were more likely to be admitted because of non-dementia mental, behavioural or nervous system disorders, or due to injury or poisoning, and less likely because of neoplasms or circulatory diseases. People with dementia were 50% more likely to have allied health or imaging services as their principal procedure. Outcomes as measured by length of stay, mortality, transfer to residential aged care, and re-admission to hospital within 3 months were all poorer for people with dementia.

Appendix tables

Table A1: ICD–10–AM codes identifying dementia

Code	ICD–10–AM description	Dementia type for HDS analysis
F00	Dementia in Alzheimer's disease (G30.-+)	Alzheimer disease
F00.0	Dementia in Alzheimer's disease with early onset (G30.0+)	Alzheimer disease
F00.1	Dementia in Alzheimer's disease with late onset (G30.1+)	Alzheimer disease
F00.2	Dementia in Alzheimer's disease, atypical or mixed type (G30.8+)	Alzheimer disease
F00.9	Dementia in Alzheimer's disease, unspecified (G30.9+)	Alzheimer disease
G30	Alzheimer's disease	Alzheimer disease
G30.0	Alzheimer's disease with early onset	Alzheimer disease
G30.1	Alzheimer's disease with late onset	Alzheimer disease
G30.8	Other Alzheimer's disease	Alzheimer disease
G30.9	Alzheimer's disease, unspecified	Alzheimer disease
F01	Vascular dementia	Vascular dementia
F01.0	Vascular dementia of acute onset	Vascular dementia
F01.1	Multi-infarct dementia	Vascular dementia
F01.2	Subcortical vascular dementia	Vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia	Vascular dementia
F01.8	Other vascular dementia	Vascular dementia
F01.9	Vascular dementia, unspecified	Vascular dementia
F02.3	Dementia in Parkinson's disease (G20+)	Parkinson and/or Lewy bodies
G31.3	Lewy body disease	Parkinson and/or Lewy bodies
F05.1	Delirium superimposed on dementia	Dementia with delirium
G31	Other degenerative diseases of nervous system, not elsewhere classified	Other degenerative dementia
G31.0	Circumscribed brain atrophy	Other degenerative dementia
G31.1	Senile degeneration of brain, not elsewhere classified	Other degenerative dementia
G31.8	Other specified degenerative diseases of nervous system	Other degenerative dementia
G31.9	Degenerative disease of nervous system, unspecified	Other degenerative dementia
F02	Dementia in other diseases classified elsewhere	Other dementia
F02.0	Dementia in Pick's disease (G31.0+)	Other dementia
F02.1	Dementia in Creutzfeldt-Jakob disease (A81.0+)	Other dementia
F02.2	Dementia in Huntington's disease (G10+)	Other dementia
F02.4	Dementia in human immunodeficiency virus (HIV) disease (B22.0+)	Other dementia
F02.8	Dementia in other specified diseases classified elsewhere	Other dementia
G31.2	Degeneration of nervous system due to alcohol	Other degenerative dementia
F03	Unspecified dementia	Unspecified dementia

- Symbol denotes any digit.

+ Symbol denotes a code describing the aetiology or underlying cause of a disease.

Note: Where codes F02 or F02.8 were reported, where possible secondary diagnoses were examined to determine the type of dementia more precisely.

Table A2: Patients: sex and age by dementia status, HDS patients 2006–07 (per cent)

Sex	Age at 1 July 2006	Patient dementia status		Total	Prevalence of dementia	
		With dementia	Without dementia		Within patient group	Population[(a)]
		Per cent			Per cent	
Male		39.9	49.5	48.7	6.7	3.1
Female		60.1	50.5	51.3	9.6	5.0
Total %		**100.0**	**100.0**	**100.0**	**8.2**	**4.1**
Total number		**20,793**	**231,926**	**252,719**	..	..
Male	50–54	1.2	11.4	10.7	0.8	0.1
	55–59	1.4	13.3	12.5	0.8	0.3
	60–64	3.0	13.5	12.8	1.6	1.5
	65–69	4.7	14.0	13.4	2.4	2.4
	70–74	9.5	14.2	13.9	4.6	3.9
	75–79	19.5	14.5	14.9	8.9	6.8
	80–84	27.8	11.0	12.1	15.5	11.5
	85–89	21.8	5.7	6.7	21.8	19.1
	90+	11.1	2.4	3.0	25.1	37.2
Total %		*100.0*	*100.0*	*100.0*	*6.7*	*3.1*
Total number		*8,304*	*114,769*	*123,073*	..	..
Median age (years)		*81.9*	*69.2*	*70.2*	..	..
Female	50–54	0.4	10.2	9.2	0.4	0.0
	55–59	0.7	11.2	10.2	0.7	0.1
	60–64	1.2	11.0	10.0	1.2	1.6
	65–69	2.5	11.7	10.8	2.2	2.6
	70–74	5.7	12.6	11.9	4.6	4.4
	75–79	14.2	14.6	14.6	9.4	7.7
	80–84	26.9	14.0	15.3	17.0	13.7
	85–89	27.7	9.3	11.1	24.1	23.4
	90+	20.7	5.4	6.9	28.8	47.9
Total %		*100.0*	*100.0*	*100.0*	*9.6*	*5.0*
Total number		*12,489*	*117,157*	*129,646*	..	..
Median age (years)		*84.8*	*72.4*	*74.1*	..	..
All	50–54	0.7	10.8	9.9	0.6	0.1
	55–59	1.0	12.2	11.3	0.7	0.2
	60–64	1.9	12.2	11.4	1.4	1.6
	65–69	3.4	12.8	12.1	2.3	2.5
	70–74	7.2	13.4	12.9	4.6	4.2
	75–79	16.3	14.6	14.7	9.1	7.3
	80–84	27.3	12.5	13.7	16.3	12.8
	85–89	25.4	7.5	9.0	23.3	21.9
	90+	16.8	3.9	5.0	27.7	45.1
Total %		**100.0**	**100.0**	**100.0**	**8.2**	**4.1**
Total number		**20,793**	**231,926**	**252,719**	..	..
Median age (years)		**83.7**	**70.7**	**72.1**	..	..

(a) Population prevalence by age and sex from AIHW 2012a. Prevalence estimates across age and/or sex use estimated resident population at 30 June 2006 for New South Wales from ABS Australian demographic statistics series (for example, ABS 2008).

Note: Percentages may not sum to 100% due to rounding.

Table A3: Patients: hospital stays per HDS patient, by age and dementia status, 2006–07

	50–64	65–74	75–84	85+	All[(a)]
With dementia					
Multi-day stays					
With one multi-day stay only (%)	*50.9	*51.1	*54.3	*57.5	55.2 (*52.5)
Mean number	*2.3	*2.0	*1.9	1.7	1.8 (*2.0)
Same-day stays					
With a same-day stay (%)	24.1	*21.2	*18.2	*14.9	17.3 (*20.9)
With one stay (for those with a stay) (%)	65.6	70.4	*74.5	*78.4	75.0 (70.8)
Mean number (for those with a stay)	4.6	6.5	3.1	*1.6	3.1 (4.5)
Number	**759**	**2,201**	**9,062**	**8,771**	**20,793**
Without dementia					
Multi-day stays					
With one multi-day stay only (%)	71.7	66.8	61.7	60.6	66.4 (66.1)
Mean number	1.5	1.6	1.7	1.7	1.6 (1.6)
Same-day stays					
With a same-day stay (%)	24.8	27.6	26.6	18.2	25.3 (25.1)
With one stay (for those with a stay) (%)	70.5	67.1	66.0	72.0	68.4 (68.4)
Mean number (for those with a stay)	4.0	4.7	4.1	2.5	4.1 (4.1)
Number	**81,738**	**60,840**	**62,855**	**26,493**	**231,926**
All					
Multi-day stays					
With one multi-day stay only (%)	71.5	66.2	60.7	59.8	65.5
Mean number	1.5	1.6	1.7	1.7	1.6
Same-day stays					
With a same-day stay (%)	24.8	27.4	25.5	17.4	24.6
With one stay (for those with a stay) (%)	70.5	67.2	66.8	73.3	68.8
Mean number (for those with a stay)	4.0	4.7	4.0	2.3	4.1
Number	**82,497**	**63,041**	**71,917**	**35,264**	**252,719**

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Brackets contain age-sex standardised value. The standard distribution was derived from all HDS stays.

Note: Due to the scope of the study, all HDS patients had at least one multi-day stay.

Table A4: Patients: hospital stays per HDS patient ending in the 12 months before the end of the last stay in 2006–07, by age and dementia status, 2006–07

	50–64	65–74	75–84	85+	All	Standardised[(a)]
With dementia						
Multi-day stays						
With one multi-day stay only (%)	36.5	36.9	40.2	41.9	40.4	*38.2
Mean number	2.84	2.47	2.25	2.14	2.25	*2.51
Same-day stays						
With a same-day stay (%)	30.0	26.7	23.7	20.3	22.8	*26.7
With one stay (for those with a stay) (%)	62.7	69.2	70.1	76.1	71.9	68.1
Mean number (for those with a stay)	4.55	5.81	2.99	1.67	2.92	4.14
Number	**759**	**2,201**	**9,062**	**8,771**	**20,793**	..
Without dementia						
Multi-day stays						
With one multi-day stay only (%)	64.1	57.4	51.0	48.1	57.0	56.5
Mean number	1.69	1.83	1.98	2.01	1.84	1.85
Same-day stays						
With a same-day stay (%)	30.1	34.1	33.7	24.1	31.5	31.3
With one stay (for those with a stay) (%)	67.7	63.5	62.6	68.1	65.1	65.1
Mean number (for those with a stay)	3.90	4.48	3.93	2.57	3.95	3.92
Number	**81,738**	**60,840**	**62,855**	**26,493**	**231,926**	..
All						
Multi-day stays						
With one multi-day stay only (%)	63.8	56.7	49.7	46.6	55.6	..
Mean number	1.70	1.85	2.01	2.04	1.87	..
Same-day stays						
With a same-day stay (%)	30.1	33.9	32.4	23.2	30.8	..
With one stay (for those with a stay) (%)	67.7	63.7	63.3	69.8	65.5	..
Mean number (for those with a stay)	3.90	4.52	3.84	2.37	3.89	..
Number	**82,497**	**63,041**	**71,917**	**35,264**	**252,719**	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Note: Due to the scope of the study, all HDS patients had at least one multi-day stay.

Table A5: Hospital stays, by same-day status and dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
	With dementia	Without dementia	Total	With dementia	Without dementia
Multi-day stay	77.3	60.6	61.8	*70.6	61.0
Same-day stay	22.7	39.4	38.2	29.4	39.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**49,379**	**611,583**	**660,962**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Table A6: Hospital stays, by same-day status, hospital sector and dementia status, for HDS patients 2006–07 (per cent)

	Multi-day stays		
Sector	With dementia	Without dementia	Total
Observed			
Mixed sector[a]	3.1	3.5	3.5
Private only	4.1	6.7	6.5
Public only	92.8	89.8	90.0
Total	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**
Standardised[b]			
Mixed sector	*2.3	3.6	..
Private only	*3.3	6.8	..
Public only	*94.4	89.6	..
Total	**100.0**	**100.0**	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Stay includes episodes in both public and private hospitals.

(b) Age-sex standardised. The standard distribution was derived from all HDS stays.

Table A7: Multi-day hospital stays, by principal diagnosis on admission by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
Principal diagnosis (ICD-10-AM codes)	With dementia	Without dementia	Total	With dementia	Without dementia
Dementia	6.4	..	0.6	..	..
Total number	**38,046**	**369,534**	**407,580**	..	..
Excluding dementia					
Certain infectious & parasitic (A00-B99)	2.6	1.7	1.8	*2.2	1.7
Neoplasms (C00-D48)	4.3	10.1	9.6	*4.2	10.0
Blood & blood forming organs (D50-D89)	1.5	1.4	1.4	*1.1	1.5
Endocrine, nutritional, metabolic & immunity (E00-E90)	3.8	2.7	2.8	*4.5	2.7
Delirium, not F05.1 (that is, not Delirium superimposed on dementia)	1.1	0.1	0.2	*1.0	0.2
Other mental and behavioural disorders (excluding dementia) (F00-F99, but not in Table A1)	3.0	2.4	2.5	*8.1	2.3
Other nervous system (G00-G98, but not in Table A1)	3.4	2.4	2.5	*5.4	2.4
Eye/ear/congenital (H00-H59, H60-H95, Q00-Q99)	0.5	1.4	1.3	*0.4	1.4
Circulatory system (I00-I99)	14.7	18.7	18.3	*13.0	18.9
Respiratory system (J00-J99)	11.3	9.4	9.6	10.2	9.5
Digestive system (K00-K93)	7.8	11.7	11.3	*8.7	11.5
Skin & subcutaneous tissue (L00-L99)	2.6	2.1	2.1	2.6	2.1
Musculoskeletal system (M00-M99)	3.4	6.6	6.3	*3.5	6.6
Genitourinary system (N00-N99)	7.3	5.7	5.9	6.2	5.7
Symptoms, signs & ill-defined conditions (R00-R99)	10.9	10.5	10.6	11.0	10.5
Injury and poisoning(S00-T98)	*17.9*	*10.2*	*10.9*	**14.2*	*10.5*
Fractures	9.9	4.2	4.7	*7.0	4.4
Other injury/poisoning	8.0	6.0	6.2	*7.2	6.1
Factors influencing health status & contact with health services (Z00-Z99)	3.7	2.7	2.8	*3.8	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**35,612**	**369,534**	**405,146**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay and excludes cases with missing principal diagnosis (953) or pregnancy or peri-natal diagnoses (6).
2. Percentages may not sum to 100% due to rounding.

Table A8: Multi-day hospital stays, with injury/poisoning as principal diagnosis on admission by dementia status, for HDS patients 2006–07 (per cent)

Principal diagnosis (ICD-10-AM codes)	Observed			Standardised[(a)]	
	With dementia	Without dementia	Total	With dementia	Without dementia
Fractures					
Head injuries	1.9	3.5	3.2	*1.9	3.3
Neck, cervical spine and neck blood vessel injuries	1.3	1.4	1.4	1.6	1.4
Injuries to thorax and thoracic spine	6.9	10.8	10.0	*7.2	10.8
Injuries of abdomen, lower back and pelvis	13.5	10.8	11.3	10.7	11.4
Injuries of shoulder, arm or hand	15.8	29.9	27.3	*20.9	28.6
Injuries of hip, leg, ankle and foot	60.5	43.6	46.7	*57.7	44.5
Other injury/poisoning	0.1	0.1	0.1	0.0	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**3,538**	**15,692**	**19,230**	..	..
Other injury/poisoning					
Head injuries	35.9	16.2	18.4	*33.7	16.9
Neck, cervical spine and neck blood vessel injuries	1.0	1.2	1.2	2.3	1.2
Injuries to thorax and thoracic spine	2.5	2.8	2.8	2.9	2.8
Injuries of abdomen, lower back and pelvis	6.2	4.3	4.5	5.6	4.4
Injuries of shoulder, arm or hand	10.4	10.6	10.6	10.5	10.5
Injuries of hip, leg, ankle and foot	19.6	13.5	14.2	15.1	14.2
Poisonings by therapeutic drugs	3.1	5.0	4.8	6.3	4.7
Complications of therapeutic procedures	15.8	38.3	35.7	*16.3	37.3
Other injury/poisoning	5.4	8.2	7.9	7.4	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**2,858**	**22,346**	**25,204**	..	..
All					
Head injuries	17.1	10.9	11.8	*18.5	11.2
Neck, cervical spine and neck blood vessel injuries	1.2	1.3	1.3	2.1	1.3
Injuries to thorax and thoracic spine	4.9	6.1	5.9	5.1	6.2
Injuries of abdomen, lower back and pelvis	10.3	7.0	7.4	8.1	7.3
Injuries of shoulder, arm or hand	13.4	18.6	17.8	*15.1	18.2
Injuries of hip, leg, ankle and foot	42.3	25.9	28.3	*35.5	27.0
Poisonings by therapeutic drugs	1.4	2.9	2.7	3.4	2.7
Complications of therapeutic procedures	7.1	22.5	20.3	*8.3	21.4
Other injury/poisoning	2.4	4.8	4.5	3.9	4.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**6,396**	**38,038**	**44,434**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay.
2. Percentages may not sum to 100% due to rounding.

Table A9: Multi-day hospital stays, with principal procedure of allied health, by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[(a)]	
Principal procedure	With dementia	Without dementia	Total	With dementia	Without dementia
Allied health intervention, dietetics	7.6	9.2	8.9	8.3	8.9
Allied health intervention, occupational therapy	10.4	10.4	10.4	10.1	10.6
Allied health intervention, pastoral care	1.9	3.3	3.1	1.9	*3.2
Allied health intervention, pharmacy	2.4	3.8	3.6	2.4	*3.8
Allied health intervention, physiotherapy	46.2	51.4	50.6	42.5	*51.9
Allied health intervention, psychology	0.3	0.5	0.4	0.7	0.4
Allied health intervention, social work	16.3	14.6	14.8	19.1	*14.4
Allied health intervention, speech pathology	11.9	3.6	4.9	11.7	*3.7
Other allied health	3.0	3.2	3.1	3.3	3.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**10,243**	**55,228**	**65,471**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay and excludes cases with missing principal procedure (1,576).
2. Percentages may not sum to 100% due to rounding.

Table A10: Multi-day hospital stays, elapsed length of stay in hospital by dementia status, for HDS patients, 2006–07 (days)

	With dementia	Without dementia	All
Mean			
50–54*	15.3	6.6	6.7
55–59*	20.6	6.8	6.9
60–64*	23.3	7.4	7.7
65–69*	21.2	7.8	8.2
70–74*	17.1	8.5	8.9
75–79*	16.1	9.6	10.3
80–84*	15.9	10.7	11.6
85–89*	16.2	12.5	13.4
90+*	15.5	13.8	14.3
Total	**16.5**	**8.9**	**9.6**
Median			
50–54	5	3	3
55–59	7	3	3
60–64	7	3	4
65–69	7	4	4
70–74	7	4	4
75–79	7	5	5
80–84	8	5	6
85–89	8	6	6
90+	7	7	7
Total	**7**	**4**	**4**
90th percentile			
50–54	34	14	14
55–59	50	14	14
60–64	49	15	16
65–69	38	17	17
70–74	39	19	20
75–79	36	21	23
80–84	36	25	27
85–89	35	29	31
90+	34	31	32
Total	**36**	**20**	**21**

* Significantly different at .001 level when comparing patients with and without dementia using Kolmogorov-Smirnov test to compare distribution of length of stay.

Note: Age as at 1 July 2006. Table is not standardised because it gives ELOS by age.

Table A11: Discharge destination after a multi-day hospital stay, by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
	With dementia	Without dementia	Total	With dementia	Without dementia
To residential aged care	*13.9*	*2.1*	*3.2*	**11.4*	*2.3*
To permanent RAC	8.8	1.2	1.9	*7.2	1.3
To respite RAC	5.1	0.9	1.3	*4.3	1.0
Returned to RAC	29.1	3.6	6.0	*21.5	4.0
Transferred to other health-care accommodation[b]	1.2	0.9	0.9	*1.4	0.9
To community[c]	47.5	88.8	84.9	*58.9	87.9
Died	*8.4*	*4.6*	*5.0*	**6.8*	*4.8*
Died—RAC resident[d]	3.7	0.4	0.7	*2.4	0.5
Died—other	4.6	4.2	4.2	4.4	4.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,182**	**370,334**	**408,516**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

(b) Includes unidentified hospital transfers.

(c) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC).

(d) Includes patients admitted while a permanent RAC resident. Excludes people discharged directly to hospital without any RAC hospital leave.

Notes

1. Destination has been derived using data linkage with RAC data—see AIHW 2012b.
2. Table excludes stays with unknown destination.
3. Component percentages may not sum to total due to rounding.

Table A12: Any re-admission after a multi-day hospital stay, by time to re-admission and dementia status, hospital stays ending in 1 July 2006 – 31 December 2006 for HDS patients (per cent)

	Observed			Standardised[(a)]	
Days to next admission	With dementia	Without dementia	Total	With dementia	Without dementia
With a re-admission within 3 months					
Same day	8.2	6.5	6.7	7.8	6.6
Next day	4.3	4.3	4.3	4.8	4.2
2 to 7 days	15.9	17.4	17.2	16.8	17.3
8 to 28 days	31.2	31.6	31.5	32.1	31.5
29 to 91 days	40.4	40.3	40.3	38.5	40.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**8,730**	**71,767**	**80,497**	. .	. .
All					
With a re-admission within 3 months	43.3	37.9	38.4	*48.7	38.0
Next admission later, or never	56.7	62.1	61.6	51.3	62.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**20,170**	**189,349**	**209,519**	. .	. .

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Note: Percentages may not sum to 100% due to rounding.

Acknowledgments

Authorship

The authors of this report were Rosemary Karmel and Phil Anderson of the Data Linkage Unit at the Australian Institute of Health and Welfare (AIHW).

Contributors

The Hospital Dementia Services Project was conceived and designed by Diane Gibson (now of the University of Canberra), Brian Draper (University of New South Wales), Cathy Hales (now of the Department of Education, Employment and Workplace Relations) and Ann Peut, Rosemary Karmel and Phil Anderson (all of the AIHW). Project partners are NSW Health, Alzheimer's Australia, Alzheimer's Australia NSW, the Aged & Community Services Association of NSW & ACT Incorporated, and the Benevolent Society.

The project team thanks the Department of Health and Ageing for providing aged care data for this project, NSW Health for providing a special extract from the Admitted Patient Data Collection, and the New South Wales Centre for Health Record Linkage for providing associated patient linkage keys.

Kara Tew and Cath Lawrence assisted with the data linkage undertaken at the AIHW. Brian Draper, Diane Gibson, Ann Peut and Natalie Chan provided valuable comment on and input to the writing of the paper.

Funding

This study is funded by the National Health and Medical Research Council. Chief Investigators are Diane Gibson, Brian Draper, Rosemary Karmel, and Ann Peut.

Abbreviations

AIHW	Australian Institute of Health and Welfare
APDC	Admitted Patient Data Collection
CT	computerised tomography
ELOS	elapsed length of stay
HDS	Hospital Dementia Services
ICD–10–AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
LOS	length of stay
RAC	residential aged care

Symbols

—	nil or rounded to zero
. .	not applicable
n.a.	not available
nec	not elsewhere classified
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

References

ABS (Australian Bureau of Statistics) 2008. Australian demographic statistics. ABS cat. no. 3101.0. Canberra: ABS.

ACEMA (Aged Care Evaluation and Management Advisors) 2002. Examination of length of stay for older persons in acute and sub-acute sectors. Canberra: Care of Older Australians Working Group.

AIHW (Australian Institute of Health and Welfare) 2006. Data linkage and protecting privacy: a protocol for linking between two or more data sets held within the Australian Institute of Health and Welfare. Canberra: AIHW. Viewed 28 July 2006, <http://www.aihw.gov.au/dataonline/aihw_privacy_protection_protocols_data_linkage.pdf> .

AIHW 2007. Dementia in Australia: national data analysis and development. Cat. no. AGE 53. Canberra: AIHW.

AIHW 2008. Australian hospital statistics 2006–07. Health services series no. 31. Cat. no. HSE 55. Canberra: AIHW.

AIHW 2010. The Hospital Dementia Services Project. Canberra: AIHW. Viewed 11 October 2012, <http://www.aihw.gov.au/hospital-dementia-services-project/> .

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012a. Dementia in Australia. Cat. no. AGE 70. Canberra: AIHW.

AIHW 2012b. Deriving key patient variables: a Hospital Dementia Services technical paper. Cat. no. CSI 15. Canberra: AIHW.

AIHW: Karmel R, Hales C & Lloyd J 2007. Older Australians in hospital. AIHW bulletin no. 53. Cat. no. AUS 92. Canberra: AIHW.

AIHW: Karmel R & Rosman D 2007. Comparing name-based and event-based strategies for data linkage: a study linking hospital and residential aged care data for Western Australia. Data linkage series no. 3. Cat. no. CSI 3. Canberra: AIHW.

CHeReL (Centre for Health Record Linkage) 2009. Centre for Health Record Linkage. Sydney: CHeReL. Viewed 27 July 2010, <http://www.cherel.org.au/> .

Covinsky KE, Palmer RM, Fortinsky RH, Counsell SR, Stewart AL, Kresevic D et al. 2003. Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. Journal of the American Geriatrics Society 51:451–8.

Creditor MC 1993. Hazards of hospitalization of the elderly. Annals of International Medicine, 118:219–23.

Cunningham C 2006. Understanding challenging behaviour in patients with dementia. Nursing Standard 20:42–5.

Department of Ageing Disability and Home Care (DADHC) & NSW Health 2002. Future directions for dementia care and support in NSW 2001–2006. Sydney: Department of Ageing, Disability and Home Care.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1–10.

Fleming R, Forbes I & Bennett K 2003. Adapting the ward for people with dementia. Sydney: NSW Department of Health.

Foreman P & Gardner I 2005. Evaluation of Education and Training of Staff in Dementia Care and Management in Acute setting. Melbourne: Victorian Government Department of Human Services.

King B, Jones C & Brand C 2006. Relationship between dementia and length of stay of general medical patients admitted to acute care. Australasian Journal on Ageing 25:20–3.

McCusker J, Kakuma R & Abrahamowicz M 2002. Predictors of functional decline in hospitalised elderly patients: a systematic review. Journal of Gerontology: Medical sciences 57A.

NCCH (National Centre for Classification in Heath) 2000. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (2nd edn). Sydney: University of Sydney.

NCCH 2010. Australian coding standards (7th edn). Sydney: University of Sydney.

Nichol B, Lonergan J & Mould M 2000. The use of hospitals by older people: a casemix analysis. Canberra: Australian Department of Health and Aged Care.

NSW Department of Health 2007. Annual report 2006/07. Sydney: NSW Department of Health.

Sager M, Rudberg M, Jalaluddin M, Franke T, Inouye S, Landefeld S et al. 1996. Hospital Admission risk Profile (HARP): Identifying Older Patients at Risk for Functional Decline Following Acute Medical Illness and Hospitalization. American Geriatrics Society 44:251–7.

Thomas EJ & Brennan TA 2000. Incidence and types of preventable adverse events in elderly patients: population based review of medical records. British Medical Journal 320:741–4.

Torian L, Davidson E, Fulop G, Sell L & Fillit H 1992. The effect of dementia on acute care in a geriatric medical unit. International Psychogeriatrics 4:231–9.

Watkin L, Blanchard MR, Tookman A & Sampson EL 2012. Prospective cohort study of adverse events in older people admitted to the acute general hospital: risk factors and the impact of dementia. International Journal of Geriatric Psychiatry 27:76–82.

List of tables

List of figures

List of boxes

Other Hospital Dementia Services publications

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012. Deriving key patient variables: a Hospital Dementia Services technical paper. Canberra: AIHW.

Bail K & Draper B 2011. Blurring lines between acute and aged. Aged care Insite. Viewed 11 October 2012. <http://www.agedcareinsite.com.au/pages/section/article.php?s=Breaking+News&idArticle=22774>.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics 1–10.

Draper B, Karmel R, Gibson D & Peut A 2011. Alcohol related cognitive impairment in NSW hospital patients aged 50 years and over. Australian and New Zealand Journal of Psychiatry 45: 985–92.

Glossary

Elapsed length of stay: derived as difference in dates of admission into hospital and discharged from hospital. All changes in care type and transfers between hospitals are included (see 'hospital stay'). No adjustment is made for absences on hospital leave or hospital visits.

HDS patient: person aged 50 and over who had a completed stay in 2006-07 that included at least one night in a New South Wales public hospital.

Hospital episode: period in hospital of a particular care type in a particular hospital.

Hospital stay: the period from admission into the hospital system to discharge from the system, or death in hospital.

Hospital visit: a hospital episode in one hospital while admitted to another.

Multi-day stay: a hospital stay that includes at least one night in hospital.

Person with dementia: a patient with dementia recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007.

Same-day stay: a hospital stay starting and ending on the same date.

bulletin 110

The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is *authoritative information and statistics to promote better health and wellbeing*.

A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISBN 978-1-74249-368-8

Suggested citation

Australian Institute of Health and Welfare 2012. People with dementia in hospitals in New South Wales 2006–07 Bulletin no. 110. Cat. no. AUS 165. Canberra: AIHW.

Any enquiries about or comments on this publication should be directed to:
Communications, Media and Marketing Unit
Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Tel: (02) 6244 1032
Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report.
Please check the online version at <www.aihw.gov.au> for any amendments.

Australian Government

Australian Institute of Health and Welfare

Deriving key patient variables

A technical paper for the Hospital Dementia Services Project

DATA LINKAGE SERIES NO. 15

Australian Government
Australian Institute of Health and Welfare

Authoritative information and statistics to promote better health and wellbeing

DATA LINKAGE SERIES
Number 15

Deriving key patient variables

A technical paper for the Hospital Dementia Services Project

Australian Institute of Health and Welfare
Canberra
Cat. no. CSI 15

The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is *authoritative information and statistics to promote better health and wellbeing*.

This publication is part of the Australian Institute of Health and Welfare's Data linkage series. A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISBN 978-1-74249-372-5

Suggested citation

Australian Institute of Health and Welfare 2012. Deriving key patient variables: a technical paper for the Hospital Dementia Services project. Data Linkage Series no. 15. Cat. no. CSI 15. Canberra: AIHW.

Australian Institute of Health and Welfare

Board Chair

Dr Andrew Refshauge

Director

David Kalisch

Any enquiries about or comments on this publication should be directed to:

Communications, Media and Marketing Unit

Australian Institute of Health and Welfare

GPO Box 570

Canberra ACT 2601

Tel: (02) 6244 1032

Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au> for any amendments.

Contents

Acknowledgments

Authorship

The authors of this report were Rosemary Karmel and Phil Anderson of the Data Linkage Unit at the Australian Institute of Health and Welfare (AIHW).

Contributors

The Hospital Dementia Services Project was conceived and designed by Diane Gibson (now of the University of Canberra), Brian Draper (University of New South Wales), Cathy Hales (now of the Department of Education, Employment and Workplace Relations) and Ann Peut, Rosemary Karmel and Phil Anderson (all of the AIHW). Project partners are NSW Health, Alzheimer's Australia, Alzheimer's Australia NSW, the Aged & Community Services Association of NSW & ACT Incorporated, and the Benevolent Society.

The project team thanks the Department of Health and Ageing for providing aged care data for this project, NSW Health for providing a special extract from the Admitted Patient Data Collection, and the New South Wales Centre for Health Record Linkage for providing associated patient linkage keys.

Kara Tew and Cath Lawrence assisted with the data linkage undertaken at the AIHW. Brian Draper, Diane Gibson, Ann Peut and Natalie Chan provided valuable comment on and input to the writing of the paper.

Funding

This study is funded by the National Health and Medical Research Council. Chief Investigators are Diane Gibson, Brian Draper, Rosemary Karmel, and Ann Peut.

Abbreviations

AIHW	Australian Institute of Health and Welfare
APDC	Admitted Patient Data Collection
ELOS	elapsed length of stay
FMR	false match rate
HDS	Hospital Dementia Services
ICD–10–AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
RAC	residential aged care

Symbols

–	nil or rounded to zero
. .	not applicable

Summary

The Hospital Dementia Services (HDS) Project is an innovative study which uses linked data to explore how hospital-based aged care and dementia services are related to hospital outcomes for people with dementia. The scope of the study is people aged 50 and over who had at least 1 night in a public hospital in New South Wales in 2006–07 (termed 'HDS patients').

This publication describes the approach taken to derive key hospital use variables employed in project analyses. Hospital use data for the HDS Project were provided by NSW Health from the New South Wales Admitted Patient Data Collection (APDC) and contained a unique patient identifier; episodes from both public and private hospitals were included. The report is a companion publication to *People with dementia in hospitals in New South Wales 2006–07* (AIHW 2012).

Stays versus episodes

Each record in the New South Wales APDC extract provided for the HDS Project relates to an episode of care within a hospital. Almost 14% of multi-day hospital episodes finishing in 2006–07 ended with the patient moving within the hospital system.

Episode dates and reported separation mode were used to combine episodes into hospital stays, where a hospital stay is defined as the period from admission into the hospital system to discharge from the hospital system, or death in hospital. On average, there were 1.18 episodes per multi-day stay for HDS patients. Just over 86% of stays consisted of just one episode, a further 3% had two or more episodes in the one hospital, with the remaining 11% including at least one transfer between hospitals. The average length of multi-day hospital stays is necessarily longer than the average length of multi-day episodes: 9.6 days compared with 8.3 days in 2006–07.

Identifying patients with dementia

Identifying patients with dementia is key for the HDS Project. For a diagnosis of dementia to be reported for a particular hospital episode, the medical diagnosis had to contribute to the care provided or resource use during the patient's hospital stay. To allow for the possibility of dementia being recorded for only a proportion of a patient's hospital episodes, patients in the HDS Project were identified as having dementia if dementia was recorded as a diagnosis for *any* hospital episode—in either a public or private hospital—ending in the 2-year period between 1 July 2005 and 30 June 2007. Using this definition, 9.3% of multi-day stays were identified as being for people with dementia, compared with 6.2% if using only data relating to a particular stay. Even using this approach, some patients with dementia may have remained unidentified.

Post-hospital destination

Previous studies have shown that there are inconsistencies in the APDC reported post-hospital destination, particularly for people moving between hospital and residential aged care (RAC). Therefore data linkage between hospital and RAC data sets has been used to identify post-hospital destination. Data linkage also allows the identification of people

returning to RAC, and aged care residents who die in hospital. The linkage process used for the HDS Project is described in this paper.

There is considerable discordance between events identified as new admissions into RAC from hospital using items reported in the hospital data, and those identified through data linkage. For example, only 46% of stays reported as ending in transfer to RAC were linked to an aged care admission, with 42% being matched to someone already living in RAC.

Analyses by post-hospital destination are affected by whether 'derived' rather than 'reported' post-hospital destination—and 'hospital stay' rather than 'hospital episode' data—are used. Analyses of elapsed length of stay are particularly affected. In addition, using diagnoses reported across a patient's hospital episodes over an extended period—as opposed to single episode—affects analyses of hospital use by people with particular conditions. The differences in results between using reported unlinked episode data and linked person-level data show that using linkage methods to enhance the data is justified. Furthermore, this report demonstrates the importance of using analytical data and methods that match the particular policy or research question being asked.

1 Background

The Hospital Dementia Services (HDS) Project is an innovative study that explores how hospital-based aged care and dementia services are related to outcomes for people with dementia who used a public hospital in New South Wales in 2006–07. It is a mixed methods study involving data linkage of existing routinely collected data sets to create a linked data set containing patient trajectories in hospitals and into residential aged care (RAC), a survey of all New South Wales public hospitals about hospital-based aged care and dementia-specific services, follow-up site visits in selected locations to obtain qualitative data on operational aspects of different hospital-based service models for patients with dementia, and a desk audit to measure the regional availability of key aged care program services (see AIHW 2010, 2011b for more details).

The data sets included in the project are:

- public and private hospital episodes ending between 1 July 2005 and 30 June 2007 from the New South Wales Admitted Patient Data Collection (APDC)
- RAC use and aged care program availability data contained in the Department of Health and Ageing's Aged and Community Care Management Information System
- Aged Care Assessment Program national minimum data set, 2006–07.

This publication describes the approaches taken to derive key hospital use variables used in the various analyses undertaken as part of the HDS Project. The effects on analysis are also examined.

2 Hospital patient data

Hospital use data for the HDS Project from the New South Wales APDC were provided by NSW Health and included all public and private hospital episodes ending between 1 July 2005 and 30 June 2007. The data extract contained a unique patient identifier derived by the New South Wales Centre for Health Record Linkage (CHeReL 2009).

The HDS analysis population is people aged 50 and over by 1 July 2006 who had a completed hospital stay in 2006–07 that included at least 1 night in a New South Wales public hospital. A total of 252,719 people—termed HDS patients—on the APDC data set met these conditions. All stays for these patients in New South Wales hospitals, including those in private hospitals and same-day stays in any hospital, are included in the analysis.

2.1 Deriving hospital stays

Each record in the New South Wales APDC extract provided for the HDS Project related to an episode of care within a hospital. An episode of care for an admitted patient (or inpatient) can be:

- a total hospital stay—from admission into hospital to discharge from hospital or death
- a portion of a hospital stay beginning and/or ending in a change of type of care (for example, from acute care to rehabilitation). Episodes ending with a change in care type in the same hospital are reported as ending in a statistical discharge.
- a portion of a hospital stay beginning and/or ending in a transfer from/to another hospital.

In New South Wales hospitals, there were 490,300 multi-day episodes ending in 2006–07 for people aged 50 and over as at 1 July 2006; 3.7% of these episodes were reported as ending with a change in care type (statistical discharge) and 10% as ending with a transfer to another hospital. In addition, there were 485,800 same-day episodes; 4.7% of these ended with a hospital transfer and just 0.1% ended with a change in care type.

For HDS analyses, the main unit of analysis is the hospital stay, defined as the period from admission into the hospital system to discharge from the hospital system, or death in hospital. A hospital stay can therefore:

- start and end on the same day (a same-day stay)
- include at least 1 night in hospital (a multi-day stay)
- include one or more transfers between hospitals (that is, a multi-episode stay)
- include changes in care type within a hospital (that is, a multi-episode stay)
- include an episode as an admitted patient in one hospital while admitted to another (termed a 'visit')
- include any combination of the above.

Consequently, a hospital stay may comprise one or more hospital episodes. This approach of using hospital stays is different from that taken for previous analyses of hospital care, which have generally been episode based (AIHW 2007; AIHW: Karmel et al. 2007).

Examples of stays and 'visits' are illustrated in Figure 2.1. In these examples, Stay A is a same-day stay consisting of a single same-day episode and Stay B is a multi-day stay

comprising a single multi-day episode. Stays C and D, both multi-day stays, are more complex. In Stay C, the patient is admitted to a hospital and on the same day is transferred out; after a period of acute care in the second hospital, the patient receives a period of rehabilitation before being transferred back to the first hospital for further rehabilitation and discharge. In Stay D, the patient enters a hospital for care; at some point during this care, the patient 'visits' another hospital for a particular procedure, returning to the first hospital for the completion of treatment.

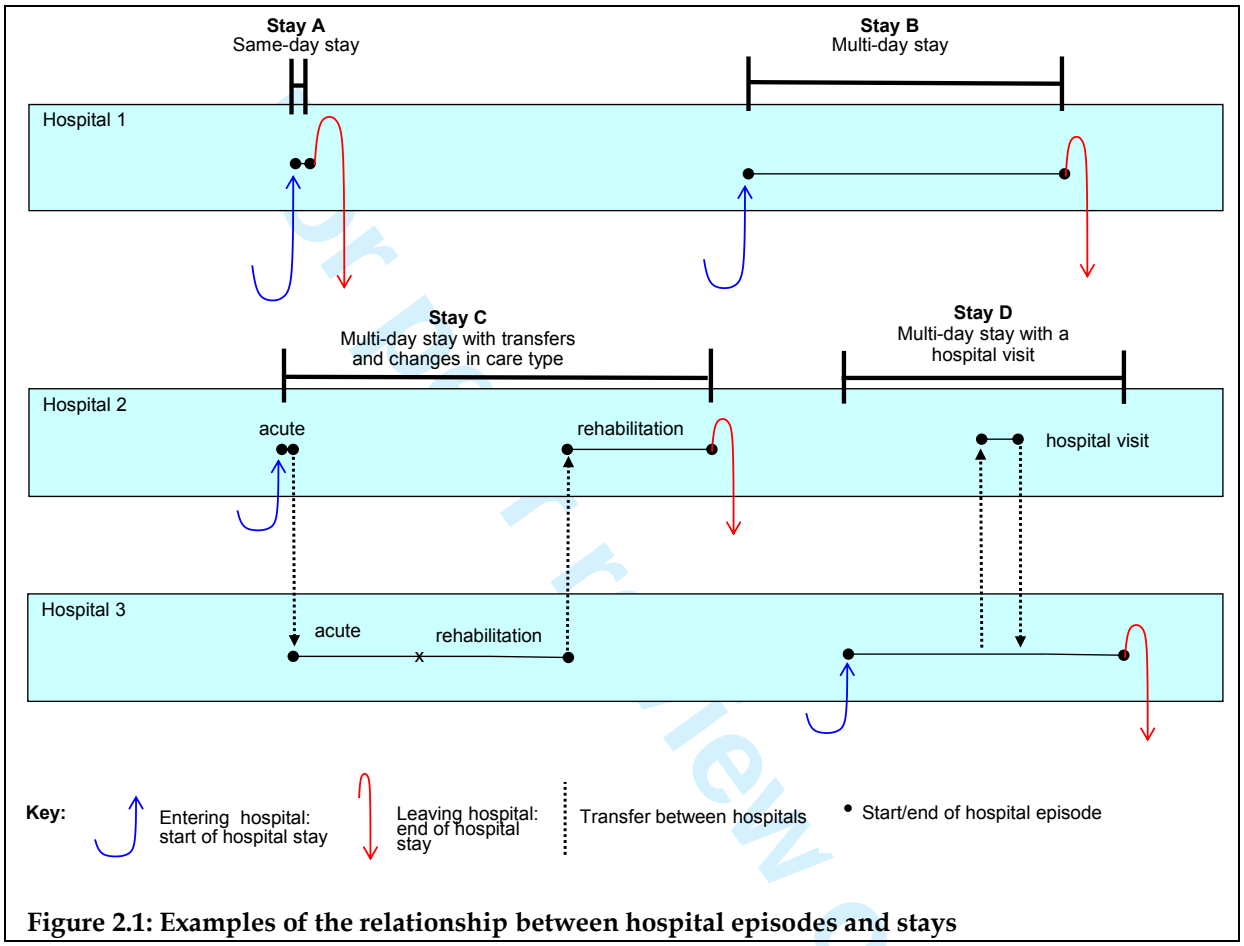


Figure 2.1: Examples of the relationship between hospital episodes and stays

The derivation of completed hospital stay data from the New South Wales APDC episode-based extract is described below. Note that episodes were excluded from the analysis if they:

- were multi-day duplicates; that is, episodes for the same patient with the same admission and separation dates in the same hospital (148 episodes across 2005–07)
- had a care type of 'newborn', 'posthumous' or 'boarder' (108 episodes)
- had a separation date before the admission date (7 episodes).

In addition, 817 hospital episodes were in RAC-type services associated with a hospital and 15 establishments on the APDC were identified as providing RAC services only (1,558 episodes across 2005–07). These data were also excluded from the hospital data as all government-funded RAC places are included in the RAC data set.

Deriving hospital stays

The unique patient identifier provided on the New South Wales APDC extract information allows episodes belonging to the same person to be readily identified. This information, along with data on episode start and end dates and mode of discharge, meant that hospital episodes for an individual could be combined into hospital stays—from first admission to final discharge.

Because people can be re-admitted to hospital on the same day that they leave hospital, a person's hospital episodes were combined into stays using both episode dates and reported mode of separation (or discharge) as explained below.

Adjacent hospital episodes for a patient were identified as belonging to the same stay if:

- the dates for the episodes overlapped, or
- the gap between two episodes was zero (0) days and the separation mode of the earlier episode was reported as a:
  - statistical discharge, or
  - transfer to another acute hospital, or
  - transfer to a psychiatric hospital.

Adjacent hospital episodes were identified as belonging to a different stay if the gap between the two episodes was:

- 1 day or more, or
- zero (0) days and the separation mode of the earlier episode was not reported as a statistical discharge or transfer to another hospital.

A stay was said to be completed if the next episode for a person was identified as belonging to a new stay using the above rules (irrespective of the separation mode of the last episode of the stay), or if the last identified episode in the stay was *not* reported as a statistical discharge or transfer to another hospital. The latter is relevant when a person's last episode in the year finishes as a statistical discharge or transfer to another hospital, implying that the next ('receiving') episode in the stay finished after 30 June 2007 and so was not in the data set.

Overall, the 252,719 HDS patients had 408,539 multi-day stays ending in 2006–07. These stays were made up of almost 482,500 episodes, including some same-day episodes and episodes that had ended in the previous financial year. Consequently, on average there were 1.18 episodes per stay. Just over 86% of stays consisted of just one episode, almost 11% included at least one transfer between hospitals and 2.7% had a change in care type but no hospital transfer (Table 2.1).

Table 2.1: Multi-day hospital stays, by number of episodes and transfers, for HDS patients, 2006–07

No. of episodes in the stay[(a)]	No. of hospital-to-hospital transfers in the stay[(a)]	Per cent
1	. .	86.4
2	0	2.3
2	1	8.2
3+	0	0.3
3+	1	0.6
3+	2	1.6
4+	≥3	0.5
Stay included a change in care type only	. .	*2.7*
Stay included a transfer	. .	*10.9*
Total	**. .**	**100.0**
Total (N)	**. .**	**408,539**
Mean episodes per stay (N)	**. .**	**1.18**

(a) Excludes 'hospital visits'.

Note: Percentages may not sum to 100% due to rounding.

2.2 Identifying patients with dementia

Medical diagnoses are recorded on the APDC if they contribute to the care provided or resource use during the hospital stay. The principal diagnosis for a hospital episode is that diagnosis chiefly responsible for causing the hospitalisation episode. Up to 54 other diagnoses can also potentially be recorded per episode of care on the New South Wales APDC. Dementia diagnoses can be recorded on any of these 55 diagnoses in any episode of a stay.

For the HDS Project, using the unique patient identifier, patients were identified as having dementia if dementia was recorded as a diagnosis for *any* hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. Diagnoses in the APDC data are coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (NCCH 2000). The codes used to identify people with dementia are given in Table 2.2.

The proportion of multi-day hospital episodes for the HDS population said to be for people with dementia varies considerably with the method of dementia identification used. It ranges from 0.6%, if only the principal diagnosis for an episode or stay is used to identify patients with dementia, to 10.2% when using the above 'ever dementia' approach taken for the HDS Project (Table 2.3).

It is likely that dementia is underestimated in the hospital patient population due to a combination of poor recognition by medical staff; deficiencies in the medical record; and because the condition, like other pre-existing conditions, may not be recorded on the hospital admission data if it does not affect the care provided or resource use during the hospital stay. On the other hand, patients were identified as having dementia if a dementia condition was reported for any of their New South Wales hospital episodes ending between 1 July 2005 and

30 June 2007. Consequently, it is possible that, in this study, people with dementia who had more or longer hospital stays were more likely to have been identified as having the condition. These two factors have opposing effects. It is also possible that cases of delirium were misdiagnosed as dementia (Draper et al. 2011).

Table 2.2: ICD–10–AM codes identifying dementia

Code	ICD–10–AM description
F00	Dementia in Alzheimer's disease (G30.-†)
F00.0	Dementia in Alzheimer's disease with early onset (G30.0†)
F00.1	Dementia in Alzheimer's disease with late onset (G30.1†)
F00.2	Dementia in Alzheimer's disease, atypical or mixed type (G30.8†)
F00.9	Dementia in Alzheimer's disease, unspecified (G30.9†)
F01	Vascular dementia
F01.0	Vascular dementia of acute onset
F01.1	Multi-infarct dementia
F01.2	Subcortical vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia
F01.8	Other vascular dementia
F01.9	Vascular dementia, unspecified
F02	Dementia in other diseases classified elsewhere
F02.0	Dementia in Pick's disease (G31.0†)
F02.1	Dementia in Creutzfeldt-Jakob disease (A81.0†)
F02.2	Dementia in Huntington's disease (G10†)
F02.3	Dementia in Parkinson's disease (G20†)
F02.4	Dementia in human immunodeficiency virus (HIV) disease (B22.0†)
F02.8	Dementia in other specified diseases classified elsewhere
F03	Unspecified dementia
F05.1	Delirium superimposed on dementia
G30	Alzheimer's disease
G30.0	Alzheimer's disease with early onset
G30.1	Alzheimer's disease with late onset
G30.8	Other Alzheimer's disease
G30.9	Alzheimer's disease, unspecified
G31	Other degenerative diseases of nervous system, not elsewhere classified
G31.0	Circumscribed brain atrophy
G31.1	Senile degeneration of brain, not elsewhere classified
G31.2	Degeneration of nervous system due to alcohol
G31.3	Lewy body disease
G31.8	Other specified degenerative diseases of nervous system
G31.9	Degenerative disease of nervous system, unspecified

- Symbol denotes any digit.

† Symbol denotes a code describing the aetiology or underlying cause of a disease.

2.3 Elapsed length of stay

The elapsed time in hospital for a hospital stay—or elapsed length of stay (ELOS)—is calculated as the gap between the date the person entered hospital and the date he or she was finally discharged. Consequently, no adjustment is made for absences on hospital leave or hospital 'visits'. This approach was taken to facilitate calculation of length of stay allowing for hospital visits and hospital stays comprising more than one episode (including some same-day stays). This differs from the approach used in the standard episode-based measure of length of stay which gives same-day episodes a length of 1 day and deducts hospital leave days from the elapsed time (AIHW: Karmel et al. 2007; AIHW 2008).

The effect of different definitions of length of stay is demonstrated in Table 2.3, along with the effect of different ways of identifying patients with dementia. From this, it can be seen that excluding leave days from the length of stay ('reported patient days' compared with 'ELOS') has a small effect on the measured mean length of stay for episodes (8.3 versus 8.4 days) but no effect on the median or 90th percentile. Combining contiguous episodes into stays has a larger effect, with mean ELOS for stays (as opposed to episodes) estimated at 9.6 days. This effect is largely driven by the tails of the distributions, with the median being 4 days for both episodes and stays.

Different definitions of dementia result in even larger effects. As the definition of 'patient with dementia' is extended from being based on principal diagnosis only to being based on whether a person was ever identified with dementia in a 2-year period, the proportion of multi-day stays identified as being for people with dementia increases from 0.6% to 9%. On the other hand, the ELOS is longer for the narrower methods of dementia identification: mean ELOS is 30 days for stays where the principal diagnosis was dementia, 19 days for stays with any diagnosis of dementia, and 17 days for stays for people ever diagnosed with dementia (as used in the HDS Project). Similar effects are seen in the median and 90th percentile.

Table 2.3: Length of stay for multi-day hospital events, by event length and dementia definitions, HDS patients, 2006–07

Dementia definition		Per cent	Number	Mean	Median	90th percentile
		Episodes		**Reported patient days (days)***		
Principal diagnosis of episode[(a)]	Other	99.4	464,816	8.2	4	18
	Dementia	0.6	3,041	23.3	11	42
Any diagnosis of episode[(b)]	No dementia	93.6	437,816	8.0	4	17
	Dementia	6.4	30,041	13.8	8	28
Person diagnosis[(c)]	Without dementia	89.8	420,148	7.8	4	17
	With dementia	10.2	47,709	13.2	7	27
All		**100.0**	**467,857**	**8.3**	**4**	**18**
		Episodes		**ELOS (days)**		
Principal diagnosis of episode[(a)]	Other	99.4	464,816	8.3	4	18
	Dementia	0.6	3,041	23.6	11	42
Any diagnosis of episode[(b)]	No dementia	93.6	437,816	8.0	4	18
	Dementia	6.4	30,041	13.9	8	28
Person diagnosis[(c)]	Without dementia	89.8	420,148	7.8	4	17
	With dementia	10.2	47,709	13.2	7	27
All		**100.0**	**467,857**	**8.4**	**4**	**18**
		Stays		**ELOS (days)**		
Principal diagnosis of stay[(a)]	Other	99.4	406,079	9.5	4	21
	Dementia	0.6	2,460	30.3	14	59.5
Any diagnosis of stay[(b)]	No dementia	93.8	383,266	9.0	4	20
	Dementia	6.2	25,273	18.5	9	40
Person diagnosis[(c)]	Without dementia	90.7	370,355	8.9	4	20
	With dementia	9.3	38,184	16.5	7	36
All		**100.0**	**408,539**	**9.6**	**4**	**21**

* excludes days on leave from hospital.

(a) Dementia identification based on principal diagnosis of episode or first episode of a multi-episode stay, as applicable.

(b) Dementia identification based on any diagnosis of episode or stay, as applicable.

(c) Dementia identification based on all diagnoses reported for a patient in any hospital episode in New South Wales ending between 1 July 2005 and 30 June 2007 (as used in the HDS Project).

3 Post-hospital destination

The New South Wales APDC reports the post-hospital destination of patients, nominally distinguishing between people transferring into RAC for the first time (coded to the category 'discharge/transfer to a Residential Aged Care service, unless this is the usual place of residence') and those returning to their usual place of residence. These latter are coded to an 'other' category, that includes discharge to usual residence, own accommodation, or welfare institution (such as prisons, hostels and group homes providing primarily welfare services) (AIHW 2005). However, differences between reported and actual destination have been seen in studies that have linked hospital discharges to entries into RAC. For example, in a study linking Western Australian hospital episodes to RAC data, only two-thirds of links to admissions to permanent RAC were reported as transferring to RAC for the first time, while one-fifth of links were reported as 'other'—that is, returning to their usual residence. Also, only about 85% of linked RAC leave events (that is, leave from RAC to go to hospital) that did not link to a death in hospital were reported as the patient returning to their usual residence (AIHW: Karmel & Rosman 2007, Table A6.2).

The anomalies in the APDC reported post-hospital destination seen in the Western Australian study suggest that analyses based on this data item could be misleading. Therefore, the APDC data in the HDS study were linked to RAC event data to improve information on post-hospital destination. As well as better identifying transfers to RAC, such linkage means that it is also possible to:

- distinguish between hospital discharges to permanent and respite RAC
- identify hospital stays for permanent RAC residents
- identify in-hospital deaths for RAC residents.

The linkage process used for the HDS Project is described below. Results of the linkage and comparisons of the distributions of post-hospital destination as derived through data linkage and as reported are then presented.

3.1 Linking hospital and residential aged care data

Matching individual hospital patients to RAC clients would facilitate identifying transfer events and hospital stays by RAC residents; it would also ensure that hospital stays for a particular patient would be matched only to RAC events associated with the same RAC client. Such person-based matching was possible for the HDS Project for two reasons. Firstly, both the APDC data and RAC data for the HDS Project have a client identifier. Secondly, all RAC clients and 95% of HDS patients had data suitable for person-based matching—namely, data for the statistical linkage key SLK-581 (consisting of the second, third and fifth letters of surname (S235), the second and third letters of first name (F23), date of birth, sex, region of residence and event data (see below)). People who were both HDS patients and RAC clients in 2006–07 were therefore identified through person-based data linkage centred on SLK-581. Hospital-to-RAC transfer events and hospital stays by permanent RAC residents were then identified by comparing hospital episode and RAC entry and exit dates for matched people.

Additional matches for the 5% of HDS patients without name information were identified by matching hospital stays to RAC admissions and reported periods in hospital (termed 'RAC

hospital leave') using event dates and date of birth, sex and region of residence. This type of anonymous linkage is called 'event-based matching' in the following description.

The linkage process consisted of three phases:

- Phase 1: matching hospital patients with SLK-581 data to RAC clients
- Phase 2: matching hospital and RAC events for hospital patients matched in phase 1
- Phase 3: matching hospital events for hospital patients without SLK-581 data to RAC events.

National data on RAC service use were linked to the HDS hospital patient data to allow identification of related RAC use by all HDS patients, including those using RAC services outside New South Wales. Previous studies of link accuracy for different linkage strategies are presented in AIHW: Karmel & Rosman 2007 and AIHW 2011a.

Phase 1: person matching

HDS patients were matched to RAC clients using stepwise deterministic matching with a specially selected set of statistical linkage keys. (For a general description of this method—including key selection—see Karmel et al. 2010 or AIHW 2011c.) Keys were composed of combinations of the following elements:

- match elements from SLK-581
  - surname elements based on two or three letters out of the second, third and fifth letters of surname: S235, S23, S25, S35
  - first name element, being the second and third letters of first name: F23
  - date of birth, separated into day, month, year
  - sex
- other match elements
  - region indicator based on postcode of usual residence (community and residential care postcode were both used for RAC data), using 1, 2, 3 and 4 digits: pc1, pc2, pc3, pc4
  - date of hospital entry to match to date of RAC exit (for RAC leave)
  - date of hospital exit to match to date of RAC entry (for RAC leave and admissions)
  - length of hospital stay to match to length of RAC hospital leave.

Event dates were included in the person matching process to facilitate matching between people with differences on the two data sets in reported name and demographic data. Hospital event dates were based on stays, and not episodes. These data were considered useful in identifying the best person matches because of the high use of hospital by RAC residents, and the large proportion of permanent RAC residents who get admitted from hospital (AIHW: Karmel et al. 2008). Same-day hospital stays were excluded because RAC hospital leave must last at least 1 night and such short stays are unlikely to end with admission into RAC.

RAC clients who had hospital leave reported—and so were highly likely to match—were matched before other RAC clients. Data on all events for individuals (rather than just selecting one event) were used to allow all people, including those without name information on the hospital data, to be matched. A total of 951 different keys (that is,

different combinations of the above elements) were used when matching people with RAC hospital leave; some of these keys did not include name information.

Hospital patients who did not match to an RAC client with hospital leave were then matched to RAC clients without such events in 2006–07. In this match process, 165 different keys were used; all included some name information.

Because a state-level data set was being matched with a national data set, all keys used to match people included a region indicator (at least pc1). Also, all keys had an estimated underlying false match rate (FMR) of less than 0.5%, and at least two-thirds of additional matches made by the key (given links already made) were expected to be true (see Karmel et al. 2010 for discussion of key selection).

Differences in reported SLK-581 and postcode of usual residence in the two data sets were specifically allowed for. For the RAC data, both the client postcode before admission into RAC and the postcode of the RAC facility were used for linking, with the former being given preference when linking to RAC admissions and the latter when linking to people already in permanent RAC. In the APDC data, a patient may have different name and demographic data reported across hospital episodes. All versions of a client's SLK-581 and residence postcode were retained for matching. The number of variations considered when matching using a particular key was determined by the estimated FMR of that key, with the aim being to maintain an estimated FMR below 0.5% when using variants.

Phase 2: matching events for matched people

In this phase, the related hospital and RAC events were identified for each person matched in phase 1. These included hospital stays for people living permanently in RAC and hospital stays ending with transfer to RAC. Same-day hospital stays were included in this process as the person-based matching allowed their identification; this permits the use of same-day stays by RAC residents to be quantified. Some difference in dates was allowed to account for differences in recording dates (for example, due to entry into hospital via an Emergency Department, use of RAC pre-entry leave—which allows reservation of an RAC place for up to 6 days before admission into permanent residential care, or recording errors). Related events for matched people were identified as follows:

- The date of hospital entry (that is, stay start date) was compared with the date of RAC exit (for RAC leave).
- The date of hospital exit (that is, stay end date) was compared with the date of RAC entry (for RAC leave and admissions).
- Identification of related hospital and RAC events was undertaken in the following order:
  1. RAC hospital leave events: Up to 3 days difference between hospital and RAC dates was allowed (symmetric test). Also, 'related' RAC admissions (that is, admission to a different RAC facility on leaving hospital) were identified, allowing +/–1 day date differences. These related admissions were excluded when identifying matches between hospital discharges and RAC admissions.
  2. RAC admissions: When identifying these event links, allowance was made for date-reporting issues. RAC entry dates could be up to 3 days before the hospital exit date or up to 6 days after (to allow for pre-entry leave for permanent RAC admissions). Same-day transfers (even between respite and permanent care) were combined into one RAC event.

3 Social leave (absence from RAC for non-medical reasons): Matches to social leave were made to allow for RAC residents entering hospital while visiting family and friends. For this matching, RAC entry dates (return from leave) could be up to 11 days after the end of the hospital stay; preliminary analysis had shown that very few related events had larger gaps. For a substantial majority (92%) of these matches, the resident returned to RAC within 1 day of leaving hospital.

4 Unreported RAC hospital leave (hospital stays by permanent RAC residents not reported in the RAC data): Additional hospital stays by permanent RAC residents were identified by comparing RAC admission and discharge dates with hospital stay dates for matched people; hospital stay dates had to be encompassed by the RAC dates. Note that this last step also identified the few matches to social leave missed in (3) above due to the 11-day cut-off.

The above process resulted in identifying associated RAC events for nearly 45,200 hospital stays, including same-day hospital stays and stays for a small number of people aged under 50 at 1 July 2006 on the HDS data set.

Phase 3: matching events for patients without SLK-581 data

Finally, RAC events matching hospital stays for the 5% of HDS patients without name information were identified using event-based matching (Karmel & Gibson 2007; AIHW: Karmel et al. 2008); that is, by matching events directly rather than by first matching people. Stepwise deterministic matching was again used for matches to RAC hospital leave and admissions, with keys based on the same data as the person-based matching, excluding the name elements. That is, keys were composed of combinations of the following elements:

- date of birth, separated into day, month, year
- sex
- postcode of usual residence, using 1, 2, 3 and 4 digits: pc1, pc2, pc3, pc4
- date of hospital entry matching to date of RAC exit (for RAC leave)
- date of hospital exit matching to date of RAC entry (for RAC leave and admissions)
- length of hospital stay matching to length of RAC hospital leave.

Because of the reduced information for matching, this process was expected to be less accurate than the person-based matching. Therefore, key selection was refined by comparing results from the person-based linkage process and event-based linkage for HDS patients with name information. As a result, an FMR limit of 1% was used when matching to RAC hospital leave (18 keys), and a limit of 1.5% was used when matching to RAC admissions (2 keys). Event date variation of +/– 2 days and alternative postcodes, sex and date of birth were also allowed. Additional matches to social leave were identified by matching on date of birth, sex and postcode (no variation) and finding hospital events encompassed by the social leave dates.

This linkage phase resulted in a small number of additional matches (115 events).

Results

Overall, 10% of HDS multi-day stays matched to an RAC event in 2006–07 (Table 3.1). Just over 60% of these matches were for people already living in RAC.

Table 3.1: Linkage results: multi-day hospital stays by RAC event match type, HDS patients, 2006–07

Matching RAC event	Frequency	Per cent	Per cent linked with an RAC event
None	372,052	90.2	. .
Permanent RAC admission followed the hospital stay	7,664	1.9	18.9
Respite RAC admission followed the hospital stay	5,436	1.3	13.4
RAC hospital leave corresponded to the hospital stay	24,142	5.9	59.5
RAC hospital leave corresponded to the hospital stay, but the RAC client had a new permanent admission on return to aged care	1,302	0.3	3.2
RAC hospital leave corresponded to the hospital stay, but the RAC client was admitted into respite RAC on return to aged care	120	—	0.3
Hospital stays occurred during RAC social leave	412	0.1	1.0
In hospital while permanent RAC resident (no leave reported)	1,531	0.4	3.8
Total	**412,659**	**100.0**	**100.0**

Notes

1. Table includes 4,120 stays for people aged under 50 at 1 July 2006 on the HDS input data set.
2. Percentages may not sum to 100% due to rounding.

3.2 Deriving post-hospital destination

Post-hospital destination was derived using the event matches; death in hospital was assumed to be reported accurately, and transfer to other health-care accommodation was assumed to be correct unless the hospital stay was linked to an RAC event (Table 3.2). Overall, 3.2% of HDS multi-day stays were identified as ending with the patient being newly transferred to RAC—the majority (60%) entering permanent RAC. In addition, 6% of stays ended with the patient returning to RAC—predominantly for permanent care in the facility they had left. Nearly 5% of all stays ended with the death of the patient; 15% of these deaths were for people who had been on leave from permanent RAC.

Table 3.2: Post-hospital destination derived through data linkage, multi-day hospital stays for HDS patients, 2006–07

Derived post-hospital destination	Number	Per cent
To RAC, permanent	7,651	1.9
To RAC, respite	5,426	1.3
Return to permanent RAC	23,019	5.6
Return to permanent RAC, permanent admission to a different facility	1,301	0.3
Return to RAC, in permanent RAC before hospital stay but admitted to respite RAC on discharge from hospital	120	—
Return to respite RAC	5	—
Transferred to other health-care accommodation[(a)]	3,791	0.9
To community[(b)]	346,877	84.9
Died – RAC resident[(c)]	3,062	0.7
Died – other	17,264	4.2
Unknown	23	—
Total	**408,539**	**100.0**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Percentages may not sum to 100% due to rounding.

3.3 Comparison of derived and reported post-hospital destination

Table 3.3 compares the derived post-hospital destination with that reported on the APDC. Overall, the number of people reported as transferring to RAC is slightly higher than that derived through linkage (3.8% versus 3.2%). At first glance, this could be thought to be due to missed links. However, a closer look at Table 3.3 shows that there is considerable discordance between reported transfers to RAC and those derived through data linkage. These large discrepancies are illustrated in Figure 3.1. Only 46% of stays reported as ending in transfer to RAC were linked to an RAC admission, with 42% being matched to someone already living in RAC. Similarly, 55% of stays linked to an RAC admission were reported as ending in a transfer to RAC and 37% were reported as discharged to their own accommodation. A higher proportion of people were also reported as going to other health-care accommodation (1.5 %) than was found using linked data (0.9%, assuming that this reported destination was correct unless the hospital stay was matched to an RAC event).

Previous studies on the quality of the linkage processes used for this project (AIHW: Karmel & Rosman 2007; AIHW 2011a) indicate that this level of difference is highly likely to be due to reporting issues rather than to errors in the linkage—that is, it is not due to missed and false matches. One of the possible causes could be confusion about what should be reported on the hospital data as the patient's usual residence: usual residence before or usual residence after hospitalisation.

The effect of these differences in post-hospital destination on the profiles of patients in the various movement categories is demonstrated in the following sections.

Table 3.3: Multi-day hospital stays by derived and reported post-hospital destination, HDS patients, 2006–07

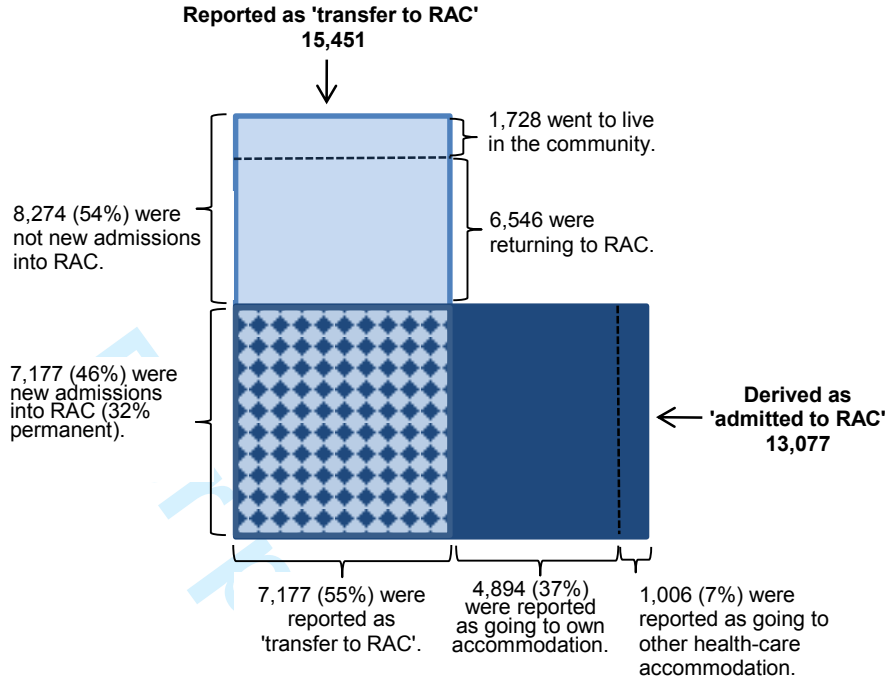
	Reported post-hospital destination					Total	
Derived post-hospital destination	**Discharge/ transfer to RAC (not previous usual residence)**	**To other health-care accommodation[a]**	**To own accommodation, including discharged at own risk or while on leave**	**Died**	**Unknown**	**No.**	**Per cent**
Admitted to RAC	*7,177*	*1,006*	*4,894*	. .	—	*13,077*	*3.2*
To permanent RAC	4,912	444	2,295	. .	—	7,651	1.9
To respite RAC	2,265	562	2,599	. .	—	5,426	1.3
Returned to RAC	6,546	1,135	16,763	. .	1	24,445	6.0
Transferred to other health-care accommodation[a]	. .	3,791	. .	. .	. .	3,791	0.9
To community[b]	1,728	8	345,141	. .	. .	346,877	84.9
Died – RAC resident[c]	. .	. .	. .	3,062	. .	3,062	0.7
Died – other	. .	. .	. .	17,264	. .	17,264	4.2
Unknown	. .	. .	. .	. .	23	23	—
Total (number)	**15,451**	**5,940**	**366,798**	**20,326**	**24**	**408,539**	**100.0**
Total (per cent)	**3.8**	**1.5**	**89.8**	**5.0**	**—**	**100.0**	**. .**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Percentages may not sum to 100% due to rounding.



Source: Table 3.3.

Figure 3.1: Comparing hospital stays reported as transferring to RAC and stays linking to admission into RAC, HDS patients, 2006–07

Dementia status

Using both destination classifications, patients with dementia are seen to be more likely to be transferred from hospital to RAC than those without dementia (Table 3.4). However, among patients with dementia, using the reported destination results in a 40% higher proportion being seen as a transfer to RAC (19% compared with 14%); for patients without dementia, the estimates are very similar for the two classifications (2%). The derived destination also shows that almost 30% of stays for people with dementia ended with the patient returning to RAC as their usual residence—a proportion hidden in the 'own accommodation' category in the reported data.

Table 3.4: Multi-day hospital stays: derived and reported post-hospital destination by dementia status, HDS patients, 2006–07 (per cent)

Derived post-hospital destination	With dementia	Without dementia	Total
Admitted to RAC	*13.9*	*2.1*	*3.2*
To permanent RAC	8.8	1.2	1.9
To respite RAC	5.1	0.9	1.3
Returned to RAC	29.1	3.6	6.0
Transferred to other health-care accommodation[(a)]	1.2	0.9	0.9
To community[(b)]	47.5	88.8	84.9
Died – RAC resident[(c)]	3.7	0.4	0.7
Died – other	4.6	4.2	4.2
Total	**100.0**	**100.0**	**100.0**
Total N	**38,182**	**370,334**	**408,516**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	19.4	2.2	3.8
Transfer to other health-care accommodation[(a)]	3.5	1.2	1.5
To own accommodation, including discharged at own risk or while on leave	68.7	92.0	89.8
Died	8.4	4.6	5.0
Total	**100.0**	**100.0**	**100.0**
Total N	**38,182**	**370,333**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Age and sex

People aged over 65 are more likely to be reported as transferring from hospital to RAC than to be identified through data linkage as making this move (for example, 11% versus 9% for people aged 85+; see Table 3.5). The proportion derived as returning to RAC rises with age (up to 19% among those aged 85+), leading to increasing differences with age between those reported as returning to their own home and those derived as returning to the community. Using the reported destination, the proportion seen to be transferring to other health-care accommodation increases with age. This apparent effect is marginal at most when using the derived destination.

The effects seen by dementia status and age are reflected in the distributions of post-hospital destination by sex (Table 3.6). The differences between the two distributions are more marked for women, with the reported destinations of transfer to RAC and transfer to other

health-care accommodation being relatively high compared with those based on the derived destination.

Table 3.5: Multi-day hospital stays: derived and reported post-hospital destination by age, HDS patients, 2006–07 (per cent)

	Age at 1 July 2006				
Derived post-hospital destination	**50–64**	**65–74**	**75–84**	**85+**	**Total**
Admitted to RAC	*0.5*	*1.6*	*4.5*	*9.0*	*3.2*
To permanent RAC	0.3	0.9	2.6	5.3	1.9
To respite RAC	0.2	0.6	1.9	3.7	1.3
Returned to RAC	0.8	2.5	7.6	19.4	6.0
Transferred to other health-care accommodation[(a)]	0.8	0.9	1.0	1.0	0.9
To community[(b)]	95.6	90.8	80.7	61.4	84.9
Died – RAC resident[(c)]	—	0.3	0.9	2.7	0.7
Died – other	2.3	4.0	5.3	6.5	4.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total N	**124,574**	**101,177**	**122,889**	**59,876**	**408,516**
Reported post-hospital destination					
Discharge/transfer to RAC (not previous usual residence)	0.5	1.8	5.1	11.3	3.8
Transfer to other health-care accommodation[(a)]	0.9	1.2	1.7	2.6	1.5
To own accommodation, including discharged at own risk or while on leave	96.2	92.8	87.0	76.9	89.8
Died	2.4	4.2	6.2	9.2	5.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total N	**124,573**	**101,177**	**122,889**	**59,876**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Table 3.6: Multi-day hospital stays: derived and reported post-hospital destination by sex, HDS patients, 2006–07 (per cent)

Derived post-hospital destination	Male	Female	Total
Admitted to RAC	*2.6*	*3.8*	*3.2*
To permanent RAC	1.6	2.2	1.9
To respite RAC	1.0	1.6	1.3
Returned to RAC	4.2	7.8	6.0
Transfer to other health-care accommodation[(a)]	1.0	0.9	0.9
To community[(b)]	87.0	82.9	84.9
Died – RAC resident[(c)]	0.6	0.9	0.7
Died – other	4.7	3.8	4.2
Total	**100.0**	**100.0**	**100.0**
Total N	**204,809**	**203,707**	**408,516**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	2.9	4.6	3.8
Transfer to other health-care accommodation[(a)]	1.3	1.6	1.5
To own accommodation, including discharged at own risk or while on leave	90.5	89.1	89.8
Died	5.3	4.7	5.0
Total	**100.0**	**100.0**	**100.0**
Total N	**204,808**	**203,707**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Elapsed length of stay

The length of stay distribution is substantially different using the reported and derived post-hospital destination classifications (Table 3.7). Both mean and median ELOS were 9 days shorter among patients reported as transferring to RAC when compared with stays linked to an RAC admission. This is because people who were already RAC residents tended to have shorter stays than those who were newly admitted into such care on discharge from hospital. People reported as transferring to other health-care accommodation also had longer stays than those identified through data linkage as making this move. It is also interesting to note that the length of stay for RAC residents who died in hospital was generally less than that for non-RAC residents who died.

Table 3.7: Multi-day hospital stays: length of stay by derived and reported post-hospital destination, HDS patients, 2006–07 (days)

Derived post-hospital destination	Mean	Median	90th percentile
Admitted to RAC	*34.1*	*23*	*70*
To permanent RAC	40.5	28	81
To respite RAC	25.0	17	55
Returned to RAC	10.3	6	24
Transferred to other health-care accommodation[(a)]	15.9	7	34
To community[(b)]	7.8	4	17
Died – RAC resident[(c)]	11.6	6	25
Died – other	23.6	9	43
Total	**9.6**	**4**	**21**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	25.0	14	56
Transfer to other health-care accommodation[(a)]	19.4	9	44
To own accommodation, including discharged at own risk or while on leave	8.1	4	18
Died	21.8	9	40
Total	**9.6**	**4**	**21**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.

Glossary

HDS patient: a person aged 50 and over who had a completed hospital stay in 2006–07 that included at least 1 night in a New South Wales public hospital

Hospital episode: a period in hospital of a particular care type in a particular hospital

Hospital stay: the period from admission into the hospital system to discharge from the hospital system, or death in hospital

Hospital visit: an episode as an admitted patient in one hospital while admitted to another

Patient with dementia: a patient with dementia recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007 (definition for HDS Project)

References

AIHW (Australian Institute of Health and Welfare) 2005. METeOR: Episode of admitted patient care—separation mode, code N. Canberra: AIHW. Viewed 3 April 2008, <http://meteor.aihw.gov.au/content/index.phtml/itemId/270094>.

AIHW 2007. Australian hospital statistics 2005-06. Health services series no. 30. Cat. no. HSE 50. Canberra: AIHW.

AIHW 2008. Australian hospital statistics 2006-07. Health services series no. 31. Cat. no. HSE 55. Canberra: AIHW.

AIHW 2010. The Hospital Dementia Services Project. Canberra: AIHW. Viewed 11 October 2012, <http://www.aihw.gov.au/hospital-dementia-services-project/>.

AIHW 2011a. Comparing an SLK-based and a name-based data linkage strategy: an investigation into the PIAC linkage. Data linkage series no. 11. Cat. no. CSI 11. Canberra: AIHW.

AIHW 2011b. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2011c. Pathways in Aged Care: program use after assessment. Data linkage series no. 10. Cat. no. CSI 10. Canberra: AIHW.

AIHW 2012. People with dementia in hospitals in New South Wales 2006-07. Cat. no. AUS 165. Canberra: AIHW.

AIHW: Karmel R, Hales C & Lloyd J 2007. Older Australians in hospital. AIHW bulletin no. 53. Cat. no. AUS 92. Canberra: AIHW.

AIHW: Karmel R, Lloyd J & Anderson P 2008. Movement from hospital to residential aged care. Data linkage series no. 6. Cat. no. CSI 6. Canberra: AIHW.

AIHW: Karmel R & Rosman D 2007. Comparing name-based and event-based strategies for data linkage: a study linking hospital and residential aged care data for Western Australia. Data linkage series no. 3. Cat. no. CSI 3. Canberra: AIHW.

CHeReL (Centre for Health Record Linkage) 2009. Centre for Health Record Linkage. Sydney: CHeReL. Viewed 27 July 2010, <http://www.cherel.org.au/>.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1-10.

Karmel R, Anderson P, Gibson D, Peut A, Duckett SJ & Wells Y 2010. Empirical aspects of record linkage across multiple data sets using statistical linkage keys: the experience of the PIAC cohort study. BMC Health Services Research 10:41.

Karmel R & Gibson D 2007. Event-based record linkage in health and aged care services data: a methodological innovation. BMC Health Services Research 7:154.

NCCH (National Centre for Classification in Health) 2000. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) 2nd edn. Sydney: University of Sydney.

List of tables

List of figures

Other Hospital Dementia Services publications

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012. People with dementia in hospitals in New South Wales 2006–07. Cat. no. AUS 165. Canberra: AIHW.

Bail K & Draper B 2011. Blurring lines between acute and aged. Aged care Insite. Viewed 11 October 2012. <http://www.agedcareinsite.com.au/pages/section/article.php?s=Breaking+News&idArticle=22774>.

Draper B, Karmel R, Gibson D & Peut A 2011. Alcohol related cognitive impairment in NSW hospital patients aged 50 years and over. Australian and New Zealand Journal of Psychiatry 45: 985–92.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1–10.

This report describes the methods used for the Hospital Dementia Services Project to derive dementia status, complete hospital stays and post-hospital destination using New South Wales hospital data for 2006–07. Comparisons of estimates using these key variables show that the method used to derive the variables can substantially affect analytical results on use of hospitals. This report demonstrates the importance of using analytical data and methods that match the particular policy or research question being asked.

International Psychogeriatrics: page 1 of 10 © International Psychogeriatric Association 2011
doi:10.1017/S1041610211001694

The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia

Brian Draper,[1] Rosemary Karmel,[2] Diane Gibson,[3] Ann Peut[4] and Phil Anderson[5]

[1] *School of Psychiatry, University of New South Wales, Sydney, Australia*
[2] *Data Linkage Unit, Australian Institute of Health and Welfare, Canberra, Australia*
[3] *Faculty of Health, University of Canberra, Canberra, Australia*
[4] *Ageing and Aged Care Unit, Australian Institute of Health and Welfare, Canberra, Australia*
[5] *Australian Institute of Health and Welfare, Canbersra, Australia*

ABSTRACT

Background: People with dementia may have adverse outcomes following periods of acute hospitalization. This study aimed to explore the effects of age upon hospitalization outcomes for patients with dementia in comparison to patients without dementia.

Methods: Data extracted from the New South Wales Admitted Patient Care Database for people aged 50 years and over for the period July 2006 to June 2007 were linked to create person-based records relating to both single and multiple periods of hospitalization. This yielded nearly 409,000 multi-day periods of hospitalization relating to almost 253,000 persons. Using ICD-10-AM codes for dementia and other principal diagnoses, the relationship between age and hospitalization characteristics were examined for people with and without dementia.

Results: Dementia was age-related, with 25% of patients aged 85 years and over having dementia compared with 0.9% of patients aged 50–54 years. People with dementia were more likely to be admitted for fractured femurs, lower respiratory tract infections, urinary tract infections and head injuries than people without dementia. Mean length of stay for admissions for people with dementia was 16.4 days and 8.9 days for those without dementia. People with dementia were more likely than those without to be re-admitted within three months for another multi-day stay. Mortality rates and transfers to nursing home care were higher for people with dementia than for people without dementia. These outcomes were more pronounced in younger people with dementia.

Conclusion: Outcomes of hospitalization vary substantially for patients with dementia compared with patients without dementia and these differences are frequently most marked among patients aged under 65 years.

Key words: dementia, hospitalization, outcomes, length of stay, age effects

Introduction

People with dementia experience the full range of acute illnesses and are relatively high users of general hospitals. Common reasons for hospitalization include hip fractures and other injuries, lower respiratory tract infections, urinary tract infections, strokes and delirium (Natalwala *et al.*, 2008; Zuliani *et al.*, 2011).

There is evidence that people with dementia can experience a range of adverse outcomes in hospitals (Kurrle, 2006), including functional decline, polypharmacy, undernutrition, skin tears, pressure areas, fall-related injuries, nosocomial infections and deconditioning (Torian *et al.*, 1992; Creditor, 1993; Foreman and Gardner, 2005; Borbasi *et al.*, 2006). In some studies, the relatively high case-mix complexity of older patients with dementia contributes to longer hospital stays and this has an impact on a patient's physical and mental state (Nichol *et al.*, 2000; ACEMA, 2003; King *et al.*, 2006; Zekry *et al.*, 2009). These adverse outcomes may also result in increased mortality or increased risk of transfer to nursing home care, although there are discrepant findings (Peut *et al.*, 2007; Zekry *et al.*, 2009; Zuliani *et al.*, 2011).

Previous research into the acute hospitalization of persons with dementia has focused on older patients (Saravay *et al.*, 2004; Natalwala *et al.*, 2008;

Correspondence should be addressed to: Professor Brian Draper, Academic Department for Old Age Psychiatry, Prince of Wales Hospital, Randwick, NSW, 2031, Australia. Phone: +61 2 9382 3753; Fax: +61 2 9382 3762. Email: b.draper@unsw.edu.au. Received 19 Jan 2011; revision requested 19 Feb 2011; revised version received 30 Jun 2011; accepted 5 Jul 2011.

Zekry *et al.*, 2009; Douzenis *et al.*, 2010; Zuliani *et al.*, 2011). Early-onset dementia is clinically more heterogeneous than late-onset dementia, with a number of causes such as HIV/AIDS-related dementia, alcohol-related dementia and dementia secondary to multiple sclerosis that might require medical treatment for the dementia or related conditions (Harvey *et al.*, 2003; Withall and Draper, 2009). Hence it is possible that the hospitalization of younger people with dementia might be for different reasons and have different outcomes than those reported in older people with dementia.

The Hospital Dementia Services Project is an innovative mixed methods study that explores at the patient level how hospital experiences and outcomes vary for people with and without dementia, and at the system level how hospital-based aged care and dementia care influence outcomes for people with dementia. This paper uses internally linked existing hospital administrative data to create a dataset containing patient trajectories in hospitals. It focuses on people aged 50 years and over who had at least one multi-day stay in a public hospital in the state of New South Wales (NSW, total population 6.9 million) in Australia in 2006–2007 (termed HDS patients) and it aims to explore the effects of age upon reasons for hospitalization and outcomes in persons with dementia compared with persons without dementia. The analysis incorporates data on stays in both public and private hospitals for this cohort of patients.

Methods

For this study, data were extracted by the NSW Department of Health from the NSW Admitted Patient Care Database for hospital episodes in public and private NSW hospitals between 1 July 2005 and 30 June 2007. The Admitted Patient Care Database records new episodes for every within-hospital change in care type and each transfer between hospitals (Karmel *et al.*, 2008). A unique patient identifier, derived by the Centre for Health Record Linkage (or CHeReL), was added to the extract to permit, first, combining related hospital episodes into a single completed hospital stay (i.e. from initial admission to final discharge from hospital, allowing for movement both within and between hospitals) and, second, identification of re-admissions by individuals. Transfers and re-admissions for individual patients were identified using episode start and end dates and reported mode of episode discharge.

This linking of patients' data is a major advance on traditional analyses of national hospital statistics (Peut *et al.*, 2007; Karmel *et al.*, 2008). Of most significance is the capacity to report on the full period of hospitalization from admission to discharge as experienced by the patient, whereas national hospital data are most commonly reported in terms of separate "episodes of care", whereby a person whose care type changes from acute care to rehabilitation and then to palliation in one hospital stay is reported in national statistics as three episodes of care (with three lengths of stay and so forth). The present method also integrates hospital stays involving transfers between hospitals, creating one record per patient from admission to final discharge.

Combining the patient-level hospital episode data, we identified 253,000 persons aged at least 50 years on 1 July 2006 who had at least one multi-day stay ending between 1 July 2006 and 30 June 2007 in one of the 222 public hospitals in NSW (including seven public psychiatric hospitals). Between them, these people had 409,000 multi-day stays and 252,000 single day stays ending in that year across 222 public hospitals and 167 private hospitals.

Up to 55 diagnoses could potentially be recorded per episode of care. Diagnoses were coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) (National Centre for the Classification of Health, 1998). The principal diagnosis was defined as the diagnosis chiefly responsible for occasioning the hospitalization episode.

The group of interest was patients for whom dementia was recorded on at least one hospital stay from July 2005 to June 2007 as contributing significantly to the cost of hospital care, the criterion used by hospitals when coding medical records. Where recorded, the type of dementia was determined. If more than one dementia diagnosis was recorded in separate hospital admissions, we categorized the patient as having "dementia with mixed diagnoses".

We also investigated for the presence of comorbid delirium, which in some cases was captured with the ICD-10-AM category "dementia with delirium" and in other cases was captured as a separate diagnosis comorbid with a dementia diagnosis. Medical disorders associated with types of dementia, including alcohol abuse, HIV/AIDS, Parkinson's disease and multiple sclerosis, were determined. We also examined other comorbidities associated with hospital admission including hip (femur) fractures, head injuries, other mental and behavioral disorders, lower respiratory tract infections, urinary tract infections, stroke, subdural hematoma, epilepsy, transient ischemic attacks, collapse/syncope, septicemia and constipation.

Principal procedures that were undertaken during each hospital episode were grouped into the following broad ICD10-AM categories: nervous system; endocrine system; respiratory system; cardiovascular system; blood and blood forming organs; digestive system; urinary system; musculoskeletal system; non-invasive, cognitive and other interventions; allied health; and imaging. Some specific subcategories of procedures were examined: skull, meninges and brain; stomach; large intestine; bladder; pelvis and hip; generalized allied health; and computerized tomography.

The following outcomes of hospitalization were examined: length of stay; mortality; discharge destination; and re-admission. The data were analyzed by four age groups: 50–64 years; 65–74 years, 75–84 years; and 85 years and over. Comparisons were made between admissions with and without dementia, both overall and within age groups. In particular, this was done by fitting logistic regressions to calculate the odds ratios for principal diagnoses and procedures and destination on discharge for people with dementia compared with those without dementia, allowing for the effects of sex and age (using five-year age groups up to 95+). Both odds ratios and 95% confidence intervals are presented, and the statistical significance of age/dementia interaction effects is also reported. In addition, the statistical significance of differences in proportions cited in text for people with and without dementia were tested allowing for sex and age differences (due to the large number of comparisons being made, a significance level of $p < 0.001$ was used for these). Lengths of stay distributions were compared using non-parametric methods, and the resulting statistical significance of these tests is presented.

Institutional Ethics Committee approval was obtained from the Australian Institute of Health and Welfare Ethics Committee, the NSW Population and Health Services Research Ethics Committee, the University of NSW Human Research Ethics Committee, and 19 Site Specific Approvals that covered all of the public hospitals in NSW.

Results

Dementia occurrence was related to age with 25% of patients aged 85 years and over having dementia compared with 0.9% of patients aged 50–64 years. The majority of dementia patients were female (n = 12,489; 60%); however this increased with age, from only 38% of those aged 50–64 years to 69% of those aged 85 years and over. Overall, the type of dementia was not specified in 58% of patients with dementia but this lack of categorization of dementia type showed an association with age group, occurring for 25% of 50–64 year old patients with dementia, but for 67% of those aged 85 years and over. When the type of dementia was specified, there were significant differences in the types of dementia reported for the different age groups ($\chi^2 = 1522$, df = 12, $p < 0.0001$). Patients aged 50–64 years were more likely than others to have non-Alzheimer non-vascular dementia, with particularly high rates of alcohol-related dementia (21%, 158 out of 568). Dementia in other degenerative disorders (including Parkinson's disease and Pick's disease) and other dementias (including HIV/AIDs dementia complex and Huntington's dementia) were also more common in this age group (see Table 1).

Among people with dementia, age had a limited association with the rates of comorbid delirium, with 12% of 50–64 year olds with dementia having delirium during at least one hospital stay compared with 17% of people with dementia in the two older age groups. However, older patients who experienced delirium were more likely than younger patients to have dementia: 12% of 50–64 year olds who experienced delirium had dementia compared

Table 1. Types of dementia specified, by patient age (HDS patients, New South Wales, 2006–2007)

	50–64 YEARS N = 759		65–74 YEARS N = 2201		75–84 YEARS N = 9062		85+ YEARS N = 8771		TOTAL N = 20793	
	%	n	%	n	%	n	%	n	%	n
Alzheimer's disease	11.1	84	16.2	357	18.4	1671	14.4	1263	16.2	3375
Vascular dementia	7.9	60	9.8	215	8.0	722	5.5	486	7.1	1483
Other degenerative dementia	24.5	186	16.1	354	11.0	996	6.4	560	10.1	2096
Alcohol dementia	20.8	158	3.0	65	0.5	41	0.0	4	1.3	268
Other dementia	10.5	80	8.1	178	7.5	677	6.3	552	7.2	1487
Unspecified dementia	25.2	191	46.9	1032	54.7	4955	67.3	5906	58.1	12084
Total	100		100		100		100		100	

with 57% of patients aged 85+. Delirium was less common among people without dementia, with propensity increasing with age – from 0.8% of patients aged 50–64 to 4.1% among those aged 85+.

Reasons for admission

Dementia was the principal reason for admission in only 6% of multi-day stays for people with dementia. Excluding dementia, the principal diagnoses for this group were commonly related to the circulatory system (15%), respiratory system (11%), fractures (10%), other injury and poisoning (8%) and the digestive system (8%). There were significant differences in the principal reasons for admission when comparing people with and without dementia. In particular, people with dementia were more likely to be admitted principally because of mental and behavioral disorders (OR 3.61, 3.39–3.85), other nervous disorders (OR 1.71, 1.61–1.83), fractures (OR 1.84, 1.77–1.92) or other injury/poisoning (OR 1.32, 1.26–1.37), but were less likely to be admitted because of neoplasms (OR 0.47, 0.45–0.50), circulatory disorders (OR 0.65, 0.63–0.68) or digestive disorders (OR 0.75, 0.72–0.78).

Examining specific disorders, people with dementia were more likely to be admitted because of alcohol disorders (OR 5.05, 4.37–5.83), epilepsy (OR 4.47, 3.85–5.20), fractured femur (OR 2.62, 2.47–2.78), urinary tract infection (OR 2.61, 2.47–2.77), lower respiratory tract infections (OR 1.64, 1.57–1.72), head injuries (OR 2.16, 1.99–2.33), stroke (OR 1.25, 1.17–1.34), subdural (OR 1.83, 1.39–2.40), constipation (OR 1.33, 1.18–1.50) and septicemia (OR 2.14, 1.95–2.35) than those without dementia.

As shown in Table 2, for those with dementia, there was variation with age in the proportion of admissions attributed to particular diagnoses. For example, admissions resulting from mental and behavioral disorders, other nervous disorders and epilepsy were more prominent among 50–64 year olds than older groups, while admissions due to fractures in general, fractures of the femur, head injuries, urinary tract infections and respiratory tract infections were more common at older ages. The ORs across the age groups show that for many conditions the effect of dementia on reason for admission also varied with age. For some conditions, the ORs tended to increase with age (e.g. admissions due to fractures and genitourinary conditions); for others the ORs decreased with age (e.g. admissions due to other mental and behavioral disorders and other nervous disorders).

Principal procedures

Patients with dementia were less likely than non-dementia patients to have no procedure recorded in a hospital stay (OR 0.86, 0.84–0.89). In stays with a procedure recorded, dementia patients were more likely than non-dementia patients to have an imaging procedure as the principal procedure (OR 1.58, 1.54–1.63), in particular computer tomography brain scans (OR 2.61, 2.53–2.70). Overall, dementia patients had higher odds of having hip and pelvis procedures as the principal procedure than non-dementia patients (OR 1.69, 1.60–1.80); however, this difference was only significant for patients aged 65 and over. Also, urinary catheterization was more likely to be the principal procedure in dementia patients (OR 1.51, 1.30–1.75). Dementia patients were much less likely than other patients to have digestive system procedures (OR 0.49, 0.46–0.52, with little variation across the age groups) or cardiovascular procedures as the principal procedure (OR 0.31, 0.29–0.34); the latter were largely driven by coronary artery procedures (OR 0.20, 0.17–0.24). Dementia patients were more likely to receive allied health input than non-dementia patients (OR 1.39, 1.36–1.43); the difference was particularly marked in patients aged under 85 years. This was mainly physiotherapy and social work (Table 3).

Length of stay and readmission

Mean length of stay (LOS, including transfers within and between hospitals) for multi-day stays for persons with dementia was 16.5 days compared with 8.9 days for those without dementia (medians of 7 and 4 days, respectively) (Table 4). This difference was more pronounced in younger people with dementia, particularly those aged 55–69 years, with mean LOS for persons with dementia in this age range being over 20 days compared with less than eight days in those without dementia. In the older age groups, differences in LOS between persons with and without dementia decreased, and by age 95 the two groups had similar LOS. The much longer mean LOS in patients aged under 70 years was due to a small percentage having very long stays and thus the difference in median LOS for this younger age group was much less. Reported discharge outcomes of the long-stay 50–64 year olds with dementia showed that over two-thirds (69%) returned to their usual accommodation, while nearly 25% were transferred to residential care or a different type of accommodation.

Persons with dementia were more likely to be readmitted within three months for another multi-day stay (40%) than persons without dementia (32%) ($p < 0.001$). Among patients with dementia,

Table 2. Selected principal diagnosis for hospital admission of patients with dementia compared with patients without dementia, by age (multi-day stays for HDS patients, New South Wales, 2006–07)

PART A: DEMENTIA AS PRINCIPAL DIAGNOSIS	50–64 N = 1773 (%)		65–74 N = 4336 (%)		75–84 N = 16732 (%)		85+ N = 15205 (%)		TOTAL N = 38046 (%)		SIGNIFICANCE OF AGE/DEMENTIA INTERACTION
DEMENTIA	7.5		8.3		6.9		5.1		6.4		
OTHER DIAGNOSIS	92.5		91.7		93.1		94.9		93.6		
PART B[a]: OTHER PRINCIPAL DIAGNOSIS	50–64 N = 1640		65–74 N = 3976		75–84 N = 15573		85+ N = 14423		TOTAL N = 35612		
	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	
Circulatory	**9.4**	0.52; 0.44–0.62	**13.6**	0.65; 0.60–0.72	**15.1**	0.66; 0.63–0.69	**15.3**	0.65; 0.62–0.68	**14.7**	0.65; 0.63–0.68	*
Stroke	**1.4**	1.26; 0.83–1.91	**3.0**	1.79; 1.48–2.17	**3.1**	1.36; 1.23–1.50	**3.0**	1.02; 0.91–1.13	**3.0**	1.25; 1.17–1.34	**
Subdural	**0.2**	3.09; 0.97–9.87	**0.3**	2.94; 1.61–5.36	**0.2**	1.55; 1.05–2.29	**0.2**	1.71; 1.03–2.84	**0.2**	1.83; 1.39–2.40	n.s.
Other mental and behavioral	**20.4**	5.39; 4.76–6.31	**6.6**	4.08; 3.56–4.67	**3.5**	3.15; 2.84–3.49	**2.1**	2.43; 2.09–2.83	**4.0**	3.61; 3.39–3.85	***
Alcohol	**9.1**	7.52; 6.29–8.99	**1.3**	4.42; 3.27–5.96	**0.3**	2.39; 1.67–3.44	**0.0**	1.12; 0.47–2.63	**0.7**	5.05; 4.37–5.83	***
Respiratory	**6.8**	0.91; 0.71–1.10	**11.2**	1.14; 1.03–1.26	**11.8**	1.10; 1.05–1.16	**11.4**	1.09; 1.02–1.15	**11.3**	1.08; 1.05–1.12	n.s.
Lower RTI	**4.0**	1.54; 1.20–1.98	**5.8**	1.80; 1.56–2.06	**7.7**	1.82; 1.71–1.95	**8.7**	1.47; 1.37–1.57	**7.8**	1.64; 1.57–1.72	***
Ill-defined conditions	**10.3**	0.91; 0.77–1.07	**12.0**	1.25; 1.13–1.28	**11.4**	1.13; 1.08–1.20	**10.2**	1.00; 0.94–1.07	**10.9**	1.08; 1.04–1.12	***
Syncope/collapse	**1.2**	1.31; 0.83–2.07	**2.0**	1.71; 1.36–2.15	**1.9**	1.08; 0.95–1.22	**1.7**	0.83; 0.72–0.95	**1.8**	1.03; 0.95–1.13	***
Fractures	**3.8**	1.08; 0.84–1.40	**5.4**	1.73; 1.50–1.99	**8.9**	1.92; 1.80–2.04	**13.0**	1.85; 1.74–1.97	**9.9**	1.84; 1.77–1.92	**
Femur	**1.3**	4.03; 2.61–6.21	**2.5**	3.57; 2.88–4.42	**4.7**	2.77; 2.54–3.03	**7.7**	2.38; 2.19–2.58	**5.5**	2.62; 2.47–2.78	**
Other injury/poisoning	**6.5**	0.97; 0.80–1.18	**6.6**	1.25; 1.10–1.43	**7.7**	1.39; 1.30–1.48	**9.0**	1.30; 1.21–1.39	**8.0**	1.32; 1.26–1.37	n.s.
Head injuries/fractures[b]	**2.3**	2.97; 2.09–4.23	**2.0**	2.86; 2.20–3.72	**2.8**	2.45; 2.17–2.76	**3.7**	1.76; 1.57–1.97	**3.1**	2.16; 1.99–2.33	***
Digestive	**10.4**	0.77; 0.65–0.90	**9.0**	0.75; 0.67–0.83	**7.5**	0.70; 0.66–0.75	**7.6**	0.81; 0.75–0.87	**7.8**	0.75; 0.72–0.78	***
Constipation	**0.8**	2.71; 1.55–4.73	**1.0**	2.04; 1.47–2.84	**0.9**	1.38; 1.15–1.65	**1.0**	1.10; 0.91–1.33	**1.0**	1.33; 1.18–1.50	**
Genitourinary	**3.5**	0.58; 0.44–0.75	**6.4**	1.08; 0.95–1.23	**7.7**	1.48; 1.38–1.58	**7.5**	1.53; 1.42–1.65	**7.3**	1.37; 1.31–1.44	***
UTI	**2.1**	3.23; 2.29–4.55	**4.4**	3.74; 3.17–4.41	**5.7**	3.02; 2.79–3.28	**5.8**	2.00; 1.83–2.18	**5.5**	2.61; 2.47–2.77	***
Neoplasms	**3.2**	0.28; 0.21–0.37	**4.9**	0.41; 0.35–0.47	**4.6**	0.47; 0.43–0.51	**4.0**	0.55; 0.51–0.61	**4.3**	0.47; 0.45–0.50	***
Endocrine, nutritional, metabolic & immunity	**5.0**	1.79; 1.43–2.24	**5.5**	1.94; 1.68–2.23	**4.0**	1.54; 1.41–1.69	**3.1**	1.28; 1.14–1.43	**3.8**	1.53; 1.44–1.63	***
Other nervous disorders	**9.6**	3.86; 3.26–4.57	**4.5**	2.11; 1.86–2.46	**3.6**	1.59; 1.45–1.75	**2.3**	1.24; 1.09–1.42	**3.4**	1.71; 1.61–1.83	***
TIAs	**1.2**	1.92; 1.22–3.04	**1.2**	1.44; 1.07–1.93	**1.4**	1.18; 1.02–1.37	**1.3**	1.06; 0.90–1.26	**1.3**	1.19; 1.07–1.31	***
Epilepsy	**4.5**	10.17; 7.93–13.05	**0.9**	3.54; 2.49–5.03	**0.7**	3.29; 2.60–4.16	**0.4**	3.24; 2.20–4.78	**0.7**	4.47; 3.85–5.20	***
Musculoskeletal	**3.3**	0.48; 0.37–0.63	**3.5**	0.45; 0.38–0.53	**3.5**	0.54; 0.49–0.59	**3.3**	0.67; 0.60–0.74	**3.4**	0.56; 0.53–0.60	**
Infectious and parasitic	**1.5**	0.97; 0.65–1.45	**2.3**	1.40; 1.13–1.74	**2.8**	1.63; 1.46–1.81	**2.5**	1.30; 1.15–1.47	**2.6**	1.44; 1.33–1.55	*
Septicemia	**0.8**	1.41; 0.81–2.45	**1.7**	2.22; 1.72–2.86	**1.9**	2.37; 2.07–2.71	**1.8**	1.93; 1.65–2.26	**1.8**	2.14; 1.95–2.35	n.s.

[a] Part B excludes stays with dementia as the principal diagnosis.
[b] A subset of Fractures and Other Injury/Poisoning combined.
*$0.01 \le p < 0.05$; **$0.001 \le p < 0.01$; ***$p < 0.001$; n.s. = not significant at 95% level.
RTI = respiratory tract infection; UTI = urinary tract infection; TIA = transient ischemic attack.
Note: This table is based on first episode of a stay and excludes 953 stays with missing principal diagnosis, and six cases with perinatal or obstetrics as the principal diagnosis.

Table 3. Selected principal procedures and interventions for patients with dementia compared with patients without dementia, by age (multi-day stays for HDS patients, New South Wales, 2006–07)

PART A: WHETHER PROCEDURE/ INTERVENTION REPORTED	50–64 N = 1774		65–74 N = 4348		75–84 N = 16761		85+ N = 15238		TOTAL N = 38121		SIGNIFICANCE OF AGE/DEMENTIA INTERACTION
	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	
NONE GIVEN	26.1	0.82; 0.74–0.91	24.8	0.89; 0.83–0.95	23.0	0.85; 0.82–0.89	22.6	0.87; 0.84–0.91	23.2	0.86; 0.84–0.89	*
PART B[(a)]: PROCEDURE/ INTERVENTION REPORTED	50–64 N = 1311		65–74 N = 3269		75–84 N = 12902		85+ N = 11799		TOTAL N = 29281		
	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	
Allied health	**29.4**	2.69; 2.39–3.04	**33.7**	2.38; 2.20–2.56	**34.9**	1.51; 1.45–1.57	**36.0**	1.00; 0.96–1.05	**35.0**	1.39; 1.36–1.43	**
Imaging services	**33.5**	2.04; 1.81–2.29	**32.1**	1.91; 1.77–2.06	**33.4**	1.63; 1.57–1.70	**32.3**	1.36; 1.30–1.43	**32.8**	1.58; 1.54–1.63	**
– CT head scans	**24.5**	4.81; 4.23–5.48	**22.5**	3.77; 3.45–4.11	**23.5**	2.77; 2.64–2.90	**22.7**	1.95; 1.84–2.05	**23.1**	2.61; 2.53–2.70	**
Non-invasive, cognitive and other interventions, not elsewhere classified	**10.1**	1.23; 1.02–1.47	**6.7**	0.86; 0.75–0.99	**8.0**	0.99; 0.92–1.06	**9.1**	1.01; 0.94–1.09	**8.4**	1.00; 0.95–1.04	*
Procedures on musculoskeletal system	**4.8**	0.42; 0.33–0.55	**6.1**	0.54; 0.47–0.63	**7.6**	0.90; 0.84–0.96	**9.8**	1.46; 1.35–1.57	**8.2**	0.97; 0.93–1.02	**
– Pelvis/hip	**1.4**	0.83; 0.52–1.33	**3.1**	1.27; 1.03–1.55	**5.0**	1.67; 1.52–1.83	**7.5**	1.88; 1.72–2.05	**5.6**	1.69; 1.60–1.80	*
Procedures on digestive system	**7.9**	0.47; 0.38–0.57	**7.4**	0.49; 0.43–0.56	**5.7**	0.48; 0.44–0.52	**4.3**	0.51; 0.47–0.57	**5.4**	0.49; 0.46–0.52	n.s.
Procedures on cardiovascular system	**2.7**	0.23; 0.16–0.32	**3.5**	0.30; 0.25–0.36	**2.5**	0.30; 0.27–0.34	**1.4**	0.38; 0.33–0.45	**2.2**	0.31; 0.29–0.34	n.s.
– Coronary arteries	**1.2**	0.18; 0.11–0.29	**1.1**	0.19; 0.14–0.27	**0.7**	0.20; 0.16–0.25	**0.2**	0.25; 0.17–0.37	**0.6**	0.20; 0.17–0.24	n.s.
Procedures on urinary system	**2.7**	0.67; 0.48–0.94	**2.9**	0.69; 0.56–0.85	**2.4**	0.76; 0.66–0.86	**1.8**	0.83; 0.71–0.98	**2.2**	0.75; 0.69–0.82	n.s.
– Urinary catheterization	**0.5**	2.28; 1.07–4.87	**0.6**	1.39; 0.86–2.24	**0.9**	1.69; 1.38–2.08	**0.8**	1.29; 1.01–1.65	**0.8**	1.51; 1.30–1.75	

(a) Part B excludes stays with no procedure/intervention reported.
*$0.001 \leq p < 0.01$.
**$p < 0.001$.
n.s. no statistical significance at 95% level.
Note: Table is based on first episode of a stay, and excludes 1576 cases with missing procedures (i.e. not reported as "none given").

Table 4. Average length of multi-day hospital stays by dementia status and age (multi-day stays for HDS patients, New South Wales, 2006–2007) (nights)

	WITH DEMENTIA		WITHOUT DEMENTIA		TOTAL	
AGE GROUP	MEAN	MEDIAN	MEAN	MEDIAN	MEAN	MEDIAN
50–54‡	15.3	5	6.6	3	6.7	3
55–59‡	20.6	7	6.8	3	6.9	3
60–64‡	23.3	7	7.4	3	7.7	4
65–69‡	21.2	7	7.8	4	8.2	4
70–74‡	17.1	7	8.5	4	8.9	4
75–79‡	16.1	7	9.6	5	10.3	5
80–84‡	15.9	8	10.7	5	11.6	6
85–89‡	16.2	8	12.5	6	13.4	6
90–94‡	15.5	7	13.3	7	13.9	7
95+	15.5	7	16.2	7	16.0	7
Total#	**16.5**	7	**8.9**	**4**	**9.6**	**4**

‡ Indicates significant difference (all at $p < 0.0001$) using the Kolmogorov-Smirnov test to compare the distribution of length of stay (LOS) for people with and without dementia. Similar results were found using reported length of stay and the log transform. For the statistical test, LOS for the patients' first stay in 2006–2007 was used to ensure independence.
# Not tested for statistical significance.

younger people were considerably more likely to be readmitted than older people ($p < 0.001$ for 50–64 group compared with 85+ group) – a pattern not seen among patients without dementia. Consequently, the difference in readmission rates for people with and without dementia was more marked for younger people. Readmission for patients aged 50–64 was almost twice as likely for persons with dementia (55%) than without dementia (29%).

Among people with a readmission within three months for another multi-day stay, 12% were readmitted within a day of leaving hospital. There were no statistically significant differences between people with and without dementia in the timing of readmission. Across age groups there were some differences, with older people a little more likely than younger people to be readmitted within a day of discharge. For example, 10% of readmissions for persons aged 50–64 were within a day compared with 13% for patients aged 85 years and over ($p < 0.001$). Similar differences were observed for patients with and without dementia; however, these differences were not statistically significant for people with dementia ($n = 503$ for 50–64 group and $n = 3001$ for 85+ group, $p>0.05$).

Discharge outcomes

Table 5 presents reported hospital discharge outcomes (non-hospital care, discharges home and deaths) for persons with and without dementia in the four age groups. Mortality rates were higher for people with dementia across all age groups, with the effect more pronounced in patients aged 50–64 years where the mortality rate in persons with dementia was about double that for people without dementia (death vs other discharge: OR 1.93; 1.55–2.41). The cause of death was not recorded in the dataset, although 22 of the 84 dementia patients aged 50–64 years who died were admitted with a respiratory condition, 15 with a digestive condition and 10 with a neoplasm. For hospital stays that did not end in death, transfer to nursing home care and other accommodation was more likely in dementia patients across the age range but more pronounced under the age of 75 (discharge to own accommodation vs discharge to non-hospital care, 50–64 years OR 0.07, 0.06–0.08; 65–74 years OR 0.08, 0.07–0.08).

Discussion

In this study we found that nearly 21,000 patients with dementia aged 50 years and over had a multi-day stay in one or more of the 222 public hospitals in the state of New South Wales, Australia, over a 12-month period, representing approximately 25% of all persons with dementia in the state. This estimate draws on prevalence data calculated by Access Economics (2009); however, given that these prevalence data used in the denominator include mild cases of dementia, and mild cases of dementia are less likely to be recorded as a hospital diagnosis, this 25% figure is almost certainly an underestimate.

Table 5. Reported destination on discharge following a multi-day hospital stays by dementia status and age (multi-day stays for HDS patients, New South Wales, 2006–2007)

Destination	50–64 N = 1773		65–74 N = 4340		75–84 N = 16747		85+ N = 15214		Total N = 38074		Significance of age/dementia interaction
	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	
Transfer to nursing home	8.2	(a)	15.9	(a)	18.7	(a)	22.4	(a)	19.4	(a)	(a)
Transfer to other accommodation	2.6	(a)	2.4	(a)	2.6	(a)	2.8	(a)	2.7	(a)	(a)
To usual residence (a)	84.5	0.07; 0.06–0.08	75.4	0.08; 0.07–0.08	70.7	0.14; 0.14–0.15	65.0	0.29; 0.28–0.31	69.6	0.18; 0.17–0.18	***
Died (b)	4.7	1.93; 1.55–2.41	6.3	1.51; 1.33–1.71	8.0	1.35; 1.27–1.44	9.7	1.09; 1.02–1.16	8.3	1.25; 1.20–1.31	***
Total (%)	**100**		**100**		**100**		**100**		**100**		

***$p < 0.001$.
(a) ORs and 95% CIs were calculated for whether a stay ended with discharge to own accommodation versus discharged to nursing home or other accommodation. Stays ending with death in hospital were excluded for this analysis. ORs were not derived separately for discharges to nursing home or other accommodation.
(b) ORs and 95% CIs were calculated for a stay ending in death versus other.
Note: Table provides preliminary estimates and excludes 295 cases with destination unknown. "To usual accommodation" includes a small proportion (under 2% of all multi-day stays) coded as discharged while on leave, discharged at own risk and unidentified transfer to other hospital.

Our findings indicate that the outcomes of hospitalization in terms of length of stay, mortality, readmission within three months and discharge destination are significantly different in patients with dementia, with longer periods of hospitalization, higher death rates, higher rates of transfer to nursing home care and higher re-admission rates. This pattern is most evident among patients under the age of 65 years. This disproportionate effect of dementia upon hospital outcomes in younger patients has been previously noted in terms of length of stay (Zilkens *et al.*, 2009), but not other outcomes, possibly because most other studies have been limited to older patients from one hospital site (Saravay *et al.*, 2004; Natalwala *et al.*, 2008; Zekry *et al.*, 2009; Douzenis *et al.*, 2010). Our finding that dementia has less impact upon outcomes of hospitalization in older patients is consistent with a prospective study from Switzerland of patients aged 75 years and over, which found that, apart from a higher rate of discharge to nursing homes, dementia was less important than comorbidity and functional status in predicting outcome (Zekry *et al.*, 2009).

There are a number of possible explanations for the more negative outcomes in younger people with dementia. Our analyses indicate that the longer average LOS is largely due to a small proportion of younger patients with very long admissions. In addition, in almost a third of cases the principal reason for admission in younger dementia patients is due to a mental or behavioral problem or nervous system disorder. Younger dementia patients are also more likely to have alcohol-related dementia and "other degenerative dementias" (the category that includes fronto-temporal dementia), which are dementia types known to have high rates of behavioral symptoms. We therefore suspect that behavioral and psychological symptoms of dementia (BPSD) are a factor contributing to these findings, with younger patients more likely to be admitted for BPSD and who require ongoing institutional care but prove to be difficult to place due to a combination of a lack of suitable facilities for younger people and their degree of behavioral disturbance (Zilkens *et al.*, 2009). It is possible that the higher rates of mortality in the younger group might indicate that the hospital is being used for terminal care but there is nothing in the dataset to clarify this.

Our study replicates research from the UK that found that only a small proportion of dementia patients are admitted with dementia as the principal reason and that urinary tract infections, lower respiratory tract infections, fractured femur, septicemia and epilepsy are more frequent principal reasons for admission in dementia patients than

non-dementia patients (Natalwala *et al.*, 2008). These principal reasons for admission vary with age; for example, epilepsy is prominent in patients aged 50–64 years (partly attributable to the high rates of epilepsy associated with alcohol-related dementia), while urinary tract and lower respiratory tract infections are prominent in older patients, presumably related to increased rates of falls and osteoporosis at this age.

Although rates of delirium increased with age in the overall sample, this basically reflected the higher rates of dementia in old age groups. Surprisingly, we found that in persons with dementia, older age had a very limited effect on rates of delirium and, in particular, older persons without dementia had relatively low rates of delirium. Previous research has shown delirium goes unrecognized by clinicians in between one-third to two-thirds of elderly patients (Inouye *et al.*, 1999). It is possible that the confusion and behavior change due to delirium is more easily recognized by clinicians as being abnormal in younger patients.

There are also medical diagnoses that were less frequent principal reasons for admission in dementia patients and these included neoplasms, circulatory system disorders (with principal procedures related to coronary arteries much less frequently performed on dementia patients) and digestive system disorders (fewer principal procedures related to the digestive system were performed on dementia patients). The reason for the infrequent use of coronary artery procedures in persons with dementia is not clear in this dataset and we can only speculate that this might be due to clinicians being less prepared to offer the procedure to people with dementia as there is no evidence that they have lower rates of coronary artery disease. There is not such a clear explanation for the low rates of neoplasms as the principal reason for admission in dementia patients; the use of radiation oncology and chemotherapy was lower but not enough to explain the difference.

These data lend further support to the important role that alcohol plays in early onset dementia, with alcohol-related dementia – the commonest dementia diagnosis in patients aged 50–64 years – being responsible for over 20% of cases. It is also noteworthy that in patients aged 50–64 years, an alcohol-related disorder was a much more common principal reason for admission in dementia patients than non-dementia patients. Many studies of the epidemiology of early onset dementia exclude alcohol-related cases, but those that have included alcohol-related dementia have produced similar findings to ours (Harvey *et al.*, 2003; Withall and Draper, 2009). A surprising finding, however, was that alcohol-related mental disorders were significantly more common as the reason for admission in dementia patients up to the age of 85. In most cases, alcohol was regarded as comorbid rather than the cause of the dementia and this may reflect the inadvertent misuse of alcohol by cognitively impaired patients. The challenge that this presents for families and clinicians is how to minimize the adverse effects of alcohol in order to prevent hospitalizations in this compromised population.

There are a number of limitations to this study. The NSW Admitted Patient Care Database is derived from data obtained from numerous clinicians making diagnoses and hence their validity is variable. The accuracy of coding of diagnoses and data entry by medical record staff is also unknown. There have been no published studies of the validity of routine diagnoses of dementia in Australia. It is likely that dementia is underestimated in this population due to a combination of poor recognition by medical staff, deficiencies in the medical record, and the requirement that to be recorded in the hospital admission data, the medical diagnosis has to be deemed to contribute to the cost of the hospital stay. It is also possible that, in this study, patients who had multiple or longer stays were more likely to be identified as having dementia than patients with short or single admissions and this might overestimate the effect of dementia. These two factors have opposing effects; however, it is not currently possible to measure their impact on estimates. It is also possible that cases of delirium are misdiagnosed as dementia. Nevertheless, because of the large scale of the study, it is expected that patterns seen in hospital use for HDS patients with and without dementia are robust. The age cut-off of 50 years may also have excluded some younger people with dementia.

There are also important strengths to the dataset. The sample size is large, comprising over 20,000 patients with dementia of whom more than 750 were aged 50–64 years. The database covers the whole population of admitted multi-day public hospital patients aged 50 years and over in NSW, the most populous state of Australia. In addition, all hospital stays for these people are included (public and private, multi-day and single-day) allowing comprehensive analysis of their hospital experience.

In conclusion, patients with dementia are more likely to have negative outcomes associated with hospital admission than non-dementia patients and this is accentuated in dementia patients aged 50–64 years. Further investigation of these age-related effects on hospital outcomes is warranted.

Conflict of interest

None.

Description of authors' roles

BD contributed to the study design, obtained research funds, took part in data analysis, and helped prepare the first draft and final paper. RK contributed to the study design, prepared the data for patient-based analysis, undertook the data analysis, and assisted in preparation of the final paper. AP and DG contributed to the study design, obtained research funds, and assisted in preparation of the final paper. PA contributed to the study design, involvement in data analysis, and assisted in preparation of the final paper.

Acknowledgments

This study was funded by NHMRC dementia research grant no. 465701. The authors thank the New South Wales Department of Health for permission to use data from the Admitted Patient Data Collection and for provision of the data extract with patient identifiers derived by the Centre for Health Record Linkage (or CHeReL). We thank the other members of the Hospital Dementia Services project team – Gail Brien, Le Anh Pham Lobb, Natalie Chan and Charles Hudson – for their work on the project and assistance with this paper, and the Australian Institute for Health and Welfare for hosting and supporting the project. We thank Srikar Velivela for assistance with the data analysis.

References

Access Economics (2009) *Keeping Dementia Front of Mind: Incidence and Prevalence 2009–2050*. Canberra: Alzheimer's Australia.

ACEMA (Aged Care Evaluation and Management Advisors) (2003). *Examination of Length of Stay for Older Persons in the Acute and Sub-Acute Sector.* Report for the AHMAC Working Group on the Care of Older Australians. Canberra: Department of Health.

Borbasi, S., Jones, J., Lockwood, C. and Emden, C. (2006). Health professionals' perspectives of providing care to people with dementia in the acute setting: toward better practice. *Geriatric Nursing*, 27, 300–308.

Creditor, M. C. (1993). Hazards of hospitalization of the elderly. *Annals of International Medicine*, 118, 219–223.

Douzenis, A. *et al.* (2010). Cognitive decline and dementia in elderly medical inpatients remain underestimated and underdiagnosed in a recently established university general hospital in Greece. *Archives of Gerontology and Geriatrics*, 50, 147–150.

Foreman, P. and Gardner, I. (2005). *Evaluation of Education and Training of Staff in Dementia Care and Management in Acute Settings.* Report for the Department of Human Services. Melbourne: Department of Human Services, Victoria.

Harvey, R. J., Skelton-Robinson, M. and Rossor, M. N. (2003). The prevalence and causes of dementia in people under the age of 65 years. *Journal of Neurology, Neurosurgery and Psychiatry*, 74, 1206–1209.

Inouye, S. K., Schlesinger, M. J. and Lydon, T. J. (1999). Delirium: a symptom of how hospital care is failing older persons and a window to improve quality of hospital care. *American Journal of Medicine*, 106, 565–573.

Karmel, R., Lloyd, J. and Anderson, P. (2008). *Movement from Hospital to Residential Aged Care*. Canberra: AIHW.

King, B., Jones, C. and Brand, C. (2006). Relationship between dementia and length of stay of general medical patients admitted to acute care. *Australasian Journal on Ageing*, 25, 20–23.

Kurrle, S. E. (2006). Improving acute care services for older people. *Medical Journal of Australia*, 184, 427–428.

Natalwala, A., Potluri, R., Uppal, H. and Heun, R. (2008). Reasons for hospital admissions in dementia patients in Birmingham, UK, 2002–2007. *Dementia and Geriatric Cognitive Disorders*, 26, 499–505.

National Centre for Classification in Health (1998). *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM)*. Sydney: National Centre for Classification in Health, Faculty of Health Sciences, University of Sydney.

Nichol, B., Lonergan, J. and Mould, M. (2000). *The Use of Hospitals by Older People: A Casemix Analysis.* Occasional Papers, New Series no. 11. Canberra: Commonwealth Department of Health and Aged Care.

Peut, A., Hogan, R., Goss, J., Mann, N. and Levings, B. (2007). *Dementia in Australia: National data analysis and development*. Canberra: AIHW.

Saravay, S. M. *et al.* (2004). How do delirium and dementia increase length of stay of elderly general medical inpatients? *Psychosomatics*, 45, 235–242.

Torian, L., Davidson, E., Fulop, G., Sell, L. and Fillit, H. (1992). The effect of dementia on acute care in a geriatric medical unit.*International Psychogeriatrics*, 4, 231–239.

Withall, A. and Draper, B. (2009). What is the burden of younger onset dementia in Australia? *International Psychogeriatrics*, 21 (Suppl. 2), S26.

Zekry, D. *et al.* (2009). Does dementia predict adverse hospitalization outcomes? A prospective study in aged inpatients. *International Journal of Geriatric Psychiatry*, 24, 283–291.

Zilkens, R. R., Spilsbury, K., Bruce, D. G. and Semmens, J. B. (2009). Clinical epidemiology and in-patient hospital use in the last year of life (1990–2005) of 29,884 Western Australians with dementia. *Journal of Alzheimer's Disease*, 17, 399–407.

Zuliani, G. *et al.* (2011) Discharge diagnosis and comorbidity profile in hospitalized older patients with dementia. *International Journal of Geriatric Psychiatry*. Epublished ahead of print. doi: 10.1002/gps.2722.

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	P1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	P1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P2, 3
Objectives	3	State specific objectives, including any pre-specified hypotheses	P2, 3
Methods			
Study design	4	Present key elements of study design early in the paper	P3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P3, 4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	P3, 4, 5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	P3, 4,
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P3, 4, 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P3, 4, 5. And Table 1.
Bias	9	Describe any efforts to address potential sources of bias	P4
Study size	10	Explain how the study size was arrived at	P3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P3
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	P9
		(*b*) Describe any methods used to examine subgroups and interactions	P9, P10
		(*c*) Explain how missing data were addressed	P7
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	P3, 4

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P3,4
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	P9
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P9
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P9, p10
Discussion			
Key results	18	Summarise key results with reference to study objectives	P10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P12
Generalisability	21	Discuss the generalisability (external validity) of the study results	P12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Potentially preventable complications of urinary tract infections, pressure areas, pneumonia, and delirium in hospitalised dementia patients: Retrospective cohort study

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-002770.R1
Article Type:	Research
Date Submitted by the Author:	08-May-2013
Complete List of Authors:	Bail, Kasia; University of Canberra, Faculty of Health Berry, Helen; The University of Canberra, Centre for Research and Action in Public Health Grealish, Laurie; University of Canberra, Faculty of Health Draper, Brian; University of NSW Karmel, Rosemary; Australian Institute of Health and Welfare, Data Linkage Unit Gibson, Diane; University of Canberra, Faculty of Health Peut, Ann; Australian Institute of Health and Welfare, Ageing and Aged Care
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Geriatric medicine, Patient-centred medicine, Nursing, Surgery, Public health
Keywords:	Dementia < NEUROLOGY, Adverse events < THERAPEUTICS, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Adult surgery < SURGERY, Urinary tract infections < UROLOGY, Delirium & cognitive disorders < PSYCHIATRY

MANUSCRIPT

Title: Potentially preventable complications of urinary tract infections, pressure areas, pneumonia, and delirium in hospitalised dementia patients: Retrospective cohort study.

Authors: Bail, Kasia[1]; Berry, Helen[2]; Grealish, Laurie[1]; Draper, Brian[3]; Karmel, Rosemary[4]; Gibson, Diane[1]; Peut, Ann[5]

Affiliations:

1. University of Canberra - Faculty of Health
   Canberra, Australian Capital Territory Australia
2. The University of Canberra - Centre for Research and Action in Public Health
   Building 22 University Drive South Bruce, Canberra, Australian Capital Territory 2617 Australia
3. University of NSW
   Euroa Centre, Prince of Wales Hospital, Barker Street , Randwick, New South Wales 2031 Australia
4. Australian Institute of Health and Welfare - Data Linkage Unit
   Canberra, Australian Capital Territory Australia
5. Australian Institute of Health and Welfare - Ageing and Aged Care
   Canberra, Australian Capital Territory Australia

Short title: Potentially preventable complications in hospitalised dementia patients.

ABSTRACT

Objectives: Identify rates of potentially preventable complications for dementia patients compared to non-dementia patients.

Design: Retrospective cohort design using hospital discharge data for dementia patients, case matched on sex, age, comorbidity and surgical status on a 1:4 ratio to non-dementia patients.

Setting: Public hospital discharge data from the state of New South Wales, Australia for 2006/07.

Participants: 426, 276 overnight hospital episodes for patients aged 50 and above (census sample).

Main Outcome Measures: Rates of preventable complications, with episode level risk-adjustment for 12 complications that are known to be sensitive to nursing care.

Results: Controlling for age and comorbidities, surgical dementia patients had higher rates than non-dementia patients of seven of the 12 complications: urinary tract infections, pressure ulcers, delirium, pneumonia, physiological and metabolic derangement (all at $p < 0.0001$), sepsis and failure to rescue (at $p<0.05$). Medical dementia patients also had higher rates of these complications than did non-dementia patients. The highest rates and highest relative risk for dementia compared to non-dementia patients, in both medical and surgical populations, were found in four common complications: urinary tract infections, pressure areas, pneumonia and delirium.

Conclusion: Compared with non-dementia patients**,** hospitalised dementia patients have higher rates of potentially preventable complications that might be responsive to nursing interventions.

Article summary

1) Article Focus

- Dementia patients are vulnerable to complications of hospitalisation, which contributes to increased length of stay, mortality and higher rates of transfer to residential care.
- The extent to which specific potentially preventable complications occur for dementia patients has not been elucidated.
- This article establishes rates of preventable complications for 12 complications that are known to be sensitive to nursing care

2) Key Messages

- Hospitalised dementia patients have much higher rates of potentially preventable complications, particularly urinary tract infections, pressure ulcers, pneumonia and delirium, than do hospitalised non-dementia patients.
- These complications are known to be responsive to nursing care.
- Further exploration of the role of nursing in preventing these complications in dementia patients is warranted.

3) Strengths and Limitations.

- Study strengths include: an internationally established coding rule for patient level risk adjustment; the linked administrative data approach which captured any person with documented dementia in a hospital episode over a two year period; an extremely large and representative sample; and a broad age range including patients aged 50 and above.

- The study is limited to one Australian jurisdiction (New South Wales, Australia's largest state), and has the usual limitations of hospital administrative data for the documentation of diagnoses.

MAIN TEXT

INTRODUCTION

Rates of adverse events remain a steadfast indicator of quality and safety for public hospitals [1]. Older people are known to be particularly vulnerable to complications, with a Canadian study finding that 14% of older adults experienced an adverse event while in hospital [2]. In an Australian study, complications such as urinary tract and respiratory infections, altered mental state, electrolyte disorders and pressure ulcers were more common in patients over age 70 [3]. Factors that might contribute to this include multiple chronic diseases, longer hospitalisations [4 5], more frequent use of invasive devices, such as urinary catheters [6], more complicated diseases, less physiological reserve, an increased risk of falls and fractures [7], and atypical presentations of illness [8].

There has been limited research into complications in dementia patients in hospital [5] but a systematic review found that dementia patients are older, require more hours of nursing care, have longer hospital stays and are more at risk of delayed discharge and functional decline during admission [6]. To date, most study cohorts have been recruited from medical wards [6]. In a Taiwanese retrospective cohort study, Hu et al. found that dementia patients who underwent surgery had a significantly higher overall postoperative complication rate and also a higher incidence of postoperative complications that were less likely to be identified in their initial stage [9]. These included acute renal failure, pneumonia, septicaemia, stroke and urinary tract infection. These potentially preventable complications have been demonstrated to be sensitive to nursing – that is, associated with modifiable characteristics of the nursing work environment, such as registered nurse skill mix and nurse burnout – in both Europe [10] and America [11]. More information regarding the rates of potentially preventable complications that may be sensitive to nursing care for hospitalised dementia patients to confirm these findings internationally, would be useful for decisions related to resource allocation in health care.

METHODS

This study was nested in the Australian Hospital Dementia Services Project [12] using New South Wales (NSW) hospital discharge data from the 2006/07 financial year for all public hospital overnight discharges (less than 90 days length of stay) for episodes of care for people aged 50 and above. An episode of hospital care may be defined as a period in a particular hospital of a particular care type (eg acute, or rehabilitation) in a particular hospital. A hospital stay is the period from admission into the hospital system to discharge from the system, or death in hospital (eg may include multiple care types and/or hospitals).

Consequently, a stay in hospital may include several episodes of care: on average there were 1.18 episodes per stay [13]. Dementia patients were identified via a person identifier as ever having dementia documented as a principal or additional diagnosis in any hospital stay over a 2-year period, offering a high capture rate and minimising selection bias [13]. NSW is Australia's most populous state with a diverse population from metropolitan to remote areas and a range of hospital- and/or community-based dementia services. In 2007, 942,100 people or 13.7% of NSW residents were aged 65 years and over [14]. Consequently, NSW provides both system and population diversity.

Dementia patients were case-matched on age group, sex, surgical status and Charlson comorbidities on a ratio of one dementia patient to four non-dementia patients. The Charlson Index is widely used to limit confounding influence of comorbidities on the prediction of 1-year mortality[15]. The Index accounts for diabetes, hemi- or paraplegia, any cancer, HIV/AIDS and major cardiovascular, renal, rheumatic, peptic ulcer and liver diseases and its predictive validity in older people is comparable to self-report [16]. Dementia is usually also included in Charlson indexing but was excluded for the purpose of comorbidity matching in this study. Where there were insufficient controls to achieve four non-dementia patients for each dementia patient, 'bootstrapping' was utilised, where matching controls were randomised and then used more than once. This maximises the use of the existing population of

cases and controls and maintains the benefits of the 1:4 ratio [17]. This procedure was primarily necessary in the 85+ age group.

Using an internationally valid patient-level risk-adjusted 'coding rules for adverse outcomes' [18-20] (see Table 1), twelve potentially preventable complications that are sensitive to nursing care were examined. These coding rules have been used in Australia, New Zealand, Belgium and the United States over the last 20 years and has been translated from ICD9 to ICD10 [19]. Patients are grouped according to medical or surgical status using Australian Refined Diagnosis Related Groups (AR-DRG) V5.2 code, which incorporates the International Classification of Diseases, Australian Modification (ICD-10-AM) 5th Edition [21], where surgery is inclusive of 'other' procedures such as gastroscopy and intubation. The coding rules utilise administrative data to exclude patients who are at risk of developing a particular condition due to their underlying aetiology. In this way, the episodes of complications examined are less likely to have occurred from patient risk, and more likely to be related to hospitalisation. For example, patients who have paralysis as a primary or secondary diagnosis are less mobile than other patients and are therefore excluded from the complication 'pressure ulcer'; patients with a primary or secondary diagnosis of any kidney or bladder condition are excluded from the complication 'urinary tract infection'. Consequently, each complication has a different sample size, based on exclusions and inclusions. Surgical and medical cohorts are analysed separately.

The statistical package SAS EG 9.2 was used. Pearson's Chi-square test of independence demonstrated the magnitude of association and goodness-of-fit of the relative risk (RR) between dementia and non-dementia patients, where the RR was calculated using residuals adjusted for sample size and the 1:4 case–to-control ratio. Missing data were rare in the variables used in this analysis. Diagnosis information was missing in less than 0.2% and sex for less than 0.001% of records for 2006–07; AR-DRG data were always present. The dataset was extracted from the source administrative data based on

age (50+) and so patient age is never missing in this analysis. Because of the very low level of missing data, records with missing information were excluded from analysis where relevant.

Table 1. Coding Rules for Adverse Outcomes (only 4 of the 12 complications shown for readability)

Compli-cation	Inclusion Criteria Any Secondary diagnosis of:	Exclusion Criteria Any Primary Diagnosis or Major Diagnostic Category (MDC) of:
Urinary Tract Infection	Urinary tract infection, non specified site. Infection and inflammatory reaction due to implant, prosthesis, graft in urinary system	Urinary tract infection, non specified site. Infection and inflammatory reaction due to implant, prosthesis, graft in urinary system Streptococcal sepsis, other sepsis Bacterial infection, unspecified Kidney and Urinary Tract (MDC) Female Reproductive System (MDC) Pregnancy, Childbirth and Puerperium (MDC) Newborn and other Neonates (Perinatal Period) MDC) **Any Primary or Secondary Diagnosis of:** Pregnancy Abortion
Pressure Ulcer	Decubitus ulcer and pressure area	Decubitus ulcer and pressure area Skin, Subcutaneous Tissue and Breast (MDC) **Any Primary or Secondary Diagnosis of**: Hemi/quadriplegia
Pneu-monia	Pneumonitis due to solids and liquids Post procedure respiratory disorder, unspecified Other post procedural respiratory disorders Hypostatic pneumonia, unspecified Pneumoniahaemophilus influenza, bacterial pneumonia Other bacterial pneumonia Bacterial pneumonia, unspecified Bronchopneumonia, unspecified Other pneumonia, organism unspecified Pneumonia, unspecified	Viral pneumonia, not elsewhere classified Pneumonia due to streptococcus pneumoniae due to flu, bacterial pneumonia Other bacterial pneumoniae Bacterial pneumonia, unspecified Pneumonia due to mycoplasma pneumoniae due to other infectious organisms In diseases classified elsewhere Bronchopneumonia, unspecified Other pneumonia, organism unspecified Pneumonia, unspecified Influenza Influenza, virus not identified Pneumonitis due to food and vomit Post procedural respiratory disorder, unspecified Other post procedural respiratory disorders Hypostatic pneumonia, unspecified Respiratory system (MDC) **Any Primary or Secondary Diagnosis of**:

		Immunodeficiency Systemic autoimmune disease, unspec HIV
Delirium	Coma, unspecified Stupor, semi coma Delirium, unspecified Other specified dissociative (conversion) disorders Adjustment disorders Reaction to severe stress, unspecified	Coma, unspecified Stupor, semi coma Delirium, unspecified Other specified dissociative (conversion) disorders Adjustment disorders Reaction to severe stress, unspecified Nervous System (MDC) Mental Diseases and Disorders (MDC) Alcohol/Drug Use or Induced Mental Disorders (MDC)

RESULTS

There were 44,488 (10.44%) hospital episodes for dementia patients in NSW over the period 2006-07, compared to 381,788 for non-dementia patients. Surgery was much less common in dementia patients (12%) than in non-dementia patients (27%). The average surgical dementia patient age was 81 with a Charlson index of 1.04 (indicating most dementia patients had one comorbidity in addition to dementia), whereas the average surgical non-dementia patient age was 68 with a lower Charlson index of 0.89. Dementia patients had more hospital episodes with potentially preventable complications than did non-dementia patients, and this difference was higher in the surgical population.

Table 2 shows the results for medical and surgical patients. Medical dementia patients (that is, those who did not undergo surgery) had higher rates of delirium (RR 2.83), urinary tract infections (RR 1.79), pressure ulcers (RR 1.61), pneumonia (RR 1.37) (all at $p<0.0001$), as well as sepsis (RR 1.34) and failure to rescue (death following sepsis, shock, gastrointestinal bleeding, deep vein thrombosis or pneumonia) (RR 1.24) (at $p<0.05$), compared to non-dementia patients. There was no significant difference between medical dementia and non-dementia patients for shock or gastro-intestinal bleeding. Deep vein thrombosis/pulmonary embolism was the only complication found to be significantly less common in dementia patients (RR 0.82) (at $p<0.05$).

Surgical dementia patients had higher rates of delirium (RR 3.10), urinary tract infection (RR 2.88), pressure ulcers (RR 1.84), pneumonia (RR 1.66) and physical or metabolic derangement (serious fluid and/or electrolyte imbalance) (RR 1.87) (all at $p<0.0001$), as well as gastro-intestinal bleeding (RR 1.68) (at $p<0.05$), compared to non-dementia patients. There was no significant difference in rates of sepsis, shock, surgical wound infection, pulmonary failure or failure to rescue in dementia compared to non-dementia patients.

Compared to medical dementia patients, surgical dementia patients had significantly higher relative risks (at $p<0.05$) of urinary tract infections (RR1.09), pressure ulcers (RR1.24) and pneumonia (RR1.42), but not of delirium. In non-dementia patients, medical patients were more likely to get a urinary tract infection than were surgical patients (RR 0.71 at $p<0.0001$); there were no other significant differences. Dementia was consequently a more informative indicator of risk of preventable complications than was surgery for these four common complications. Separately, while noting that dementia patients were much less likely than were non-dementia patients to undergo surgery, surgical procedures carried more risk of preventable complications for dementia than for non-dementia patients.

The strongest findings of the study (at $p<0.0001$), with the greatest differences in rates of dementia and non-dementia patients, for surgical and medical cohorts, were related to four common complications: urinary tract infections, pressure ulcers, pneumonia and delirium. Fourteen per cent of surgical dementia patients suffered a urinary tract infection while in hospital, which was 2.8 times higher than surgical non-dementia patients. Seven per cent suffered a pressure ulcer, 1.84 times higher than non-dementia patients. Seven per cent also suffered pneumonia, 1.66 times the rate of non-dementia patients and 5% suffered delirium, which was 3.1 times higher than for non-dementia patients. These infections and complications were not likely to be related to the person's admitted diagnosis, and were thus more likely to be nosocomial or hospital-acquired, and therefore potentially preventable.

Table 2. Population, samples, percentage rates and relative risks of potentially preventable complications in the over 50 age group from NSW public hospital episode data 2006-07.

Prevent-able compli-cation	Patient population	Percentage of patient episodes with the complication (1)				Relative risk of dementia patients with the complication compared to non dementia patients (2)			
		Medical		Surgical		Medical		Surgical	
		Sample	%	Sample	%	Sample	RR (CI)	Sample	RR(CI)
Urinary Tract Infection	Dementia	36,075	13.4	4,854	14.7	58223^	1.79**	7,680	2.88**
	Non-Dementia	146,813	7.9	18,986	5.6		(1.70-1.90)		(2.45-3.40)
	All >50	182,888	9.0	23,840	7.4				
Pressure Ulcer	Dementia	25,832	5.9	4,007	7.3	38,480	1.61**	5,904	1.84**
	Non-Dementia	89,074	3.8	13,493	4.1		(1.46-1.77)		(1.46-1.31)
	All >50	114,906	4.2	17,500	4.9				
Pneumonia	Dementia	36,875	4.8	5,106	6.8	59,523	1.37**	8184	1.66**
	Non-Dementia	150,118	3.5	20,497	4.2		(1.26-1.48)		(1.36-2.02
	All >50	186,993	3.8	25,603	4.7				
Deep Vein Thrombosis	Dementia	39,104	0.8	5,154	1.4	62,459	0.82*	8,245	1.14
	Non-Dementia	155,882	1.0	20,609	1.2		(0.69-0.97)		(0.78-1.68)
	All >50	194,986	0.9	25,763	1.2				
Gastro-intestinal Bleeding	Dementia	30,035	1.1	2,702	3.8	50,246	1.01	5,405	1.68*
	Non-Dementia	131,088	1.1	16,215	2.3		(0.85-1.19)		(1.22-2.31)
	All >50	161,123	1.1	18,917	2.5				
Sepsis	Dementia	25,365	1.9	4,469	10.6	39,218	1.34*	6,595	1.25
	Non-Dementia	94,631	1.4	15,100	3.1		(1.15-1.57)		(0.96-1.64)
	All >50	119,996	1.6	19,569	4.9				
Shock & Cardiac Arrest	Dementia	31,021	0.6	2,793	1.3	51,256	1.09	5,521	0.93
	NonDementia	132,194	0.5	16,431	1.3		(0.86-1.37)		(0.58-1.50)
	All >50	163,215	0.6	19,224	1.3				
Delirium	Dementia	37,933	4.0	5,155	4.4	61,307	2.83**	8,251	3.10**
	NonDementia	154,805	1.5	20,636	1.5		(2.54-3.15)		(2.31-4.15)
	All >50	192,738	2.0	25,791	2.1				
Surgical wound infection^	Dementia	-	-	5,158	0.1	-	-	8,253	1.12
	NonDementia	-	-	20,633	0.0				(0.48-2.63)
	All >50	-	-	25,791	0.0				
Pulmonary failure^	Dementia	-	-	2,870	2.0	-	-	5,628	0.98
	NonDementia	-	-	16,660	1.7				(0.81-1.19)
	All >50	-	-	19,530	1.7				
Phys/ met derange-ment#^	Dementia	-	-	2,881	11.5	-	-	5,644	1.87**
	NonDementia	-	-	16,699	6.5				(1.55-2.25)
	All >50	-	-	19,580	7.3				

Failure to Rescue##	Dementia	2597	28.2	561	22.3	3745	1.24*	778	0.86
	NonDementia	8336	24.1	1647	25.0		(1.02-1.33)		(0.61-1.20)
	All >50	10933	25.1	2208	24.3				
1. Excluding precipitating pre-existing conditions for each complication									
2. Weighted 80% to 20% to compensate for 1:4 case control ratio									
RR = Relative Risk CI = confidence intervals at 95% * P value < 0.5 ** P value <0.0001									
^These complications only measured in surgical population									
#Physiological and/or metabolic derangement are serious fluid and electrolyte imbalances ##Failure to rescue is death following sepsis, shock, gastrointestinal bleeding or pnuemonia									

DISCUSSION

These findings demonstrate that hospitalised dementia patients have higher rates of complications than hospitalised non-dementia patients, controlling for current comorbidities, and that these rates of complications are significantly higher in dementia patients who have surgery. These findings support previous nationwide, cohort designed Taiwanese findings that dementia patients have higher rates of post-operative complications than non-dementia patients at the hospital-episode level [9]. The highest rates and highest relative risk for dementia patients, for both medical and surgical patients, are for urinary tract infections, pressure ulcers, delirium and pneumonia. This new finding of high rates of four very common preventable complications for dementia patients offers avenues for intervention and prevention.

We note that, compared with hospitalised people who do not have dementia, those with dementia are lightly more likely to have multi-episode stays (87% *vs* 82%); much more likely to be re-admitted within three months of discharge (45% *vs* 32%); and they average more stays over the year (2.5 *vs* 1.9) (calculations derived from [12]). Having dementia may therefore bias estimates of rates of preventable complications (primarily upwards). However, sensitivity testing, not reported here, indicated that, adjusting for sex, age and different patterns of hospital stays, all comparisons that showed significant differences in risk ratios for people with dementia in our original analyses remained significant in the adjusted analyses (and at the same *p*-value level). The effect of dementia on the likelihood of developing avoidable complications was robust. Nevertheless, future data collection planning should

directly include information about number of episodes per stay, rapid re-admissions and number of stays per year.

Three key design features of this new Australian study give additional credibility to the findings: (i) the comprehensive linked approach over two years of administrative data to better identify dementia patients[13], (ii) the patient-level risk-adjustment model to better capture in-hospital complications[18] and (iii) the inclusion of 50-65 year olds with dementia who are known to have different characteristics from other aged populations [5].

Evidence is mounting for associations between poorer nursing work environments and higher rates of patient complications (see Table 3) and demonstrates that, for the four key complications found for dementia patients in the present study, these complications may be modifiable. Nursing interventions, with and without direct medical personnel involvement, for preventing or mitigating these common complications involve mobility, hydration, hygiene, patient education and reassurance in a context of nursing surveillance, assessment, early intervention and advocacy. Nurses more than any other healthcare professional are able to recognise, interrupt, evaluate and correct health care errors [22]. Specifically, in relation to urinary tract infections, it is argued that higher levels of engaged and educated nurses better enable sterile techniques for catheter insertion, time-consuming toileting programs and management of hygiene and hydration [20 23]. In relation to pneumonia, nurses are responsible for (or at least instrumental in) many of the necessary clinical practices, such as encouraging flu vaccination, hand washing, pain relief, mobilisation and pulmonary hygiene for reducing pneumonia [23]. In relation to delirium, simple preventative measures, such as verbal reorientation, correcting sensory deficits, improving mobilisation, improving hydration, decreased use of sleeping and pscychoactive medications and restraints [24], are initiated, maintained and reinforced by nurses in acute settings. In relation to pressure areas, patient positioning and skin care are the primary domain of nurses more than any other profession, and their actions in relation to hydration, nutrition,

mobility and pain relief are also accepted to have significant impact on the prevention of pressure ulcers [25]. The development of complications can be set in motion by a seemingly innocuous first event (for example, a urinary tract infection can develop from dehydration which can start with something as simple as a missed cup of morning tea). This has been termed 'cascade iatrogensis' and is a helpful concept in understanding the link between unmet nursing care needs and potentially preventable complications [26 27].

Table 3. Evidence of association between the four key complications and nursing work environments

Study	Sample	Location & Data Timeframe	Characteristics of nursing work environments (Independent variable)	Patient Complication (Dependent variable)
Cimiotti et al 2012 [28]	161 hospitals 1,571,068 patients 7076 nurses	USA 2006	Lower levels of burnt out (a) nurses	Lower rates of urinary tract infection
Needleman et al 2001 [18]	799 hospitals 6 million+ patients	USA 1997	Higher levels of total nurse staffing	Lower rates of urinary tract infection
Cho et al 2003 [29]	232 hospitals 124,204 patients	USA 1997	Higher proportions of RNs (b)	Lower rates of pneumonia
Kovner et al 2002 [30]	187 hospitals	USA 1990-96	Higher RN hours per patient day	Lower rates of pneumonia
Pappas et al 2008 [31]	2 hospitals 3200 patients	USA 2007	Higher RN hours per patient day	Lower rates of pneumonia
Kane et al 2007 [11]	Systematic review 96 studies	USA 2006	Higher proportions of RN per patient day	Decreased odds ratio of hospital acquired pneumonia
Twigg et al 2010 [32]	3 hospitals 236,454 pts 150,925 nurses	Australia 2000-04	Refined staffing model (c)	Lower rates of pneumonia Lower rates of delirium
Schubert et al 2008 [33]	8 hospitals 779 pts 1338 nurses	Switzlerand 2003-04	Implicit care rationing (d)	Predicted higher levels of pressure ulcers
Horn et al 2005 [34]	82 RACF 1376 residents	USA 1996-97	Higher RN direct time per resident per day	Lower rates of pressure ulcers
Pekkarinen et al 2008 [35]	66 RACF 724 nurses	Finland 2002	Increased time unit pressure (e)	Higher rates of pressure ulcers
Hickey et al 2004 [36]	35 RACF Patient Assessment Files Staffing Data	USA 1998-1999	Lower skill mix (less RNs)	Higher rates of pressure ulcers

a. *"Burnt out"*: where workers emotionally and cognitively detach from work as a way to cope with demands

b. *"RN"*: Registered Nurse – a graduate from a University or college nursing program who has met national licensing conditions

c. *"Refined staffing model"*: which developed categories of nurse staffing based on patient complexity, intervention levels, high dependency beds, emergency/elective patient mix and patient turnover

d. *"Implicit care rationing"*: where nurses withhold or fail to carry out necessary nursing tasks due

to inadequate time, staffing level and/or skill mix
e. *"Time unit pressure":* as a measure of nursing working conditions
"RACF" : Residential Aged Care Facility
"USA": United States of America

These findings highlight the need to view nursing as an intervention rather than as a labour cost in terms of the nursing work environment's impact on patient outcomes. Despite hospitals spending approximately one-third of their budget on ward nursing [37], "administrative datasets have not been designed to capture a great deal of information about nurses" [23]. Staffing data in Australia are limited to hospital level aggregate data for a whole year, without differentiation of types of nurses (for example, Registered Nurse or unlicensed personnel), or state level data by the nurse's postcode of residence. Better hospital nursing data would enable research investigating associations between nurse staffing and patient outcomes, as well as opportunities for systemic benchmarking [9 38].The USA has a more systemic approach to data collection in relation to nursing care but many of the data items are restricted to specific locations (for example, intensive care units). Recommendations have been made that the minimum data sets in America be expanded so that urinary tract infection and pneumonia are measured in all at-risk hospitalised patients [23]. The present study would support this policy. We would also suggest that future acute dementia care intervention studies consider controlling for relevant nursing characteristics.

The four key complications identified here have some of the highest dollar costs for hospitals. For example, though urinary tract infections and pneumonias have relatively low per-case costs, their large volume means that they have the greatest system financial impact in Australia [3]. If we want to reduce the cost and occurrence of preventable complications in hospitalised dementia patients, we need to better understand relationships between nursing work environments and patient outcomes. In order to increase this understanding, we need better data collection strategies for quality benchmarking and research. These data collection strategies need to include (a) screening and documentation of dementia patients in hospital, (b) minimum nursing work environment characteristics, such as appropriate ratios

of registered nurse staffing and skill mix and management of workload/pressure and burnout/retention, and (c) rates of the common in-hospital complications of urinary tract infections, pressure ulcers, pneumonia and delirium, and not just as secondary diagnoses.

CONCLUSION

Dementia patients have higher rates of potentially preventable complications while in hospital than do non-dementia patients, even when controlling for age, sex, surgery and comorbidities. The highest rates, and largest differences in rates, for dementia patients compared to non-dementia patients are seen in urinary tract infections, pneumonia, pressure ulcers and delirium. These complications have been specifically associated with aspects of nursing work environments, including staffing skill mix of Registered Nurses, and workload measures, such as burnout and time pressure. Modifying aspects of the nursing work environment may reduce or prevent these complications in hospitalised dementia patients (and, indeed, in other patients). Improving hospital data collection strategies for the identification of dementia patients and key nursing characteristics would enable benchmarking and research in order to improve the care, and cost of care, for this burgeoning population.

Contributors: DG, BD, RK, and AP devised the idea of the Hospital Dementia Services study, designed the methods, raised funding and conducted the analysis. KB was responsible for implementing the nested study reported here and carrying out all the analyses. HB and LG supervised this nested study. HB, RK, and BD provided statistical advice. KB prepared the first draft of the manuscript and all authors contributed to each section of the final draft of the manuscript. KB is guarantor.

editions and any other BMJPGL products and sublicences to exploit all subsidiary rights, as set out in our licence (http://resources.bmj.com/bmj/authors/checklists-forms/licence-for-publication).

Competing interests: All authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: KB is supported by a PhD Scholarship funded by the Dementia Collaborative Research Centre – Assessment and Better Care, University of New South Wales as part of an Australian Government Initiative. The Hospital Dementia Services Project was funded by the National Health and Medical Research Council (ID465701). Support has been receieved by employing organistions from Alzheimers Australia in regard to commissioned work using data collected in the course of the Hospital Dementia Services Project. No other declarations are made regarding other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: Obtained from the NSW Population and Health Services Research Ethics Committee (HREC/08/CIPHS/49 and 2008/11/109) the Australian Institute of Health and Welfare Ethics Committee**,** the University of NSW and University of Canberra Human Research Ethics Committees (08-85).

Reporting guidelines: This observational cohort study fulfils the STROBE criteria, and a STROBE checklist is included in the submission.

Data sharing: Statistical code and technical appendix available from the corresponding author. Dataset inquiries can be made to the Australian Institute of Health and Welfare via the corresponding author.

Funding: NHMRC funded the overarching HDS project. DCRC provided PhD scholarship to the first author.

REFERENCES

1. Australian Patient Safety Foundation. Iatrogenic injury in Australia. Adelaide, 2001.
2. Ackroyd-Stolarz S, Guernsey JR, MacKinnon NJ, et al. Adverse events in older patients admitted to acute care: a preliminary cost description. *Healthcare management forum / Canadian College of Health Service Executives = Forum gestion des soins de sante / College canadien des directeurs de services de sante* 2009;22(3):32-6.
3. Purpora C, Blegen MA. Horizontal violence and the quality and safety of patient care: a conceptual model. *Nursing research and practice* 2012;2012:306948-48.
4. Lang PO, Zekry D, Michel JP, et al. Early markers of prolonged hospital stay in demented inpatients: a multicentre and prospective study *J. Nutr. Health Aging* 2010;14(2):141-47.
5. Draper B, Karmel R, Gibson D, et al. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. *International Psychogeriatrics* 2011;23(10):1649-58.
6. Mukadam N, Sampson EL. A systematic review of the prevalence, associations and outcomes of dementia in older general hospital inpatients. *International Psychogeriatrics* 2011;23(3):344-55.
7. Brennan TA, Leape LL, et al. Incidence of adverse events and negligence in hospitalised patients - results of the Harvard Medical Practice Study. *New England Journal of Medicine* 1991;324(6):370-76.
8. Mitty E. Iatrogenesis, Frailty, and Geriatric Syndromes. *Geriatric Nursing* 2010;31(5):368-74.
9. Hu C-J, Liao C-C, Chang C-C, et al. Postoperative adverse outcomes in surgical patients with dementia: a retrospective cohort study. *World J. Surg.* 2012;36(9):2051-8.
10. Aiken LH, Sermeus W, Van den Heede K, et al. Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *British Medical Journal* 2012;344.
11. Kane RL, Shamliyan TA, Mueller C, et al. The association of registered nurse staffing levels and patient outcomes - Systematic review and meta-analysis. *Medical Care* 2007;45(12):1195-204.
12. Australian Institute of Health and Welfare. People with dementia in hospitals in New South Wales 2006–07. Canberra: AIHW, 2012.
13. Australian Institute of Health and Welfare. Deriving key patient variables: a technical paper for the Hospital Dementia Services project. Canberra: AIHW, 2012.
14. Australian Bureau of Statistics. Publication 3235.0 - Population by Age and Sex, Regions of Australia, 2007. , 2007.
15. Sundararajan V, Henderson T, Perry C, et al. New ICD-10 version of the Charlson comorbidity index predicted in-hospital mortality. *Journal of Clinical Epidemiology* 2004;57(12):1288-94.
16. Susser SR, McCusker J, Belzile E. Comorbidity information in older patients at an emergency visit: self-report vs. administrative data had poor agreement but similar predictive validity. *Journal of Clinical Epidemiology* 2008;61(5):511-15.
17. Wacholder S, Silverman DT, et al. Selection of controls in case-control studies. 3. Design Options. *Am. J. Epidemiol.* 1992;135(9):1042-50.
18. Needleman J, Buerhaus P, Potter V, et al. Nurse staffing and patient outcomes in hospitals. Nashville: Harvard School of Public Health, 2001.
19. McCloskey BA, Diers DK. Effects of New Zealand's health reengineering on nursing and patient outcomes. *Medical Care* 2005;43(11):1140-46.
20. Duffield C, Roche, M, O'Brien-Pallas, L, et al. Sydney: University of Technology, 2007.
21. Department of Health and Ageing. Classifications: Australian Refined Diagnosis Related Groups (AR-DRGs). 2012.
22. Rothschild J, Hurley A, Landrigan C, et al. Recovery from medical errors: the critical care nursing safety net. *Journal of Quality and Patient Safety* 2006;32(2):63-72.

23. Naylor MD. Advancing the science in the measurement of health care quality influenced by nurses. *Medical Care Research and Review* 2007;64(2):144S-69S.
24. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly persons - Predictive model and interrelationship with baseline vulnerability. *Jama-Journal of the American Medical Association* 1996;275(11):852-57.
25. Padula CA, Osborne E, Williams J. Prevention and early detection of pressure ulcers in hospitalized patients. *Journal of wound, ostomy, and continence nursing : official publication of The Wound, Ostomy and Continence Nurses Society / WOCN* 2008;35(1):65-75; discussion 76-8.
26. Rothschild JM, Bates DW, Leape LL. Preventable medical injuries in older patients. *Arch. Intern. Med.* 2000;160(18):2717-28.
27. Thornlow DK, Anderson R, Oddone E. Cascade iatrogenesis: Factors leading to the development of adverse events in hospitalized older adults. *International Journal of Nursing Studies* 2009;46(11):1528-35.
28. Cimiotti. Nurse staffing, burnout, and health care-associated infection (vol 40, pg 486, 2012). *American Journal of Infection Control* 2012;40(7):680-80.
29. Cho SH, Ketefian S, Barkauskas VH, et al. The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nursing Research* 2003;52(2):71-79.
30. Kovner C, Jones C, Zhan C, et al. Nurse staffing and postsurgical adverse events: An analysis of administrative data from a sample of US hospitals, 1990-1996. *Health Services Research* 2002;37(3):611-29.
31. Pappas SH. The cost of nurse-sensitive adverse events. *Journal of Nursing Administration* 2008;38(5):230-36.
32. Twigg D, Duffield C, Bremner A, et al. The impact of the nursing hours per patient day (NHPPD) staffing method on patient outcomes: A retrospective analysis of patient and staffing data. *International Journal of Nursing Studies* 2010.
33. Schubert M, Glass TR, Clarke SP, et al. Rationing of nursing care and its relationship to patient outcomes: the Swiss extension of the International Hospital Outcomes Study. *International Journal for Quality in Health Care* 2008;20(4):227-37.
34. Horn SD, Buerhaus P, Bergstrom N, Smout RJ. RN staffing time and outcomes of long-stay nursing home residents - Pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care. *American Journal of Nursing* 2005;105(11):58-70.
35. Pekkarinen L, Sinervo T, Elovainio M, et al. Drug use and pressure ulcers in long-term care units: do nurse time pressure and unfair management increase the prevalence? *Journal of Clinical Nursing* 2008;17(22):3067-73.
36. Hickey EC, Young GJ, Parker VA, et al. The effects of changes in nursing home staffing on pressure ulcer rates. *J. Am. Med. Dir. Assoc.* 2004;6(1):50-53.
37. Watts J, Richardson J, Segal L. Comparing National Public Hospital Cost Data Collections for use in Performance Reporting. . In: Evaluation. TCfHP, editor. West Heidelberg Victoria. , 2000.
38. Schilling P, Goulet JA, Dougherty PJ. Do Higher Hospital-wide Nurse Staffing Levels Reduce In-hospital Mortality in Elderly Patients with Hip Fractures: A Pilot Study. *Clinical Orthopaedics and Related Research* 2011;469(10):2932-40.

Australian Government
Australian Institute of Health and Welfare

BULLETIN 110 • NOVEMBER 2012

People with dementia in hospitals in New South Wales 2006–07

Summary

The Hospital Dementia Services Project is an innovative study that uses linked data to explore how hospital-based aged care and dementia services in New South Wales in 2006–07 influenced outcomes for people with dementia.

This bulletin examines the hospital experiences of the 252,700 people aged 50 and over who stayed for at least one night in a New South Wales public hospital in 2006–07. All hospital stays that ended in 2006–07 are included to allow a complete analysis of patients' hospital care, comprising 408,500 multi-day stays and 252,400 same-day stays. Data for this analysis are person-based hospital stay data that allow both patient-level and stay-level analyses of hospital use by people with and without dementia.

Slightly more than 8% of patients (20,800 people) were identified as having dementia. Like the general population, the prevalence of dementia among patients in the study increased with age, with the rate rising from less than 1% of those aged 50–59 to 28% among the very old (90+). Consequently, patients with dementia tended to be older than those without the condition (median age of 83.7 versus 70.7), and were more likely to be female (60% versus 51%). To allow for these demographic differences, comparisons between patients with and without dementia use age-sex standardised estimates where applicable.

Greater use of hospitals

People with dementia had much higher hospitalisation rates than those without dementia: in New South Wales, 26% of people with dementia aged 50 and over had at least one overnight stay in a public hospital ending in 2006–07, compared with 12% of people without dementia. Also, patients with dementia:

- were more likely to have more than one multi-day stay in a year (62% versus 43%)
- had longer multi-day stays (mean of 18.3 days versus 9.1 days), and these stays were more likely to involve either a change in care type or a transfer between hospitals (18% versus 13%).

bulletin 110

Different reasons for hospitalisation

Compared with people without dementia, people with dementia were more likely to be admitted because of:

- non-dementia mental and behavioural disorders or conditions of the nervous system (14% versus 5%)
- injury or poisoning (14% versus 11%), particularly head and limb injuries.

Their admission was less likely to be caused by neoplasms (4% versus 10%) or circulatory diseases (13% versus 19%).

Different destinations

People with dementia were less likely than others to return to living in the community on discharge (59% versus 88%), and more likely either to return to living in residential care, to enter residential care on discharge from hospital, or to die in hospital.

Contents

1 Background

There is substantial evidence that the hospitalisation of older people can be associated with a range of poor outcomes, including deconditioning and exacerbation of a range of physical conditions (Creditor 1993; Covinsky et al. 2003). Older patients are also more likely than younger patients to experience preventable adverse events (Thomas & Brennan 2000). A number of studies have found an association between cognitive impairment and functional decline during hospitalisation (Sager et al. 1996; McCusker et al. 2002). Also, patients with dementia are more likely to experience hospital-related (nosocomial) infections and treatment complications (Torian et al. 1992; Foreman & Gardner 2005), with patient-related adverse events in hospital also being associated with cognitive impairment and delirium (Watkin et al. 2012). Hospitalisation can entail multiple bed moves, which may cause distress and exacerbate confusion, agitation, and behavioural problems (Cunningham 2006). Large and unfamiliar hospital environments are associated with patient disorientation and anxiety (Cunningham 2006; Fleming et al. 2003), while the organisational focus on efficient, cure-oriented treatment often means the particular needs of people with dementia are not well met (Cunningham 2006; DADHC & NSW Health 2002).

The mean length of stay (LOS) for all Australian hospital episodes has previously been estimated at 8.6 days, compared with 19.6 days for episodes with any diagnosis of dementia and 30.1 days with a principal diagnosis of dementia (AIHW 2007:186). The relatively high casemix complexity of patients with dementia contributes to longer hospital stays and this has an impact on patient physical and mental state (King et al. 2006; Nichol et al. 2000; ACEMA 2002).

The Hospital Dementia Services (HDS) Project is an innovative study that explores how hospital-based aged care and dementia services influenced outcomes for people with dementia who used a public hospital in New South Wales in 2006–07. It is a mixed methods study involving:

- linking existing administrative data sets to create a data set containing information on the paths patients take in hospitals and into residential aged care
- a survey of all New South Wales public hospitals about hospital-based aged care and dementia-specific services
- follow-up site visits in selected locations to obtain qualitative data on operational aspects of different hospital-based service models for patients with dementia (Box 1.1; also see AIHW 2010; AIHW 2011 for more details).

Box 1.1: HDS Project

The HDS Project is a mixed methods study that explores how hospital-based aged care and dementia services influence outcomes for people with dementia who were admitted to a public hospital in New South Wales. It is a 3-year project funded through the National Health and Medical Research Council, and involves a team of researchers from the Australian Institute of Health and Welfare (AIHW), University of Canberra, and University of New South Wales.

Objectives

The overarching objective is to inform health practitioners, health and aged care policy makers and planners, and consumers about the influence of system-level factors on care outcomes for hospital patients with dementia. Outcomes of interest include hospital admission rates, length of stay in hospital, and care outcomes such as falls, complications, and discharge rates to residential aged care.

Project design

The project consists of four streams.

Stream 1 describes hospital stay and patient accommodation outcomes for patients with dementia, and compares them with those of other older public hospital patients. This is based on analysis of linked data from existing administrative data sets (New South Wales hospital, residential aged care, and Aged Care Assessment Program data); analyses focus on older patients (50+) discharged from New South Wales public hospitals in 2006–07. Data are linked according to procedures approved by relevant ethics committees and follows the protocol developed and used extensively at the AIHW (AIHW 2006).

Stream 2 describes aged care and dementia-specific services in New South Wales in 2006–07 through a survey of all public hospitals and follow-up site visits in selected locations (see AIHW 2010 for forms). This stream also involves the collection of information to describe aged care programs at the regional level.

In **Stream 3**, the materials collected in Streams 1 and 2 are integrated to explore system-level outcomes for people with dementia who are admitted to hospital and the factors that influence the outcomes.

Throughout the project the research team is disseminating and discussing study progress and results with policy advisers, health practitioners and service planners through seminars and conference presentations, as well as publications (**Stream 4**).

Expert panel and partners

The research is guided and informed by an expert panel comprising of representatives of dementia service consumers, aged care providers, health service planning staff, and key researchers. Project partners and collaborators are New South Wales Health, Alzheimer's Australia, Alzheimer's New South Wales, the Aged and Community Services Association of New South Wales and the Australian Capital Territory, the Benevolent Society, the University of Queensland, and La Trobe University.

Source: AIHW 2010; see also AIHW 2011.

This bulletin examines completed hospital stay data for people with and without dementia. Hospital data extracted for this project means patients' stay histories within and across hospitals can be examined. This enables the hospital experiences of people with and without dementia to be compared. Analyses use both patient-level and stay-level data. Aspects examined include hospitalisation rates, age profiles, length of stay, cause of admission, principal procedure in hospital, destination on discharge from hospital, and re-admission. Because the age and sex profiles of those hospitalised with and without dementia differ, where appropriate, age-sex standardisation has been used to enable comparisons.

2 Data

Hospital use data for the HDS Project were extracted from the New South Wales Admitted Patient Data Collection (APDC) and included all hospital episodes ending between 1 July 2005 and 30 June 2007. The data extract contained a unique patient identifier derived by the New South Wales Centre for Health Record Linkage (CHeReL 2009). Using this identifier, data from the full 2 years were used to identify complete hospital stays ending in 2006–07 and whether the patient had dementia.

2.1 Scope of hospital data

People

The analysis population is people aged 50 and over by 1 July 2006 who had a completed hospital stay in 2006–07 that included at least one night in a New South Wales public hospital. Just over 252,700 people—termed HDS patients—on the APDC data set met these conditions.

Hospital stays

The analysis of hospital stays included all stays for HDS patients that ended in 2006–07. Stays in both public and private hospitals in New South Wales were included to allow a complete analysis of the hospital experience of HDS patients, and these stays may or may not have included a night in hospital.

For this analysis, a hospital stay is defined as the period from admission into the hospital system to discharge from the system, or death in hospital. It can:

- start and end on the same day (a same-day stay), or include at least one night in hospital (a multi-day stay)
- include one or more transfers between hospitals (that is, a multi-episode stay)
- include changes in care type within a hospital (that is, a multi-episode stay)
- include a visit to one hospital while admitted to another.

This approach is different from previous analyses of hospital care that have generally been episode based (AIHW: Karmel et al. 2007; AIHW 2008).

Examples of various types of stays and visits are illustrated in Figure 2.1. The derivation of completed hospital stay data from the New South Wales APDC episode-based extract is described in AIHW 2012b. Overall, HDS patients had 660,962 completed stays ending in 2006–07, comprising 408,539 multi-day stays and 252,423 same-day stays. Just 1.2% (4,991) of multi-day stays included a visit to another hospital, with an average of 1.4 visits per stay with a visit (a total of 6,887 hospital visits).

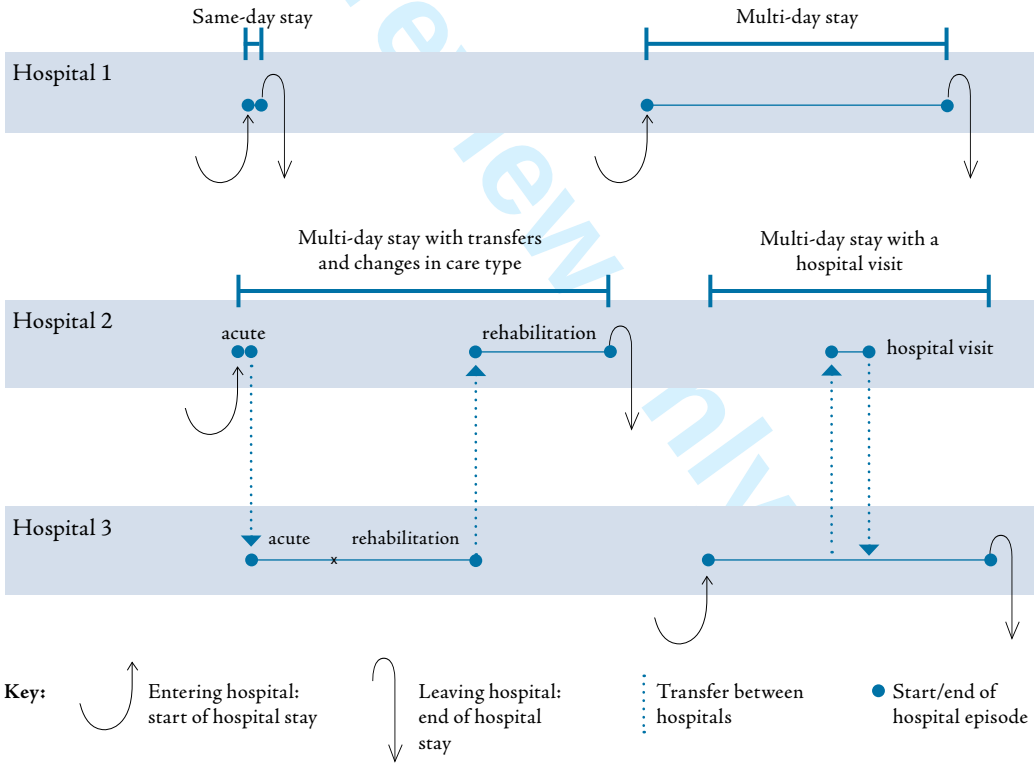


Figure 2.1: Examples of the relationship between hospital episodes and stays

Because HDS patients must have at least one multi-day stay, the pattern of same-day and multi-day stays for the study cohort is different from that for all New South Wales patients. Across all New South Wales hospital patients aged 50 and over in 2006–07, same-day episodes accounted for half of the hospital episodes, compared with 38% for HDS patients. Therefore, most of the analysis of hospital stays focuses on multi-day stays for HDS patients.

People with dementia

The New South Wales APDC can record up to 55 diagnoses as contributing to the care provided during an episode in hospital. For the HDS Project, patients were identified as having dementia if it was recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. Diagnoses in the APDC data are coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (NCCH 2000). The codes used to identify people with dementia are in Table A1.

It is likely that dementia is underestimated in the hospital patient population due to a combination of poor recognition by medical staff, deficiencies in medical records, and because the condition, like other pre-existing conditions, may not be recorded on the hospital admission data if it does not affect the care provided or resource use during the hospital stay. On the other hand, for the HDS Project, patients were identified as having dementia if a dementia condition was reported for any of their New South Wales hospital episodes ending between 1 July 2005 and 30 June 2007. Consequently, it is possible that, in this study, people with dementia who had more or longer stays were more likely to have been identified as having the condition. These two factors have opposing effects. It is also possible that some cases of delirium were misdiagnosed as dementia. Nevertheless, because of the large scale of the study, it is expected that patterns seen in hospital use for HDS patients with and without dementia are robust.

2.2 Statistical significance and standardisation of results

Age-sex standardisation has been used where appropriate to enable comparisons between people with and without dementia. In general, 5-year age groups have been used for standardisation, except for the youngest (50–59) and oldest groups (90+). Where the classification of interest may have small numbers in some categories, broader age groups have been used; this is indicated in the table notes. Percentages and means have been directly standardised using the age-sex distribution of all patients or stays (as relevant) contributing to a table.

The significance of differences between results for people with and without dementia across age groups has been examined using standardised figures. Because of the large number of comparisons being made, only differences with high statistical significance are discussed (> 99.9%).

3 People in hospital

The median age of HDS patients was 72.1, and just over half were women (Table A2). Female patients tended to be older than male patients.

Patients with dementia tended to be older than those without the condition (median age of 83.7 versus 70.7). The distribution pattern across age groups for all male and female patients was noticeably different, and also for those with and without dementia. These differences in age-sex profiles emphasise the importance of standardisation when comparing the hospital experience of people with and without dementia. Consequently, the discussion focuses on standardised figures, where relevant; both standardised and unstandardised numbers are presented in tables as the latter show the situation in hospitals.

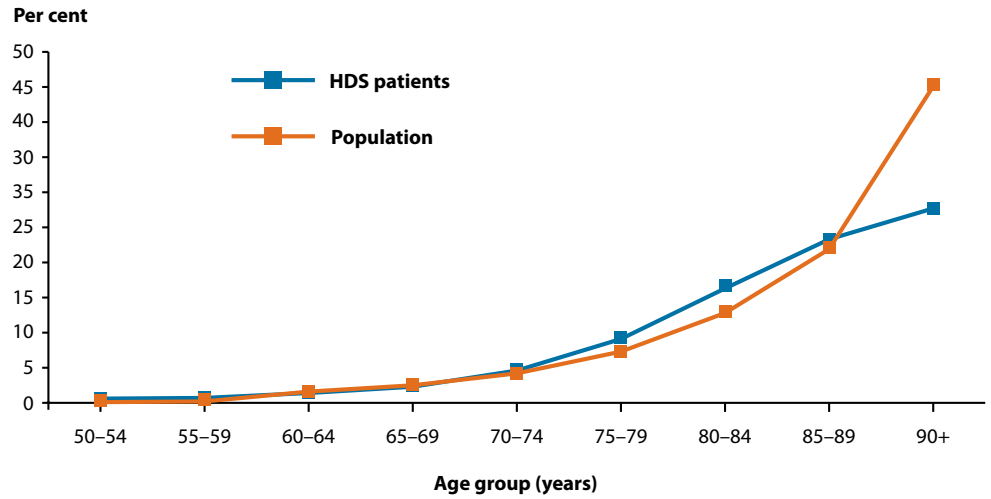
3.1 Dementia prevalence

Just over 8% of HDS patients (20,800 people) were identified as having dementia (Table A2). Like the general population, the prevalence of dementia among HDS patients increased with age, from less than 1% for patients aged 50–59 to 28% among the very old (90+). As would be expected for a group of people using health services, the estimated prevalence of dementia among patients for both sexes was generally higher than that for the general population, except for patients aged 90 and over (Figure 3.1).

For the oldest age group (90+) the estimated prevalence in the hospital population was well below population prevalence estimates. There are three possible causes for this difference: failure to identify dementia, reporting practices of diagnoses, and aversion to admit very old people with dementia.

Dementia may be less likely to be identified when present in very old patients due to high levels of frailty. Second, even when identified, it may be considered less important than other health conditions in determining hospital treatment among this group, especially among those with less severe dementia. Consequently, dementia may be less likely to be reported as a condition affecting hospital care. That other health conditions were likely to be determining hospital treatment in this age group is supported by the length of stay analysis in Section 4.6.

Finally, very old people with dementia may be less likely to be admitted into hospital. One reason could be that for some old frail people with severe dementia, there may have been a decision not to seek active treatment that could potentially be traumatic for the person for little perceived gain. Alternatively, medical practitioners may exclude very old people with dementia from some procedures that may be provided to others without dementia.



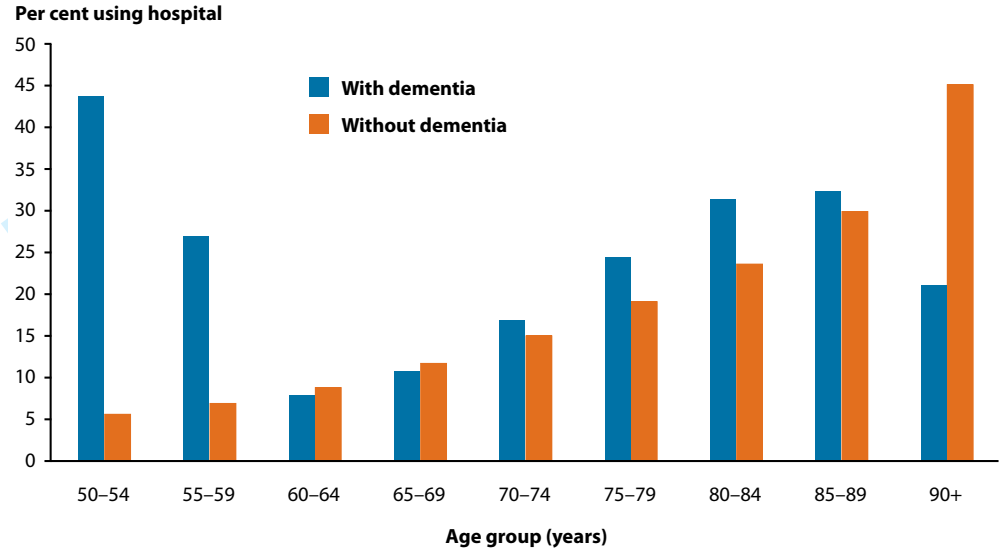
Source: Table A2.

Figure 3.1: Prevalence of dementia in HDS patients and Australian population (per cent)

3.2 Use of hospitals

By comparing the HDS patient age-sex profile with estimates for the population of New South Wales, we can estimate the proportion of the population that used a public hospital in 2006–07. Overall, it is estimated that 12% of people aged 50 and over living in New South Wales in 2006 had a multi-day stay in a New South Wales public hospital that ended in 2006–07 (Table 3.1). As expected from general hospital use statistics (AIHW 2008), older people were much more likely than younger people to have been in hospital (6% of 50–54 year olds versus 34% of people 90+).

People with dementia were more likely to have spent time in a New South Wales public hospital than other people—26% of those aged 50 and over with dementia had a multi-day stay, compared with 12% of people without dementia. However, this pattern varied with age. Young people with dementia (aged 50–59) were much more likely to be hospitalised than their counterparts without dementia; on the other hand, hospitalisation rates for people with dementia were slightly lower than those for people without dementia for people aged 65 to 69, mainly due to lower hospitalisation rates for women with dementia. (Figure 3.2, Table 3.1). For people aged 70 to 89, those with dementia were again more likely to have a period in hospital; however, among the very old (90+), the HDS estimates suggest that people with dementia had lower hospitalisation rates than people without dementia. This last result reflects the relatively low rate of identification of dementia among very old hospital patients noted in the previous section, and so may underestimate the use of hospitals by very old people with dementia; estimates for people aged 85–90 may be similarly affected. Note that the overall estimate of hospital use by people with dementia presented here is different from the HDS-based estimate published in Draper et al. 2011, due to both a difference in scope and the use of updated estimates of population prevalence.



Source: Table 3.1.

Figure 3.2: Proportion of people with a multi-day stay in a public hospital by dementia status, New South Wales, 2006–07 (per cent)

Table 3.1: Patients: people aged 50+ with at least one night in a public hospital in New South Wales in 2006–07, by age and dementia (per cent)

	With dementia			Without dementia			All		
Age group	Male	Female	All	Male	Female	All	Male	Female	All
50–54	40.6	51.9	43.7	6.0	5.3	5.6	6.0	5.4	5.7
55–59	22.6	36.3	26.9	7.4	6.4	6.9	7.5	6.4	6.9
60–64	9.9	5.9	7.9	9.6	8.0	8.8	9.6	7.9	8.8
65–69	12.7	9.0	10.7	12.8	10.6	11.7	12.8	10.6	11.6
70–74	19.5	14.5	16.8	16.4	13.7	15.0	16.6	13.7	15.1
75–79	27.6	22.0	24.4	20.7	17.8	19.1	21.2	18.1	19.5
80–84	35.0	29.4	31.4	24.8	22.7	23.6	26.0	23.6	24.6
85–89	36.5	30.5	32.3	30.8	29.4	29.9	31.9	29.6	30.4
90+	25.5	19.8	21.1	45.1	45.1	45.1	37.8	33.0	34.3
Total	**26.4**	**22.6**	**24.0**	**11.8**	**11.2**	**11.5**	**12.3**	**11.8**	**12.0**
Standardised (per cent)	**24.4**	**26.9**	**25.7**	**12.2**	**11.9**	**12.1**	..	..	..
HDS patients (number)	**8,304**	**12,489**	**20,793**	**114,769**	**117,157**	**231,926**	**123,073**	**129,646**	**252,719**
NSW population (number)	**31,429**	**55,147**	**86,575**	**969,962**	**1,047,143**	**2,017,106**	**1,001,391**	**1,102,290**	**2,103,681**

Note: Population numbers are estimated resident population at 30 June 2006 for New South Wales from ABS Australian demographic statistics series (for example, ABS 2008). Population with and without dementia was estimated using age-sex dementia prevalence rates reported in AIHW 2012a. Hospitalisation rate uses number of HDS patients (with/out dementia) divided by the estimated population for New South Wales. HDS patients are assumed to be residents of New South Wales.

3.3 Types of dementia

The type of dementia could be determined from the hospital data for less than half (42%) of patients with dementia (Table 3.2). Younger people were more likely to have their dementia type specified, with 75% of those aged 50–64 having a specifically identified form. Among people with a specified dementia type, Alzheimer disease was the most common type reported at 39%, compared with 17% for Vascular dementia—the second most common type. However, people aged 50–64 were less likely than older people to have a diagnosis of either Alzheimer disease or Vascular dementia, and much more likely to have Other degenerative dementia or Other dementia.

Table 3.2: Patients with dementia: type of dementia by age, HDS patients, 2006–07 (per cent)

Type[(a)]	50–64	65–74	75–84	85+	Total	Total
All patients identified with dementia (type specified and unspecified)			**Per cent**			
Alzheimer disease	11.1	16.2	18.4	14.4	16.2	3,375
Vascular dementia	7.9	9.8	8.0	5.5	7.1	1,483
Parkinson and/or Lewy bodies	4.6	8.5	6.8	3.4	5.4	1,132
Dementia with delirium	1.7	2.1	3.5	4.3	3.6	752
Other degenerative dementia	40.7	10.6	4.6	3.1	5.9	1,232
Other dementia	5.0	1.2	0.7	0.3	0.7	147
Mixed diagnoses	3.8	4.8	3.3	1.8	2.8	588
Unspecified	25.2	46.9	54.7	67.3	58.1	12,084
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**20,793**
Total (number)	**759**	**2,201**	**9,062**	**8,771**	**20,793**	..
Patients with type of dementia specified at least once						
Alzheimer disease	14.8	30.5	40.7	44.1	38.8	3,375
Vascular dementia	10.6	18.4	17.6	17.0	17.0	1,483
Parkinson and/or Lewy bodies	6.2	15.9	15.0	10.3	13.0	1,132
Dementia with delirium	2.3	3.9	7.8	13.1	8.6	752
Other degenerative dementia	54.4	19.9	10.2	9.4	14.1	1,232
Other dementia	6.7	2.3	1.4	0.8	1.7	147
Mixed diagnoses	5.1	9.0	7.3	5.4	6.8	588
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**8,709**
Total (number specified)	**568**	**1,169**	**4,107**	**2,865**	**8,709**	..

(a) Type of dementia was derived from all diagnoses reported for a patient in any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. See Table A1 for dementia type definitions.

Note: Percentages may not sum to 100% due to rounding.

3.4 Number of stays per person

Two-thirds of all HDS patients (66%) had just one multi-day hospital stay ending in 2006–07; that is, their stay with a night in a public hospital leading to inclusion in the study (Table A3); just 6% had four or more. In addition, one-quarter had at least one same-day stay in a hospital during the year, with the majority (69%) having just the one stay. However, the high average number of same-day stays among those with such a stay (4.1) indicates that some HDS patients had many same-day stays.

Considering the 12 months before the end of a patient's final multi-day stay in 2006–07, people with dementia were more likely than others to have had more than one multi-day stay ending in the 12 months (62% versus 43%) (Table A4). The disparity between people with and without dementia was much more marked among younger people. This variation is reflected in the average number of stays per person: the standardised mean number of multi-day stays over 12 months was 2.5 for people with dementia, compared with 1.9 for people without dementia.

HDS patients with dementia were less likely to have a same-day stay in 2006–07 than those without the condition (21% versus 25%) (Table A3). However, among those with a same-day stay, there was no statistically significant difference between patients with and without dementia for either the proportion of people with only one stay or the average number of same-day stays. This suggests that among people who had same-day stays, the use patterns for such stays were similar for the two groups.

4 Features of hospital stays

Overall, HDS patients completed 408,500 multi-day stays and 252,400 same-day stays in 2006–07. As anticipated from the preceding analysis, a relatively high proportion of stays for people with dementia was for multi-day stays (71% versus 61% for people without dementia) (Table A5).

Table 4.1: Multi-day hospital stays, by number of episodes and transfers and dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
Number	With dementia	Without dementia	Total	With dementia	Without dementia
Episodes[b] in the stay					
1	80.1	87.0	86.4	*81.7	86.7
2	14.5	10.2	10.6	*13.3	10.4
3+	5.3	2.8	3.0	*5.0	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Existence of hospital transfer					
Without transfer	86.7	89.3	89.1	*87.1	89.2
With transfer	13.3	10.7	10.9	*12.9	10.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**	..	..
Hospital-to-hospital transfers in the stay, for stays with more than one episode					
0	33.2	17.4	19.6	*29.8	18.3
1	52.3	67.1	65.1	*53.9	66.3
2	10.8	12.3	12.1	12.3	12.2
3+	3.7	3.3	3.3	4.0	3.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**7,581**	**47,973**	**55,554**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

(b) A hospital episode is a period in hospital of a particular care type in a particular hospital. A hospital stay is the period from admission into the hospital system to discharge from the system, or death in hospital.

Note: Percentages may not sum to 100% due to rounding.

Fourteen per cent of multi-day stays included a change in care type and/or a transfer between hospitals; four-fifths of these (11% of multi-day stays) included a transfer between hospitals (Table 4.1). People with dementia were more likely than others to have stays with such changes: 18% of stays for patients with dementia included a change in care type or hospital transfer compared with 13% for other patients. The majority of these changes were due to within-hospital changes in care type. However, dementia patients were a little more likely than others to be transferred between hospitals (13% versus 11%). These findings are important given that multiple bed moves may cause distress and exacerbate cognition-based problems for people with dementia (Cunningham 2006).

4.1 Hospital sector

The bulk of the multi-day stays for the HDS cohort (90%) were entirely within the public sector, which is not surprising given the scope of the study (Table A6). Just less than 4% of multi-day stays included time in both public and private hospitals. People with dementia were more likely than others to be treated solely in a public hospital (94% versus 90% of multi-day stays were within public hospitals).

4.2 Region

In 2006, health service provision in New South Wales was grouped regionally into eight Area Health Services (Figure 4.1). There was great variation in the number of HDS multi-day hospital stays provided across these regions, ranging from 23,000 in 2006–07 in Greater Western to 79,000 in South Eastern Sydney/Illawarra (Table 4.2).

The prevalence of patients with dementia in hospital stays varied across the regions, ranging from 8% to 10% (standardised to allow for different age/sex profiles of patients), compared with 9% across all multi-day stays.

Source: NSW Department of Health 2007:263,273.

Figure 4.1: Area Health Services in New South Wales

Table 4.2: Multi-day hospital stays, by Area Health Service of admission and dementia status, for HDS patients 2006–07 (per cent)

Area Health Service of admitting hospital	Dementia status				Dementia prevalence	
	With dementia	Without dementia	Total	Number	Observed	Standardised[(a)]
Greater Southern	7.0	7.7	7.6	31,145	8.6	*8.3
Greater Western	4.5	5.8	5.6	23,032	7.4	*7.9
Hunter/New England	13.7	13.4	13.4	54,807	9.5	*9.8
North Coast	8.6	9.7	9.6	39,052	8.4	*8.3
Northern Sydney/Central Coast	17.3	14.2	14.5	59,302	11.1	9.4
South Eastern Sydney/Illawarra	19.4	19.3	19.3	78,742	9.4	9.1
Sydney South West	18.1	17.7	17.7	72,412	9.5	*10.3
Sydney West	11.4	12.3	12.2	49,833	8.7	*9.9
Total	**100.0**	**100.0**	**100.0**	..	**9.3**	..
Total number	**38,097**	**370,228**	**408,325**	**408,325**	..	..

* Significantly different at .001 level when comparing with the state average of 9.3%.

(a) Age-sex standardised to enable comparisons across regions. The standard distribution was derived from all HDS stays.

Note: 214 admissions had invalid data for derivation of Area Health Service. Percentages may not sum to 100% due to rounding.

4.3 Care type

Few multi-day stays (3% overall) started with sub-acute care such as rehabilitation or palliative care; however, patients with dementia were more likely to be admitted for this type of care than others. By the end of their stay, 8% of patients were receiving sub-acute care because of changes in care type over the course of the hospital stay, and again people with dementia were more likely to be the recipients (13%) (Table 4.3). This reflects the relatively high proportion of stays for dementia patients that had more than one episode of care.

Table 4.3: Multi-day hospital stays, by care type on admission and on discharge, by dementia status, for HDS patients 2006–07

	Observed			Standardised[a]	
Care type	With dementia	Without dementia	Total	With dementia	Without dementia
On admission					
Acute care	96.0	97.4	97.3	95.4	*97.3
Sub-acute[b]	4.0	2.6	2.7	4.6	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,095**	**370,210**	**408,305**	..	..
On discharge					
Acute care	85.5	92.8	92.1	86.6	*92.5
Sub-acute	14.5	7.2	7.9	13.4	7.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,076**	**370,171**	**408,247**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.
(b) Sub-acute care includes rehabilitation, palliative care, geriatric evaluation and management, psychogeriatric care, and maintenance care.

Note: Table excludes cases with missing care type (234 on admission, 292 on discharge).

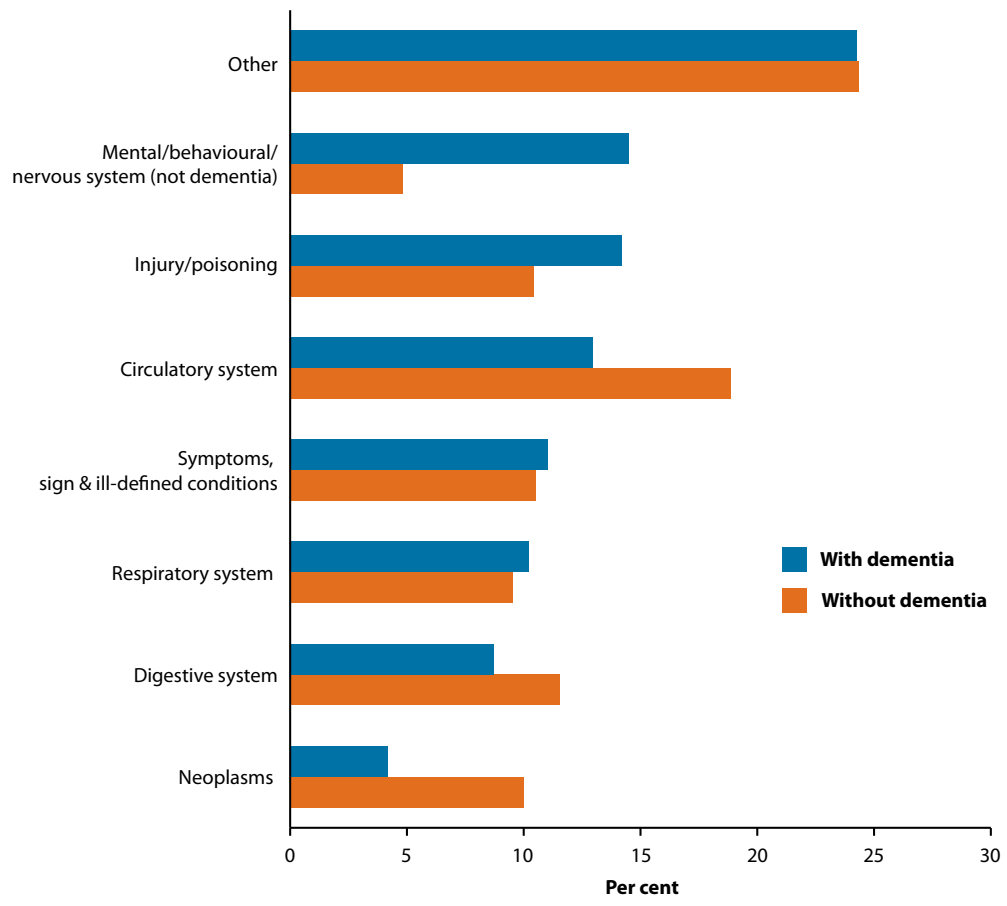
4.4 Principal diagnosis

The principal diagnosis for a hospital episode is the one chiefly responsible for the hospitalisation. Up to 54 other diagnoses could also potentially be recorded per episode of care on the APDC—a maximum of 48 was observed. Dementia was rarely reported as principal diagnosis, being recorded for less than 1% of multi-day stays for HDS patients (Table A7). Even for patients with dementia, dementia was the principal diagnosis for only 6% of multi-day stays.

People with and without dementia had different reasons for being admitted to hospital (Figure 4.2, Table A7). Diseases of the circulatory system were the most common principal diagnoses for people without dementia (19%), with a number of other health conditions accounting for about 10% of admissions each (neoplasms, diseases of the respiratory and digestive systems, injuries and poisonings, and ill-defined/unidentified conditions). In contrast, for people with dementia, injuries and poisonings were the most common reason for admission to hospital (14%, excluding stays with dementia as the principal diagnosis) with circulatory system diseases the second most common (13%). Also, together non-dementia mental and nervous system disorders accounted for almost 14% of admissions for people with dementia compared with less than 5% for people without dementia. As was the case for people without dementia, respiratory system diseases and ill-defined/unidentified conditions were the cause of about 10% of admissions each, but neoplasms were less likely (4% of admissions for people with dementia).

Among the less common principal diagnoses (included in the 'Other' group in Figure 4.2), people with dementia were more likely than others to have a principal diagnosis of infection, an endocrine condition, or a factor influencing health status. On the other hand, people without dementia were more likely to have a principal diagnosis relating to blood disorders, eye or ear conditions, or to the musculoskeletal system.

Although relatively uncommon as a principal diagnosis, delirium (not reported as superimposed on dementia) was much more likely to be reported as the principal diagnosis for people with dementia (1%) than for people without dementia (0.2%). Moreover, two-fifths of patients reported with a principal diagnosis of delirium not reported as superimposed on dementia had dementia. This relationship between dementia and delirium has been noted in other analyses of HDS data, with many people identified as having delirium also having dementia, especially among very old patients (Draper et al. 2011).

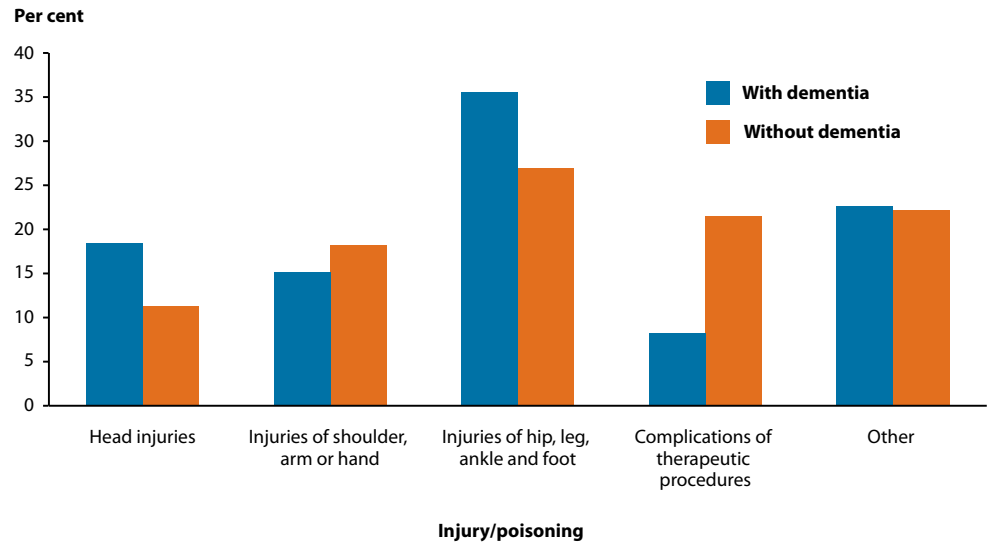


Source: Table A7.

Figure 4.2: Selected principal diagnoses (excluding dementia) on admission by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent)

Hospitalisations due to injury may be avoidable through injury prevention practices, and this analysis suggests that this could be particularly important for people with dementia. Looking more closely at injuries, people with dementia had a different injury profile leading to hospitalisation than people without dementia (Table A8, Figure 4.3). Overall, people with dementia were more likely than others to be hospitalised due to head or limb injuries and less likely because of medical complications.

Among people hospitalised because of fractures, hip and leg injuries dominated, but were more likely for people with dementia. For other injuries, head injuries were the most common among those with dementia, while medical complications were pre-eminent among people without dementia.



Source: Table A8.

Figure 4.3: Type of injury or poisoning reported as principal diagnosis, by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent)

4.5 Principal procedure

When coding the procedures provided to a patient in an episode of care, a priority system is used by APDC coders to establish the order in which procedures are recorded in the data set. This priority is based on relevancy to principal diagnosis and therapeutic nature, as follows:

Priority 1—Procedure performed for treatment of principal diagnosis.

Priority 2—Procedure performed for treatment of additional diagnosis.

Priority 3—Diagnostic or exploratory procedure related to principal diagnosis.

Priority 4—Diagnostic or exploratory procedure related to additional diagnosis.

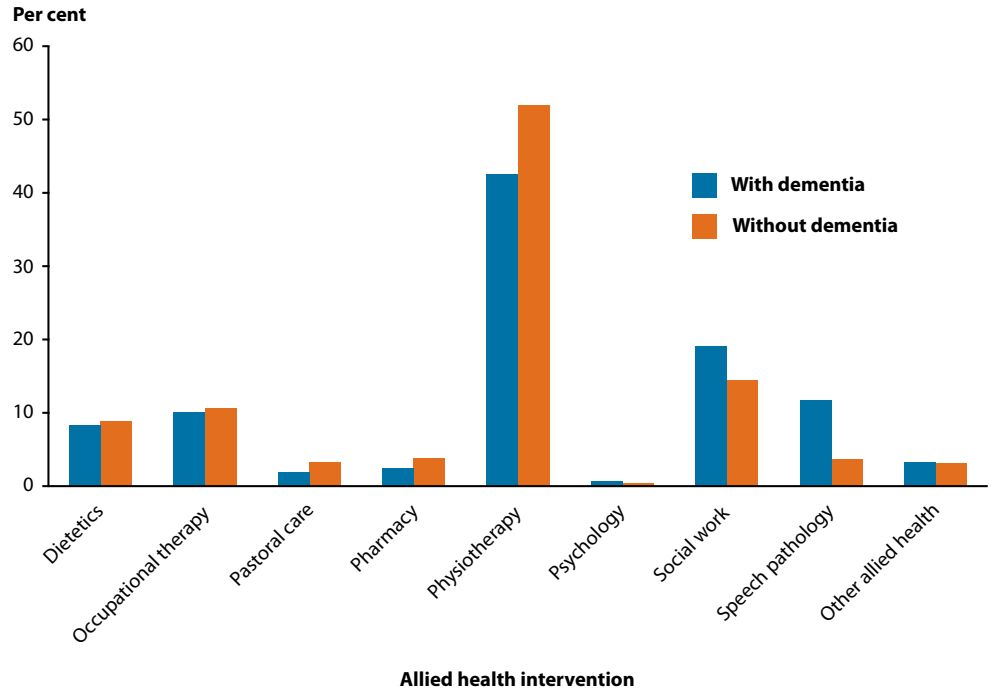
In addition, surgical procedures are coded higher than non-surgical procedures. All significant procedures are coded where they are either surgical in nature, carry a procedural risk, carry an anaesthetic risk, or require special facilities or equipment, or specialised training. The principal procedure is the procedure recorded as the first one on the APDC for an episode of care (NCCH 2010: standard 0016).

An episode of care may not always include a procedure as defined above; for example, in an admission for observation after a health episode (such as a fall or chest pain), or where multiple disorders complicate diagnosis and treatment. For both people with and without dementia, about one-quarter of multi-day hospital stays for HDS patients did not have any procedures reported against the admitting episode (Table 4.4).

In multi-day stays with a reported principal procedure, people with dementia were much more likely than others to receive either allied health or imaging services as their principal procedure (about two-thirds of stays combined, compared with two-fifths). Further, two-thirds of the imaging services for people with dementia were computerised tomography (CT scan) of the brain, while less than half of those for people without dementia were CT brain scans.

Other principal procedures reported for a reasonable proportion of patient stays included those relating to the cardiovascular system (8%), digestive system (12%), and musculoskeletal system (10%). These procedures were less likely to have been performed for patients with dementia because of the dominance of allied health and imaging services. Nevertheless, while overall procedures of the musculoskeletal system were more common among people without dementia, procedures of the pelvis or hip were more common in stays for people with dementia.

Physiotherapy was the most common allied health service provided (51% of stays with a principal procedure in allied health) (Figure 4.4, Table A9). Among stays that included use of allied health, while often provided, physiotherapy was less common among patients with dementia. In contrast, social work and speech pathology were more commonly provided as the principal allied health procedure for patients with dementia compared with those without the condition. Procedures provided to similar proportions of patients with and without dementia included dietetics (9% of stays with an allied health principal procedure) and occupational therapy (10%).



Source: Table A9.

Figure 4.4: Type of allied health intervention reported as principal procedure, by dementia status of patient, multi-day hospital stays for HDS patients, 2006–07 (standardised per cent, stays with allied health intervention as the principal procedure)

Table 4.4: Multi-day hospital stays, principal procedure after admission by dementia status, for HDS patients, 2006–07

Principal procedure (ICD-10-AM blocks)	Observed			Standardised[(a)]	
	With dementia	Without dementia	Total	With dementia	Without dementia
With a procedure reported					
Procedures on nervous system (1–86)	0.8	1.7	1.6	1.5	1.7
Procedures on endocrine system (110–129)	—	0.5	0.4	0.1	*0.5
Procedures on eye and adnexa(160–256)	0.4	1.2	1.1	0.3	*1.2
Procedures on ear and mastoid process (300–333)	—	0.2	0.1	—	*0.2
Procedures on nose, mouth and pharynx (370–422)	0.2	0.7	0.7	0.3	*0.7
Dental services (450–490)	0.1	0.1	0.1	0.1	0.1
Procedures on respiratory system (520–569)	1.2	2.5	2.4	1.8	2.5
Procedures on cardiovascular system (600–767)	2.2	9.0	8.3	2.7	*8.7
Procedures on blood and blood-forming organs (800–817)	0.2	0.6	0.6	0.2	*0.6
Procedures on digestive system (850–1011)	5.4	13.1	12.3	6.6	*12.8
Procedures on urinary system (1040–1129)	2.2	3.6	3.4	2.7	*3.5
Procedures on male genital organs (1160–1203)	0.4	1.6	1.5	0.5	*1.6
Gynaecological procedures (1240–1299)	0.2	1.6	1.4	0.3	*1.5
Procedures on musculoskeletal system (1360–1579)	8.2	9.6	9.5	6.7	*9.5
Procedures on pelvis/hip (1476–1493)	5.6	2.5	2.8	3.7	*2.6
Dermatological and plastic procedures (1600–1718)	2.2	2.6	2.6	1.8	*2.7
Procedures on breast (1740–1759)	0.1	0.8	0.7	0.2	*0.8
Chemotherapeutic and radiation oncology procedures (1786–1799)	—	0.3	0.2	—	*0.3
Non-invasive, cognitive and other interventions, nec (1820–1922, not 1916)	8.4	8.2	8.2	8.4	8.2
Allied health (1916)	35.0	20.7	22.1	33.1	*21.5
Imaging services (1940–2016)	32.8	21.5	22.6	32.8	*21.8
Computerised tomography of brain (1952–1957)	23.1	8.3	9.8	23.2	*8.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**29,281**	**266,776**	**296,057**	..	..
All					
With procedure	76.8	72.3	72.7	75.8	72.5
None given	23.2	27.7	27.3	24.2	27.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,121**	**368,842**	**406,963**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes
1. Table is based on first episode in a stay and excludes cases with missing principal procedure (1,576).
2. Percentages may not sum to 100% due to rounding.

nec not elsewhere classified.

4.6 Elapsed length of stay

The elapsed length of a hospital stay is the number of days between the dates of admission into, and discharge from, the hospital system. This is different from the 'bed days' measure used in analyses based on hospital episodes (AIHW 2008) as all changes in care type and transfers between hospitals are combined and no adjustment is made for absences on hospital leave or hospital visits.

On average, people with dementia had longer stays than people without dementia. The mean elapsed time in hospital—or elapsed length of stay (ELOS)—for stays for people with dementia was twice that for people without dementia: 18.3 compared with 9.1 days. More than half of all multi-day stays for people with dementia lasted at least 1 week, compared with just over one-third for people without dementia (Table 4.5). The mean and median ELOS presented here for people with dementia are shorter than earlier estimates of bed days based on hospital episodes (AIHW 2007:186). This is despite amalgamation of transfers. The reason is that all stays for people with dementia are included in the calculations, and not just those which included a diagnosis of dementia (see AIHW 2012b for examination of this issue).

Table 4.5: Multi-day hospital stays, by elapsed time in hospital and dementia status, for HDS patients, 2006–07 (per cent)

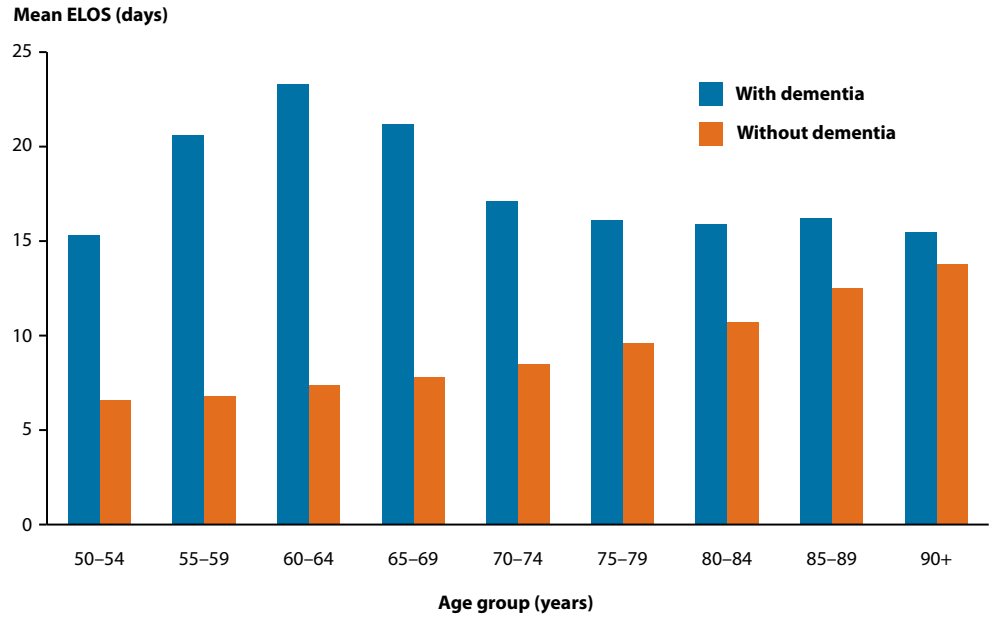
	Observed			Standardised[(a)]	
ELOS	With dementia	Without dementia	Total	With dementia	Without dementia
1 to 2 days	20.8	34.9	33.6	*22.5	34.3
3 to 6 days	24.7	29.7	29.2	*24.6	29.6
1 to < 5 weeks	43.7	31.1	32.2	*40.8	31.6
5 to < 13 weeks	9.0	3.8	4.3	*9.4	4.0
>=13 weeks	1.8	0.5	0.7	*2.6	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**	..	..
Mean (days)	16.5	8.9	9.6	*18.3	9.1
Median (days)	7	4	4	‡7	4
90th percentile (days)	36	20	21	‡39	20

* Significantly different at .001 level when comparing patients with and without dementia.

‡ Not specifically tested, but distribution significantly different within each age group (see Table A10).

(a) Age-sex standardised. The standard distribution was derived from multi-day HDS stays.

People with dementia had longer mean ELOSs within all age groups (Figure 4.5). In general, mean ELOS increased with age for people without dementia; however, for people with dementia, ELOS peaked in the 60–64 age group, levelling off after 75 years of age. Closer examination of ELOS median and 90th percentile patterns showed that the high mean ELOS for younger people was driven by a small proportion with very long stays (Table A10). There are likely to be a number of factors contributing to this finding. A higher proportion of younger people with dementia are admitted due to behavioural problems, and at site visits associated with the project it was noted that both community and residential services to support such patients were difficult to access. Also, the greater differentiation in dementia type seen for younger patients suggests that more time may be spent on assessment and diagnosis for younger patients with dementia. In addition, it is possible that some of the younger patients had complex medical comorbidity affecting ELOS, and that for older patients with dementia, other health conditions were determining hospital treatment.



Source: Table A10.

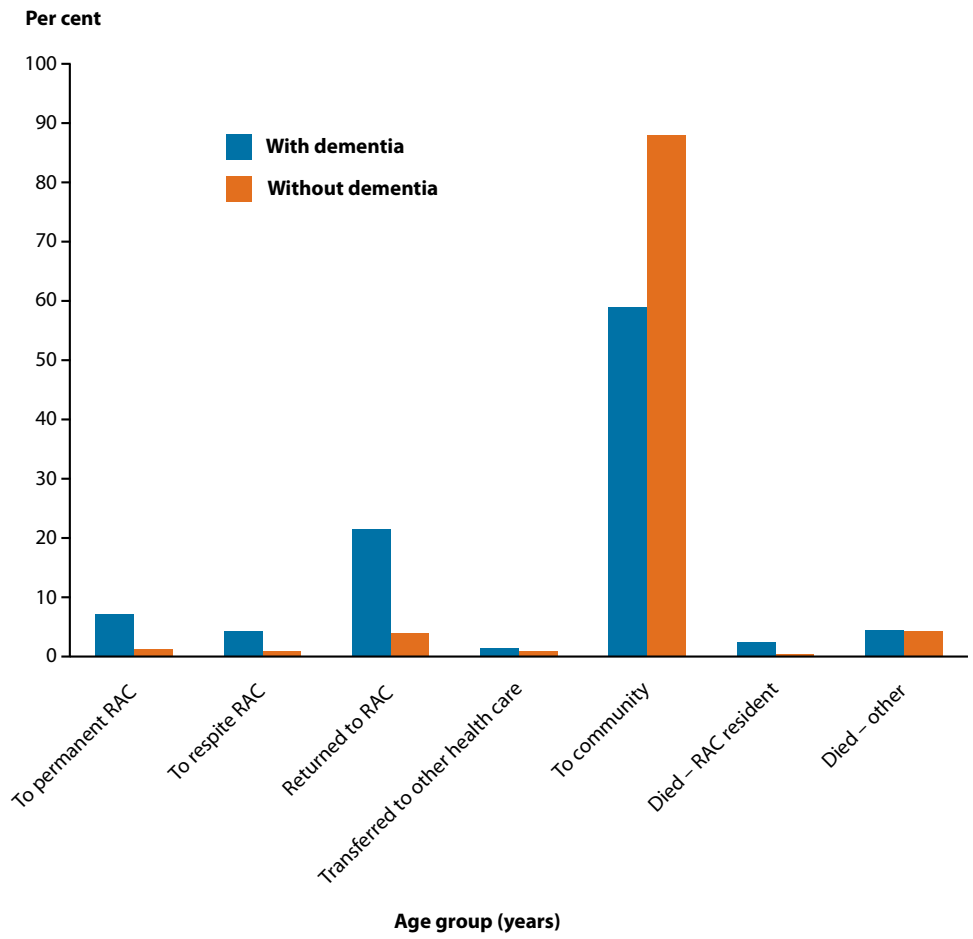
Figure 4.5: Mean ELOS for multi-day stays, HDS patients, 2006–07

4.7 Destination on discharge

APDC records contain data on destination on discharge. However, there are limitations with these data as people returning to their usual residence are recorded as going to their own accommodation, irrespective of whether that accommodation is in the community or an institution. Also, in practice, hospital coding does not always differentiate between people going back to residential care and those moving into such care from hospital; that is, a person's 'usual residence' upon which the coding is based is not consistently that before or after the hospital stay (AIHW: Karmel & Rosman 2007). To overcome these shortcomings, data linkage between hospital stay and residential aged care (RAC) service use data has been used to identify post-hospital destination more reliably and in more detail (see AIHW 2012b).

The differences in the destination mix for patients with and without dementia are stark (Figure 4.6) (Table A11). Patients with dementia were much more likely to transfer to residential care on leaving hospital (11% versus 2%); nearly two-thirds of these admissions were to permanent RAC, compared with just over one-half of those for people without dementia. In addition, patients with dementia were more than 5 times more likely than others to be returning to their home in permanent care (22% versus 4%). Even after allowing for different age-sex profiles, stays for patients with dementia were more likely to end in death than others (7% versus 5%). Patients with dementia who died in hospital were more likely to have been aged care residents than patients without dementia who died in hospital.

Despite the relatively large proportions of dementia patients going to residential care, about half (48% observed, 59% standardised) of patients with dementia returned to live in the community when they left hospital.



Source: Table A11.

Figure 4.6: Discharge destination following multi-day stays, HDS patients, 2006–07 (per cent)

4.8 Re-admission

Re-admissions into hospital were examined by looking at stays that ended in the first 6 months of 2006–07 and identifying re-admissions within 3 months. This was done to allow for re-admission into long hospital stays, noting that relatively few hospital stays (1%) were longer than 3 months (Table 4.5). However, people with dementia were more likely to have long stays than others, so under-identification of re-admissions is likely to be slightly higher for people with dementia.

As expected from their higher average numbers of stays per person (Table A3), patients with dementia were more likely to have a re-admission within 3 months than others. This was true both for any re-admission and for re-admission to another multi-day stay (Table A12 and Table 4.6).

Overall, 45% of people with dementia had a re-admission into another multi-day stay within 3 months of a multi-day stay, compared with 32% of people without dementia (Table 4.6). Among those who were re-admitted, 11% were readmitted within a day of discharge and, overall, 60% were re-admitted within 4 weeks; patients with and without dementia had similar re-admission patterns in terms of time between discharge and re-admission.

Table 4.6: Re-admission to a multi-day stay after a multi-day hospital stay, by time to re-admission and dementia status, hospital stays ending in 1 July 2006 – 31 December 2006 for HDS patients (per cent)

	Observed			Standardised[(a)]	
Days to next admission	With dementia	Without dementia	Total	With dementia	Without dementia
With a re-admission within 3 months					
Same day	8.5	7.2	7.4	8.0	7.3
Next day	3.9	3.5	3.6	4.0	3.5
2 to 7 days	15.4	16.2	16.1	15.5	16.1
8 to 28 days	30.7	32.4	32.2	31.8	32.4
29 to 91 days	41.4	40.7	40.8	40.7	40.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**8,038**	**60,197**	**68,235**	..	..
All					
With a re-admission within 3 months	39.9	31.8	32.6	*45.1	32.0
Next admission later, or never	60.1	68.2	67.4	54.9	68.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**20,170**	**189,349**	**209,519**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

4.9 Conclusion

In New South Wales in 2006–07, people with dementia were more likely than others to have spent at least one night in public hospital. Hospital stays for people with dementia were characterised by more transfers between hospitals and more changes in care type—possibly involving moves between wards. Such moves are potentially problematic for a group with heightened sensitivity and reaction to changes in environment.

People with and without dementia also had different reasons for being admitted into hospital: people with dementia were more likely to be admitted because of non-dementia mental, behavioural or nervous system disorders, or due to injury or poisoning, and less likely because of neoplasms or circulatory diseases. People with dementia were 50% more likely to have allied health or imaging services as their principal procedure. Outcomes as measured by length of stay, mortality, transfer to residential aged care, and re-admission to hospital within 3 months were all poorer for people with dementia.

Appendix tables

Table A1: ICD–10–AM codes identifying dementia

Code	ICD–10–AM description	Dementia type for HDS analysis
F00	Dementia in Alzheimer's disease (G30.-+)	Alzheimer disease
F00.0	Dementia in Alzheimer's disease with early onset (G30.0+)	Alzheimer disease
F00.1	Dementia in Alzheimer's disease with late onset (G30.1+)	Alzheimer disease
F00.2	Dementia in Alzheimer's disease, atypical or mixed type (G30.8+)	Alzheimer disease
F00.9	Dementia in Alzheimer's disease, unspecified (G30.9+)	Alzheimer disease
G30	Alzheimer's disease	Alzheimer disease
G30.0	Alzheimer's disease with early onset	Alzheimer disease
G30.1	Alzheimer's disease with late onset	Alzheimer disease
G30.8	Other Alzheimer's disease	Alzheimer disease
G30.9	Alzheimer's disease, unspecified	Alzheimer disease
F01	Vascular dementia	Vascular dementia
F01.0	Vascular dementia of acute onset	Vascular dementia
F01.1	Multi-infarct dementia	Vascular dementia
F01.2	Subcortical vascular dementia	Vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia	Vascular dementia
F01.8	Other vascular dementia	Vascular dementia
F01.9	Vascular dementia, unspecified	Vascular dementia
F02.3	Dementia in Parkinson's disease (G20+)	Parkinson and/or Lewy bodies
G31.3	Lewy body disease	Parkinson and/or Lewy bodies
F05.1	Delirium superimposed on dementia	Dementia with delirium
G31	Other degenerative diseases of nervous system, not elsewhere classified	Other degenerative dementia
G31.0	Circumscribed brain atrophy	Other degenerative dementia
G31.1	Senile degeneration of brain, not elsewhere classified	Other degenerative dementia
G31.8	Other specified degenerative diseases of nervous system	Other degenerative dementia
G31.9	Degenerative disease of nervous system, unspecified	Other degenerative dementia
F02	Dementia in other diseases classified elsewhere	Other dementia
F02.0	Dementia in Pick's disease (G31.0+)	Other dementia
F02.1	Dementia in Creutzfeldt-Jakob disease (A81.0+)	Other dementia
F02.2	Dementia in Huntington's disease (G10+)	Other dementia
F02.4	Dementia in human immunodeficiency virus (HIV) disease (B22.0+)	Other dementia
F02.8	Dementia in other specified diseases classified elsewhere	Other dementia
G31.2	Degeneration of nervous system due to alcohol	Other degenerative dementia
F03	Unspecified dementia	Unspecified dementia

- Symbol denotes any digit.

+ Symbol denotes a code describing the aetiology or underlying cause of a disease.

Note: Where codes F02 or F02.8 were reported, where possible secondary diagnoses were examined to determine the type of dementia more precisely.

Table A2: Patients: sex and age by dementia status, HDS patients 2006–07 (per cent)

Sex	Age at 1 July 2006	Patient dementia status		Total	Prevalence of dementia	
		With dementia	Without dementia		Within patient group	Population[(a)]
		Per cent			Per cent	
Male		39.9	49.5	48.7	6.7	3.1
Female		60.1	50.5	51.3	9.6	5.0
Total %		**100.0**	**100.0**	**100.0**	**8.2**	**4.1**
Total number		**20,793**	**231,926**	**252,719**	**..**	**..**
Male	50–54	1.2	11.4	10.7	0.8	0.1
	55–59	1.4	13.3	12.5	0.8	0.3
	60–64	3.0	13.5	12.8	1.6	1.5
	65–69	4.7	14.0	13.4	2.4	2.4
	70–74	9.5	14.2	13.9	4.6	3.9
	75–79	19.5	14.5	14.9	8.9	6.8
	80–84	27.8	11.0	12.1	15.5	11.5
	85–89	21.8	5.7	6.7	21.8	19.1
	90+	11.1	2.4	3.0	25.1	37.2
Total %		*100.0*	*100.0*	*100.0*	*6.7*	*3.1*
Total number		*8,304*	*114,769*	*123,073*	..	..
Median age (years)		*81.9*	*69.2*	*70.2*	..	..
Female	50–54	0.4	10.2	9.2	0.4	0.0
	55–59	0.7	11.2	10.2	0.7	0.1
	60–64	1.2	11.0	10.0	1.2	1.6
	65–69	2.5	11.7	10.8	2.2	2.6
	70–74	5.7	12.6	11.9	4.6	4.4
	75–79	14.2	14.6	14.6	9.4	7.7
	80–84	26.9	14.0	15.3	17.0	13.7
	85–89	27.7	9.3	11.1	24.1	23.4
	90+	20.7	5.4	6.9	28.8	47.9
Total %		*100.0*	*100.0*	*100.0*	*9.6*	*5.0*
Total number		*12,489*	*117,157*	*129,646*	..	..
Median age (years)		*84.8*	*72.4*	*74.1*	..	..
All	50–54	0.7	10.8	9.9	0.6	0.1
	55–59	1.0	12.2	11.3	0.7	0.2
	60–64	1.9	12.2	11.4	1.4	1.6
	65–69	3.4	12.8	12.1	2.3	2.5
	70–74	7.2	13.4	12.9	4.6	4.2
	75–79	16.3	14.6	14.7	9.1	7.3
	80–84	27.3	12.5	13.7	16.3	12.8
	85–89	25.4	7.5	9.0	23.3	21.9
	90+	16.8	3.9	5.0	27.7	45.1
Total %		**100.0**	**100.0**	**100.0**	**8.2**	**4.1**
Total number		**20,793**	**231,926**	**252,719**	**..**	**..**
Median age (years)		**83.7**	**70.7**	**72.1**	**..**	**..**

(a) Population prevalence by age and sex from AIHW 2012a. Prevalence estimates across age and/or sex use estimated resident population at 30 June 2006 for New South Wales from ABS Australian demographic statistics series (for example, ABS 2008).

Note: Percentages may not sum to 100% due to rounding.

Table A3: Patients: hospital stays per HDS patient, by age and dementia status, 2006–07

	50–64	65–74	75–84	85+	All[(a)]
With dementia					
Multi-day stays					
With one multi-day stay only (%)	*50.9	*51.1	*54.3	*57.5	55.2 (*52.5)
Mean number	*2.3	*2.0	*1.9	1.7	1.8 (*2.0)
Same-day stays					
With a same-day stay (%)	24.1	*21.2	*18.2	*14.9	17.3 (*20.9)
With one stay (for those with a stay) (%)	65.6	70.4	*74.5	*78.4	75.0 (70.8)
Mean number (for those with a stay)	4.6	6.5	3.1	*1.6	3.1 (4.5)
Number	**759**	**2,201**	**9,062**	**8,771**	**20,793**
Without dementia					
Multi-day stays					
With one multi-day stay only (%)	71.7	66.8	61.7	60.6	66.4 (66.1)
Mean number	1.5	1.6	1.7	1.7	1.6 (1.6)
Same-day stays					
With a same-day stay (%)	24.8	27.6	26.6	18.2	25.3 (25.1)
With one stay (for those with a stay) (%)	70.5	67.1	66.0	72.0	68.4 (68.4)
Mean number (for those with a stay)	4.0	4.7	4.1	2.5	4.1 (4.1)
Number	**81,738**	**60,840**	**62,855**	**26,493**	**231,926**
All					
Multi-day stays					
With one multi-day stay only (%)	71.5	66.2	60.7	59.8	65.5
Mean number	1.5	1.6	1.7	1.7	1.6
Same-day stays					
With a same-day stay (%)	24.8	27.4	25.5	17.4	24.6
With one stay (for those with a stay) (%)	70.5	67.2	66.8	73.3	68.8
Mean number (for those with a stay)	4.0	4.7	4.0	2.3	4.1
Number	**82,497**	**63,041**	**71,917**	**35,264**	**252,719**

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Brackets contain age-sex standardised value. The standard distribution was derived from all HDS stays.

Note: Due to the scope of the study, all HDS patients had at least one multi-day stay.

Table A4: Patients: hospital stays per HDS patient ending in the 12 months before the end of the last stay in 2006–07, by age and dementia status, 2006–07

	50–64	65–74	75–84	85+	All	Standardised[(a)]
With dementia						
Multi-day stays						
With one multi-day stay only (%)	36.5	36.9	40.2	41.9	40.4	*38.2
Mean number	2.84	2.47	2.25	2.14	2.25	*2.51
Same-day stays						
With a same-day stay (%)	30.0	26.7	23.7	20.3	22.8	*26.7
With one stay (for those with a stay) (%)	62.7	69.2	70.1	76.1	71.9	68.1
Mean number (for those with a stay)	4.55	5.81	2.99	1.67	2.92	4.14
Number	**759**	**2,201**	**9,062**	**8,771**	**20,793**	..
Without dementia						
Multi-day stays						
With one multi-day stay only (%)	64.1	57.4	51.0	48.1	57.0	56.5
Mean number	1.69	1.83	1.98	2.01	1.84	1.85
Same-day stays						
With a same-day stay (%)	30.1	34.1	33.7	24.1	31.5	31.3
With one stay (for those with a stay) (%)	67.7	63.5	62.6	68.1	65.1	65.1
Mean number (for those with a stay)	3.90	4.48	3.93	2.57	3.95	3.92
Number	**81,738**	**60,840**	**62,855**	**26,493**	**231,926**	..
All						
Multi-day stays						
With one multi-day stay only (%)	63.8	56.7	49.7	46.6	55.6	..
Mean number	1.70	1.85	2.01	2.04	1.87	..
Same-day stays						
With a same-day stay (%)	30.1	33.9	32.4	23.2	30.8	..
With one stay (for those with a stay) (%)	67.7	63.7	63.3	69.8	65.5	..
Mean number (for those with a stay)	3.90	4.52	3.84	2.37	3.89	..
Number	**82,497**	**63,041**	**71,917**	**35,264**	**252,719**	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Note: Due to the scope of the study, all HDS patients had at least one multi-day stay.

Table A5: Hospital stays, by same-day status and dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
	With dementia	Without dementia	Total	With dementia	Without dementia
Multi-day stay	77.3	60.6	61.8	*70.6	61.0
Same-day stay	22.7	39.4	38.2	29.4	39.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**49,379**	**611,583**	**660,962**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Table A6: Hospital stays, by same-day status, hospital sector and dementia status, for HDS patients 2006–07 (per cent)

	Multi-day stays		
Sector	With dementia	Without dementia	Total
Observed			
Mixed sector[a]	3.1	3.5	3.5
Private only	4.1	6.7	6.5
Public only	92.8	89.8	90.0
Total	**100.0**	**100.0**	**100.0**
Total number	**38,184**	**370,355**	**408,539**
Standardised[b]			
Mixed sector	*2.3	3.6	..
Private only	*3.3	6.8	..
Public only	*94.4	89.6	..
Total	**100.0**	**100.0**	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Stay includes episodes in both public and private hospitals.

(b) Age-sex standardised. The standard distribution was derived from all HDS stays.

Table A7: Multi-day hospital stays, by principal diagnosis on admission by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
Principal diagnosis (ICD-10-AM codes)	With dementia	Without dementia	Total	With dementia	Without dementia
Dementia	6.4	..	0.6	..	..
Total number	**38,046**	**369,534**	**407,580**	..	..
Excluding dementia					
Certain infectious & parasitic (A00-B99)	2.6	1.7	1.8	*2.2	1.7
Neoplasms (C00-D48)	4.3	10.1	9.6	*4.2	10.0
Blood & blood forming organs (D50-D89)	1.5	1.4	1.4	*1.1	1.5
Endocrine, nutritional, metabolic & immunity (E00-E90)	3.8	2.7	2.8	*4.5	2.7
Delirium, not F05.1 (that is, not Delirium superimposed on dementia)	1.1	0.1	0.2	*1.0	0.2
Other mental and behavioural disorders (excluding dementia) (F00-F99, but not in Table A1)	3.0	2.4	2.5	*8.1	2.3
Other nervous system (G00-G98, but not in Table A1)	3.4	2.4	2.5	*5.4	2.4
Eye/ear/congenital (H00-H59, H60-H95, Q00-Q99)	0.5	1.4	1.3	*0.4	1.4
Circulatory system (I00-I99)	14.7	18.7	18.3	*13.0	18.9
Respiratory system (J00-J99)	11.3	9.4	9.6	10.2	9.5
Digestive system (K00-K93)	7.8	11.7	11.3	*8.7	11.5
Skin & subcutaneous tissue (L00-L99)	2.6	2.1	2.1	2.6	2.1
Musculoskeletal system (M00-M99)	3.4	6.6	6.3	*3.5	6.6
Genitourinary system (N00-N99)	7.3	5.7	5.9	6.2	5.7
Symptoms, signs & ill-defined conditions (R00-R99)	10.9	10.5	10.6	11.0	10.5
Injury and poisoning(S00-T98)	*17.9*	*10.2*	*10.9*	**14.2*	*10.5*
Fractures	9.9	4.2	4.7	*7.0	4.4
Other injury/poisoning	8.0	6.0	6.2	*7.2	6.1
Factors influencing health status & contact with health services (Z00-Z99)	3.7	2.7	2.8	*3.8	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**35,612**	**369,534**	**405,146**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay and excludes cases with missing principal diagnosis (953) or pregnancy or peri-natal diagnoses (6).
2. Percentages may not sum to 100% due to rounding.

Table A8: Multi-day hospital stays, with injury/poisoning as principal diagnosis on admission by dementia status, for HDS patients 2006–07 (per cent)

Principal diagnosis (ICD-10-AM codes)	Observed			Standardised[(a)]	
	With dementia	Without dementia	Total	With dementia	Without dementia
Fractures					
Head injuries	1.9	3.5	3.2	*1.9	3.3
Neck, cervical spine and neck blood vessel injuries	1.3	1.4	1.4	1.6	1.4
Injuries to thorax and thoracic spine	6.9	10.8	10.0	*7.2	10.8
Injuries of abdomen, lower back and pelvis	13.5	10.8	11.3	10.7	11.4
Injuries of shoulder, arm or hand	15.8	29.9	27.3	*20.9	28.6
Injuries of hip, leg, ankle and foot	60.5	43.6	46.7	*57.7	44.5
Other injury/poisoning	0.1	0.1	0.1	0.0	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**3,538**	**15,692**	**19,230**	..	..
Other injury/poisoning					
Head injuries	35.9	16.2	18.4	*33.7	16.9
Neck, cervical spine and neck blood vessel injuries	1.0	1.2	1.2	2.3	1.2
Injuries to thorax and thoracic spine	2.5	2.8	2.8	2.9	2.8
Injuries of abdomen, lower back and pelvis	6.2	4.3	4.5	5.6	4.4
Injuries of shoulder, arm or hand	10.4	10.6	10.6	10.5	10.5
Injuries of hip, leg, ankle and foot	19.6	13.5	14.2	15.1	14.2
Poisonings by therapeutic drugs	3.1	5.0	4.8	6.3	4.7
Complications of therapeutic procedures	15.8	38.3	35.7	*16.3	37.3
Other injury/poisoning	5.4	8.2	7.9	7.4	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**2,858**	**22,346**	**25,204**	..	..
All					
Head injuries	17.1	10.9	11.8	*18.5	11.2
Neck, cervical spine and neck blood vessel injuries	1.2	1.3	1.3	2.1	1.3
Injuries to thorax and thoracic spine	4.9	6.1	5.9	5.1	6.2
Injuries of abdomen, lower back and pelvis	10.3	7.0	7.4	8.1	7.3
Injuries of shoulder, arm or hand	13.4	18.6	17.8	*15.1	18.2
Injuries of hip, leg, ankle and foot	42.3	25.9	28.3	*35.5	27.0
Poisonings by therapeutic drugs	1.4	2.9	2.7	3.4	2.7
Complications of therapeutic procedures	7.1	22.5	20.3	*8.3	21.4
Other injury/poisoning	2.4	4.8	4.5	3.9	4.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**6,396**	**38,038**	**44,434**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay.
2. Percentages may not sum to 100% due to rounding.

Table A9: Multi-day hospital stays, with principal procedure of allied health, by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[(a)]	
Principal procedure	With dementia	Without dementia	Total	With dementia	Without dementia
Allied health intervention, dietetics	7.6	9.2	8.9	8.3	8.9
Allied health intervention, occupational therapy	10.4	10.4	10.4	10.1	10.6
Allied health intervention, pastoral care	1.9	3.3	3.1	1.9	*3.2
Allied health intervention, pharmacy	2.4	3.8	3.6	2.4	*3.8
Allied health intervention, physiotherapy	46.2	51.4	50.6	42.5	*51.9
Allied health intervention, psychology	0.3	0.5	0.4	0.7	0.4
Allied health intervention, social work	16.3	14.6	14.8	19.1	*14.4
Allied health intervention, speech pathology	11.9	3.6	4.9	11.7	*3.7
Other allied health	3.0	3.2	3.1	3.3	3.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**10,243**	**55,228**	**65,471**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays. Standardisation used 10-year age groups (except for the 50–64 and 85+ groups).

Notes

1. Table is based on first episode in a stay and excludes cases with missing principal procedure (1,576).
2. Percentages may not sum to 100% due to rounding.

Table A10: Multi-day hospital stays, elapsed length of stay in hospital by dementia status, for HDS patients, 2006–07 (days)

	With dementia	Without dementia	All
Mean			
50–54*	15.3	6.6	6.7
55–59*	20.6	6.8	6.9
60–64*	23.3	7.4	7.7
65–69*	21.2	7.8	8.2
70–74*	17.1	8.5	8.9
75–79*	16.1	9.6	10.3
80–84*	15.9	10.7	11.6
85–89*	16.2	12.5	13.4
90+*	15.5	13.8	14.3
Total	**16.5**	**8.9**	**9.6**
Median			
50–54	5	3	3
55–59	7	3	3
60–64	7	3	4
65–69	7	4	4
70–74	7	4	4
75–79	7	5	5
80–84	8	5	6
85–89	8	6	6
90+	7	7	7
Total	**7**	**4**	**4**
90th percentile			
50–54	34	14	14
55–59	50	14	14
60–64	49	15	16
65–69	38	17	17
70–74	39	19	20
75–79	36	21	23
80–84	36	25	27
85–89	35	29	31
90+	34	31	32
Total	**36**	**20**	**21**

* Significantly different at .001 level when comparing patients with and without dementia using Kolmogorov-Smirnov test to compare distribution of length of stay.

Note: Age as at 1 July 2006. Table is not standardised because it gives ELOS by age.

Table A11: Discharge destination after a multi-day hospital stay, by dementia status, for HDS patients, 2006–07 (per cent)

	Observed			Standardised[a]	
	With dementia	Without dementia	Total	With dementia	Without dementia
To residential aged care	*13.9*	*2.1*	*3.2*	**11.4*	*2.3*
To permanent RAC	8.8	1.2	1.9	*7.2	1.3
To respite RAC	5.1	0.9	1.3	*4.3	1.0
Returned to RAC	29.1	3.6	6.0	*21.5	4.0
Transferred to other health-care accommodation[b]	1.2	0.9	0.9	*1.4	0.9
To community[c]	47.5	88.8	84.9	*58.9	87.9
Died	*8.4*	*4.6*	*5.0*	**6.8*	*4.8*
Died—RAC resident[d]	3.7	0.4	0.7	*2.4	0.5
Died—other	4.6	4.2	4.2	4.4	4.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**38,182**	**370,334**	**408,516**	..	..

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

(b) Includes unidentified hospital transfers.

(c) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC).

(d) Includes patients admitted while a permanent RAC resident. Excludes people discharged directly to hospital without any RAC hospital leave.

Notes

1. Destination has been derived using data linkage with RAC data—see AIHW 2012b.
2. Table excludes stays with unknown destination.
3. Component percentages may not sum to total due to rounding.

Table A12: Any re-admission after a multi-day hospital stay, by time to re-admission and dementia status, hospital stays ending in 1 July 2006 – 31 December 2006 for HDS patients (per cent)

	Observed			Standardised[(a)]	
Days to next admission	With dementia	Without dementia	Total	With dementia	Without dementia
With a re-admission within 3 months					
Same day	8.2	6.5	6.7	7.8	6.6
Next day	4.3	4.3	4.3	4.8	4.2
2 to 7 days	15.9	17.4	17.2	16.8	17.3
8 to 28 days	31.2	31.6	31.5	32.1	31.5
29 to 91 days	40.4	40.3	40.3	38.5	40.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**8,730**	**71,767**	**80,497**	. .	. .
All					
With a re-admission within 3 months	43.3	37.9	38.4	*48.7	38.0
Next admission later, or never	56.7	62.1	61.6	51.3	62.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number	**20,170**	**189,349**	**209,519**	. .	. .

* Significantly different at .001 level when comparing patients with and without dementia.

(a) Age-sex standardised. The standard distribution was derived from all HDS stays.

Note: Percentages may not sum to 100% due to rounding.

Acknowledgments

Authorship

The authors of this report were Rosemary Karmel and Phil Anderson of the Data Linkage Unit at the Australian Institute of Health and Welfare (AIHW).

Contributors

The Hospital Dementia Services Project was conceived and designed by Diane Gibson (now of the University of Canberra), Brian Draper (University of New South Wales), Cathy Hales (now of the Department of Education, Employment and Workplace Relations) and Ann Peut, Rosemary Karmel and Phil Anderson (all of the AIHW). Project partners are NSW Health, Alzheimer's Australia, Alzheimer's Australia NSW, the Aged & Community Services Association of NSW & ACT Incorporated, and the Benevolent Society.

The project team thanks the Department of Health and Ageing for providing aged care data for this project, NSW Health for providing a special extract from the Admitted Patient Data Collection, and the New South Wales Centre for Health Record Linkage for providing associated patient linkage keys.

Kara Tew and Cath Lawrence assisted with the data linkage undertaken at the AIHW. Brian Draper, Diane Gibson, Ann Peut and Natalie Chan provided valuable comment on and input to the writing of the paper.

Funding

This study is funded by the National Health and Medical Research Council. Chief Investigators are Diane Gibson, Brian Draper, Rosemary Karmel, and Ann Peut.

Abbreviations

AIHW	Australian Institute of Health and Welfare
APDC	Admitted Patient Data Collection
CT	computerised tomography
ELOS	elapsed length of stay
HDS	Hospital Dementia Services
ICD–10–AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
LOS	length of stay
RAC	residential aged care

Symbols

—	nil or rounded to zero
. .	not applicable
n.a.	not available
nec	not elsewhere classified
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

References

ABS (Australian Bureau of Statistics) 2008. Australian demographic statistics. ABS cat. no. 3101.0. Canberra: ABS.

ACEMA (Aged Care Evaluation and Management Advisors) 2002. Examination of length of stay for older persons in acute and sub-acute sectors. Canberra: Care of Older Australians Working Group.

AIHW (Australian Institute of Health and Welfare) 2006. Data linkage and protecting privacy: a protocol for linking between two or more data sets held within the Australian Institute of Health and Welfare. Canberra: AIHW. Viewed 28 July 2006, <http://www.aihw.gov.au/dataonline/aihw_privacy_protection_protocols_data_linkage.pdf> .

AIHW 2007. Dementia in Australia: national data analysis and development. Cat. no. AGE 53. Canberra: AIHW.

AIHW 2008. Australian hospital statistics 2006–07. Health services series no. 31. Cat. no. HSE 55. Canberra: AIHW.

AIHW 2010. The Hospital Dementia Services Project. Canberra: AIHW. Viewed 11 October 2012, <http://www.aihw.gov.au/hospital-dementia-services-project/> .

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012a. Dementia in Australia. Cat. no. AGE 70. Canberra: AIHW.

AIHW 2012b. Deriving key patient variables: a Hospital Dementia Services technical paper. Cat. no. CSI 15. Canberra: AIHW.

AIHW: Karmel R, Hales C & Lloyd J 2007. Older Australians in hospital. AIHW bulletin no. 53. Cat. no. AUS 92. Canberra: AIHW.

AIHW: Karmel R & Rosman D 2007. Comparing name-based and event-based strategies for data linkage: a study linking hospital and residential aged care data for Western Australia. Data linkage series no. 3. Cat. no. CSI 3. Canberra: AIHW.

CHeReL (Centre for Health Record Linkage) 2009. Centre for Health Record Linkage. Sydney: CHeReL. Viewed 27 July 2010, <http://www.cherel.org.au/> .

Covinsky KE, Palmer RM, Fortinsky RH, Counsell SR, Stewart AL, Kresevic D et al. 2003. Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. Journal of the American Geriatrics Society 51:451–8.

Creditor MC 1993. Hazards of hospitalization of the elderly. Annals of International Medicine, 118:219–23.

Cunningham C 2006. Understanding challenging behaviour in patients with dementia. Nursing Standard 20:42–5.

Department of Ageing Disability and Home Care (DADHC) & NSW Health 2002. Future directions for dementia care and support in NSW 2001–2006. Sydney: Department of Ageing, Disability and Home Care.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1–10.

Fleming R, Forbes I & Bennett K 2003. Adapting the ward for people with dementia. Sydney: NSW Department of Health.

Foreman P & Gardner I 2005. Evaluation of Education and Training of Staff in Dementia Care and Management in Acute setting. Melbourne: Victorian Government Department of Human Services.

King B, Jones C & Brand C 2006. Relationship between dementia and length of stay of general medical patients admitted to acute care. Australasian Journal on Ageing 25:20–3.

McCusker J, Kakuma R & Abrahamowicz M 2002. Predictors of functional decline in hospitalised elderly patients: a systematic review. Journal of Gerontology: Medical sciences 57A.

NCCH (National Centre for Classification in Heath) 2000. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (2nd edn). Sydney: University of Sydney.

NCCH 2010. Australian coding standards (7th edn). Sydney: University of Sydney.

Nichol B, Lonergan J & Mould M 2000. The use of hospitals by older people: a casemix analysis. Canberra: Australian Department of Health and Aged Care.

NSW Department of Health 2007. Annual report 2006/07. Sydney: NSW Department of Health.

Sager M, Rudberg M, Jalaluddin M, Franke T, Inouye S, Landefeld S et al. 1996. Hospital Admission risk Profile (HARP): Identifying Older Patients at Risk for Functional Decline Following Acute Medical Illness and Hospitalization. American Geriatrics Society 44:251–7.

Thomas EJ & Brennan TA 2000. Incidence and types of preventable adverse events in elderly patients: population based review of medical records. British Medical Journal 320:741–4.

Torian L, Davidson E, Fulop G, Sell L & Fillit H 1992. The effect of dementia on acute care in a geriatric medical unit. International Psychogeriatrics 4:231–9.

Watkin L, Blanchard MR, Tookman A & Sampson EL 2012. Prospective cohort study of adverse events in older people admitted to the acute general hospital: risk factors and the impact of dementia. International Journal of Geriatric Psychiatry 27:76–82.

List of tables

List of figures

List of boxes

Other Hospital Dementia Services publications

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012. Deriving key patient variables: a Hospital Dementia Services technical paper. Canberra: AIHW.

Bail K & Draper B 2011. Blurring lines between acute and aged. Aged care Insite. Viewed 11 October 2012. <http://www.agedcareinsite.com.au/pages/section/article.php?s=Breaking+News&idArticle=22774>.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics 1–10.

Draper B, Karmel R, Gibson D & Peut A 2011. Alcohol related cognitive impairment in NSW hospital patients aged 50 years and over. Australian and New Zealand Journal of Psychiatry 45: 985–92.

Glossary

Elapsed length of stay: derived as difference in dates of admission into hospital and discharged from hospital. All changes in care type and transfers between hospitals are included (see 'hospital stay'). No adjustment is made for absences on hospital leave or hospital visits.

HDS patient: person aged 50 and over who had a completed stay in 2006-07 that included at least one night in a New South Wales public hospital.

Hospital episode: period in hospital of a particular care type in a particular hospital.

Hospital stay: the period from admission into the hospital system to discharge from the system, or death in hospital.

Hospital visit: a hospital episode in one hospital while admitted to another.

Multi-day stay: a hospital stay that includes at least one night in hospital.

Person with dementia: a patient with dementia recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007.

Same-day stay: a hospital stay starting and ending on the same date.

The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is *authoritative information and statistics to promote better health and wellbeing*.

bulletin 110

A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISBN 978-1-74249-368-8

Suggested citation

Australian Institute of Health and Welfare 2012. People with dementia in hospitals in New South Wales 2006–07 Bulletin no. 110. Cat. no. AUS 165. Canberra: AIHW.

Any enquiries about or comments on this publication should be directed to:
Communications, Media and Marketing Unit
Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Tel: (02) 6244 1032
Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au> for any amendments.

Australian Government
Australian Institute of Health and Welfare

Deriving key patient variables

A technical paper for the Hospital Dementia Services Project

DATA LINKAGE SERIES NO. 15

Australian Government
Australian Institute of Health and Welfare

Authoritative information and statistics to promote better health and wellbeing

DATA LINKAGE SERIES
Number 15

Deriving key patient variables

A technical paper for the Hospital Dementia Services Project

Australian Institute of Health and Welfare
Canberra
Cat. no. CSI 15

The Australian Institute of Health and Welfare is a major national agency which provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's mission is *authoritative information and statistics to promote better health and wellbeing*.

This publication is part of the Australian Institute of Health and Welfare's Data linkage series. A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISBN 978-1-74249-372-5

Suggested citation

Australian Institute of Health and Welfare 2012. Deriving key patient variables: a technical paper for the Hospital Dementia Services project. Data Linkage Series no. 15. Cat. no. CSI 15. Canberra: AIHW.

Australian Institute of Health and Welfare

Board Chair

Dr Andrew Refshauge

Director

David Kalisch

Any enquiries about or comments on this publication should be directed to:

Communications, Media and Marketing Unit

Australian Institute of Health and Welfare

GPO Box 570

Canberra ACT 2601

Tel: (02) 6244 1032

Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au> for any amendments.

Contents

Acknowledgments

Authorship

The authors of this report were Rosemary Karmel and Phil Anderson of the Data Linkage Unit at the Australian Institute of Health and Welfare (AIHW).

Contributors

The Hospital Dementia Services Project was conceived and designed by Diane Gibson (now of the University of Canberra), Brian Draper (University of New South Wales), Cathy Hales (now of the Department of Education, Employment and Workplace Relations) and Ann Peut, Rosemary Karmel and Phil Anderson (all of the AIHW). Project partners are NSW Health, Alzheimer's Australia, Alzheimer's Australia NSW, the Aged & Community Services Association of NSW & ACT Incorporated, and the Benevolent Society.

The project team thanks the Department of Health and Ageing for providing aged care data for this project, NSW Health for providing a special extract from the Admitted Patient Data Collection, and the New South Wales Centre for Health Record Linkage for providing associated patient linkage keys.

Kara Tew and Cath Lawrence assisted with the data linkage undertaken at the AIHW. Brian Draper, Diane Gibson, Ann Peut and Natalie Chan provided valuable comment on and input to the writing of the paper.

Funding

This study is funded by the National Health and Medical Research Council. Chief Investigators are Diane Gibson, Brian Draper, Rosemary Karmel, and Ann Peut.

Abbreviations

AIHW	Australian Institute of Health and Welfare
APDC	Admitted Patient Data Collection
ELOS	elapsed length of stay
FMR	false match rate
HDS	Hospital Dementia Services
ICD–10–AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
RAC	residential aged care

Symbols

–	nil or rounded to zero
. .	not applicable

Summary

The Hospital Dementia Services (HDS) Project is an innovative study which uses linked data to explore how hospital-based aged care and dementia services are related to hospital outcomes for people with dementia. The scope of the study is people aged 50 and over who had at least 1 night in a public hospital in New South Wales in 2006–07 (termed 'HDS patients').

This publication describes the approach taken to derive key hospital use variables employed in project analyses. Hospital use data for the HDS Project were provided by NSW Health from the New South Wales Admitted Patient Data Collection (APDC) and contained a unique patient identifier; episodes from both public and private hospitals were included. The report is a companion publication to *People with dementia in hospitals in New South Wales 2006–07* (AIHW 2012).

Stays versus episodes

Each record in the New South Wales APDC extract provided for the HDS Project relates to an episode of care within a hospital. Almost 14% of multi-day hospital episodes finishing in 2006–07 ended with the patient moving within the hospital system.

Episode dates and reported separation mode were used to combine episodes into hospital stays, where a hospital stay is defined as the period from admission into the hospital system to discharge from the hospital system, or death in hospital. On average, there were 1.18 episodes per multi-day stay for HDS patients. Just over 86% of stays consisted of just one episode, a further 3% had two or more episodes in the one hospital, with the remaining 11% including at least one transfer between hospitals. The average length of multi-day hospital stays is necessarily longer than the average length of multi-day episodes: 9.6 days compared with 8.3 days in 2006–07.

Identifying patients with dementia

Identifying patients with dementia is key for the HDS Project. For a diagnosis of dementia to be reported for a particular hospital episode, the medical diagnosis had to contribute to the care provided or resource use during the patient's hospital stay. To allow for the possibility of dementia being recorded for only a proportion of a patient's hospital episodes, patients in the HDS Project were identified as having dementia if dementia was recorded as a diagnosis for *any* hospital episode—in either a public or private hospital—ending in the 2-year period between 1 July 2005 and 30 June 2007. Using this definition, 9.3% of multi-day stays were identified as being for people with dementia, compared with 6.2% if using only data relating to a particular stay. Even using this approach, some patients with dementia may have remained unidentified.

Post-hospital destination

Previous studies have shown that there are inconsistencies in the APDC reported post-hospital destination, particularly for people moving between hospital and residential aged care (RAC). Therefore data linkage between hospital and RAC data sets has been used to identify post-hospital destination. Data linkage also allows the identification of people

returning to RAC, and aged care residents who die in hospital. The linkage process used for the HDS Project is described in this paper.

There is considerable discordance between events identified as new admissions into RAC from hospital using items reported in the hospital data, and those identified through data linkage. For example, only 46% of stays reported as ending in transfer to RAC were linked to an aged care admission, with 42% being matched to someone already living in RAC.

Analyses by post-hospital destination are affected by whether 'derived' rather than 'reported' post-hospital destination—and 'hospital stay' rather than 'hospital episode' data—are used. Analyses of elapsed length of stay are particularly affected. In addition, using diagnoses reported across a patient's hospital episodes over an extended period—as opposed to single episode—affects analyses of hospital use by people with particular conditions. The differences in results between using reported unlinked episode data and linked person-level data show that using linkage methods to enhance the data is justified. Furthermore, this report demonstrates the importance of using analytical data and methods that match the particular policy or research question being asked.

1 Background

The Hospital Dementia Services (HDS) Project is an innovative study that explores how hospital-based aged care and dementia services are related to outcomes for people with dementia who used a public hospital in New South Wales in 2006–07. It is a mixed methods study involving data linkage of existing routinely collected data sets to create a linked data set containing patient trajectories in hospitals and into residential aged care (RAC), a survey of all New South Wales public hospitals about hospital-based aged care and dementia-specific services, follow-up site visits in selected locations to obtain qualitative data on operational aspects of different hospital-based service models for patients with dementia, and a desk audit to measure the regional availability of key aged care program services (see AIHW 2010, 2011b for more details).

The data sets included in the project are:

- public and private hospital episodes ending between 1 July 2005 and 30 June 2007 from the New South Wales Admitted Patient Data Collection (APDC)
- RAC use and aged care program availability data contained in the Department of Health and Ageing's Aged and Community Care Management Information System
- Aged Care Assessment Program national minimum data set, 2006–07.

This publication describes the approaches taken to derive key hospital use variables used in the various analyses undertaken as part of the HDS Project. The effects on analysis are also examined.

2 Hospital patient data

Hospital use data for the HDS Project from the New South Wales APDC were provided by NSW Health and included all public and private hospital episodes ending between 1 July 2005 and 30 June 2007. The data extract contained a unique patient identifier derived by the New South Wales Centre for Health Record Linkage (CHeReL 2009).

The HDS analysis population is people aged 50 and over by 1 July 2006 who had a completed hospital stay in 2006–07 that included at least 1 night in a New South Wales public hospital. A total of 252,719 people—termed HDS patients—on the APDC data set met these conditions. All stays for these patients in New South Wales hospitals, including those in private hospitals and same-day stays in any hospital, are included in the analysis.

2.1 Deriving hospital stays

Each record in the New South Wales APDC extract provided for the HDS Project related to an episode of care within a hospital. An episode of care for an admitted patient (or inpatient) can be:

- a total hospital stay—from admission into hospital to discharge from hospital or death
- a portion of a hospital stay beginning and/or ending in a change of type of care (for example, from acute care to rehabilitation). Episodes ending with a change in care type in the same hospital are reported as ending in a statistical discharge.
- a portion of a hospital stay beginning and/or ending in a transfer from/to another hospital.

In New South Wales hospitals, there were 490,300 multi-day episodes ending in 2006–07 for people aged 50 and over as at 1 July 2006; 3.7% of these episodes were reported as ending with a change in care type (statistical discharge) and 10% as ending with a transfer to another hospital. In addition, there were 485,800 same-day episodes; 4.7% of these ended with a hospital transfer and just 0.1% ended with a change in care type.

For HDS analyses, the main unit of analysis is the hospital stay, defined as the period from admission into the hospital system to discharge from the hospital system, or death in hospital. A hospital stay can therefore:

- start and end on the same day (a same-day stay)
- include at least 1 night in hospital (a multi-day stay)
- include one or more transfers between hospitals (that is, a multi-episode stay)
- include changes in care type within a hospital (that is, a multi-episode stay)
- include an episode as an admitted patient in one hospital while admitted to another (termed a 'visit')
- include any combination of the above.

Consequently, a hospital stay may comprise one or more hospital episodes. This approach of using hospital stays is different from that taken for previous analyses of hospital care, which have generally been episode based (AIHW 2007; AIHW: Karmel et al. 2007).

Examples of stays and 'visits' are illustrated in Figure 2.1. In these examples, Stay A is a same-day stay consisting of a single same-day episode and Stay B is a multi-day stay

comprising a single multi-day episode. Stays C and D, both multi-day stays, are more complex. In Stay C, the patient is admitted to a hospital and on the same day is transferred out; after a period of acute care in the second hospital, the patient receives a period of rehabilitation before being transferred back to the first hospital for further rehabilitation and discharge. In Stay D, the patient enters a hospital for care; at some point during this care, the patient 'visits' another hospital for a particular procedure, returning to the first hospital for the completion of treatment.

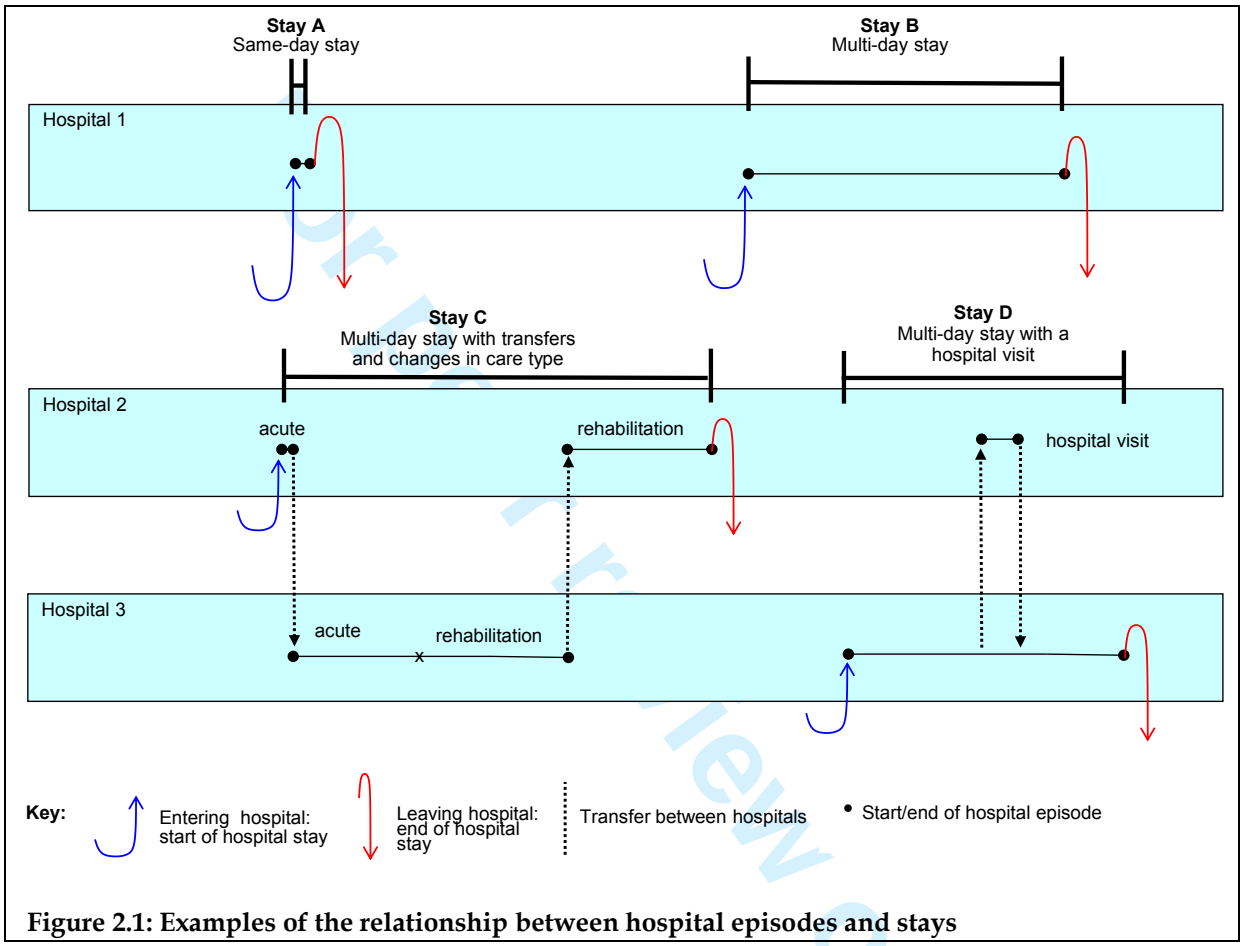


Figure 2.1: Examples of the relationship between hospital episodes and stays

The derivation of completed hospital stay data from the New South Wales APDC episode-based extract is described below. Note that episodes were excluded from the analysis if they:

- were multi-day duplicates; that is, episodes for the same patient with the same admission and separation dates in the same hospital (148 episodes across 2005–07)
- had a care type of 'newborn', 'posthumous' or 'boarder' (108 episodes)
- had a separation date before the admission date (7 episodes).

In addition, 817 hospital episodes were in RAC-type services associated with a hospital and 15 establishments on the APDC were identified as providing RAC services only (1,558 episodes across 2005–07). These data were also excluded from the hospital data as all government-funded RAC places are included in the RAC data set.

Deriving hospital stays

The unique patient identifier provided on the New South Wales APDC extract information allows episodes belonging to the same person to be readily identified. This information, along with data on episode start and end dates and mode of discharge, meant that hospital episodes for an individual could be combined into hospital stays—from first admission to final discharge.

Because people can be re-admitted to hospital on the same day that they leave hospital, a person's hospital episodes were combined into stays using both episode dates and reported mode of separation (or discharge) as explained below.

Adjacent hospital episodes for a patient were identified as belonging to the same stay if:

- the dates for the episodes overlapped, or
- the gap between two episodes was zero (0) days and the separation mode of the earlier episode was reported as a:
  - statistical discharge, or
  - transfer to another acute hospital, or
  - transfer to a psychiatric hospital.

Adjacent hospital episodes were identified as belonging to a different stay if the gap between the two episodes was:

- 1 day or more, or
- zero (0) days and the separation mode of the earlier episode was not reported as a statistical discharge or transfer to another hospital.

A stay was said to be completed if the next episode for a person was identified as belonging to a new stay using the above rules (irrespective of the separation mode of the last episode of the stay), or if the last identified episode in the stay was *not* reported as a statistical discharge or transfer to another hospital. The latter is relevant when a person's last episode in the year finishes as a statistical discharge or transfer to another hospital, implying that the next ('receiving') episode in the stay finished after 30 June 2007 and so was not in the data set.

Overall, the 252,719 HDS patients had 408,539 multi-day stays ending in 2006–07. These stays were made up of almost 482,500 episodes, including some same-day episodes and episodes that had ended in the previous financial year. Consequently, on average there were 1.18 episodes per stay. Just over 86% of stays consisted of just one episode, almost 11% included at least one transfer between hospitals and 2.7% had a change in care type but no hospital transfer (Table 2.1).

Table 2.1: Multi-day hospital stays, by number of episodes and transfers, for HDS patients, 2006–07

No. of episodes in the stay[(a)]	No. of hospital-to-hospital transfers in the stay[(a)]	Per cent
1	. .	86.4
2	0	2.3
2	1	8.2
3+	0	0.3
3+	1	0.6
3+	2	1.6
4+	≥3	0.5
Stay included a change in care type only	. .	*2.7*
Stay included a transfer	. .	*10.9*
Total	**. .**	**100.0**
Total (N)	**. .**	**408,539**
Mean episodes per stay (N)	**. .**	**1.18**

(a) Excludes 'hospital visits'.

Note: Percentages may not sum to 100% due to rounding.

2.2 Identifying patients with dementia

Medical diagnoses are recorded on the APDC if they contribute to the care provided or resource use during the hospital stay. The principal diagnosis for a hospital episode is that diagnosis chiefly responsible for causing the hospitalisation episode. Up to 54 other diagnoses can also potentially be recorded per episode of care on the New South Wales APDC. Dementia diagnoses can be recorded on any of these 55 diagnoses in any episode of a stay.

For the HDS Project, using the unique patient identifier, patients were identified as having dementia if dementia was recorded as a diagnosis for *any* hospital episode (private or public) ending between 1 July 2005 and 30 June 2007. Diagnoses in the APDC data are coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD–10–AM) (NCCH 2000). The codes used to identify people with dementia are given in Table 2.2.

The proportion of multi-day hospital episodes for the HDS population said to be for people with dementia varies considerably with the method of dementia identification used. It ranges from 0.6%, if only the principal diagnosis for an episode or stay is used to identify patients with dementia, to 10.2% when using the above 'ever dementia' approach taken for the HDS Project (Table 2.3).

It is likely that dementia is underestimated in the hospital patient population due to a combination of poor recognition by medical staff; deficiencies in the medical record; and because the condition, like other pre-existing conditions, may not be recorded on the hospital admission data if it does not affect the care provided or resource use during the hospital stay. On the other hand, patients were identified as having dementia if a dementia condition was reported for any of their New South Wales hospital episodes ending between 1 July 2005 and

30 June 2007. Consequently, it is possible that, in this study, people with dementia who had more or longer hospital stays were more likely to have been identified as having the condition. These two factors have opposing effects. It is also possible that cases of delirium were misdiagnosed as dementia (Draper et al. 2011).

Table 2.2: ICD–10–AM codes identifying dementia

Code	ICD–10–AM description
F00	Dementia in Alzheimer's disease (G30.-†)
F00.0	Dementia in Alzheimer's disease with early onset (G30.0†)
F00.1	Dementia in Alzheimer's disease with late onset (G30.1†)
F00.2	Dementia in Alzheimer's disease, atypical or mixed type (G30.8†)
F00.9	Dementia in Alzheimer's disease, unspecified (G30.9†)
F01	Vascular dementia
F01.0	Vascular dementia of acute onset
F01.1	Multi-infarct dementia
F01.2	Subcortical vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia
F01.8	Other vascular dementia
F01.9	Vascular dementia, unspecified
F02	Dementia in other diseases classified elsewhere
F02.0	Dementia in Pick's disease (G31.0†)
F02.1	Dementia in Creutzfeldt-Jakob disease (A81.0†)
F02.2	Dementia in Huntington's disease (G10†)
F02.3	Dementia in Parkinson's disease (G20†)
F02.4	Dementia in human immunodeficiency virus (HIV) disease (B22.0†)
F02.8	Dementia in other specified diseases classified elsewhere
F03	Unspecified dementia
F05.1	Delirium superimposed on dementia
G30	Alzheimer's disease
G30.0	Alzheimer's disease with early onset
G30.1	Alzheimer's disease with late onset
G30.8	Other Alzheimer's disease
G30.9	Alzheimer's disease, unspecified
G31	Other degenerative diseases of nervous system, not elsewhere classified
G31.0	Circumscribed brain atrophy
G31.1	Senile degeneration of brain, not elsewhere classified
G31.2	Degeneration of nervous system due to alcohol
G31.3	Lewy body disease
G31.8	Other specified degenerative diseases of nervous system
G31.9	Degenerative disease of nervous system, unspecified

- Symbol denotes any digit.

† Symbol denotes a code describing the aetiology or underlying cause of a disease.

2.3 Elapsed length of stay

The elapsed time in hospital for a hospital stay—or elapsed length of stay (ELOS)—is calculated as the gap between the date the person entered hospital and the date he or she was finally discharged. Consequently, no adjustment is made for absences on hospital leave or hospital 'visits'. This approach was taken to facilitate calculation of length of stay allowing for hospital visits and hospital stays comprising more than one episode (including some same-day stays). This differs from the approach used in the standard episode-based measure of length of stay which gives same-day episodes a length of 1 day and deducts hospital leave days from the elapsed time (AIHW: Karmel et al. 2007; AIHW 2008).

The effect of different definitions of length of stay is demonstrated in Table 2.3, along with the effect of different ways of identifying patients with dementia. From this, it can be seen that excluding leave days from the length of stay ('reported patient days' compared with 'ELOS') has a small effect on the measured mean length of stay for episodes (8.3 versus 8.4 days) but no effect on the median or 90th percentile. Combining contiguous episodes into stays has a larger effect, with mean ELOS for stays (as opposed to episodes) estimated at 9.6 days. This effect is largely driven by the tails of the distributions, with the median being 4 days for both episodes and stays.

Different definitions of dementia result in even larger effects. As the definition of 'patient with dementia' is extended from being based on principal diagnosis only to being based on whether a person was ever identified with dementia in a 2-year period, the proportion of multi-day stays identified as being for people with dementia increases from 0.6% to 9%. On the other hand, the ELOS is longer for the narrower methods of dementia identification: mean ELOS is 30 days for stays where the principal diagnosis was dementia, 19 days for stays with any diagnosis of dementia, and 17 days for stays for people ever diagnosed with dementia (as used in the HDS Project). Similar effects are seen in the median and 90th percentile.

Table 2.3: Length of stay for multi-day hospital events, by event length and dementia definitions, HDS patients, 2006–07

Dementia definition		Per cent	Number	Mean	Median	90th percentile
		Episodes		**Reported patient days (days)***		
Principal diagnosis of episode[(a)]	Other	99.4	464,816	8.2	4	18
	Dementia	0.6	3,041	23.3	11	42
Any diagnosis of episode[(b)]	No dementia	93.6	437,816	8.0	4	17
	Dementia	6.4	30,041	13.8	8	28
Person diagnosis[(c)]	Without dementia	89.8	420,148	7.8	4	17
	With dementia	10.2	47,709	13.2	7	27
All		**100.0**	**467,857**	**8.3**	**4**	**18**
		Episodes		**ELOS (days)**		
Principal diagnosis of episode[(a)]	Other	99.4	464,816	8.3	4	18
	Dementia	0.6	3,041	23.6	11	42
Any diagnosis of episode[(b)]	No dementia	93.6	437,816	8.0	4	18
	Dementia	6.4	30,041	13.9	8	28
Person diagnosis[(c)]	Without dementia	89.8	420,148	7.8	4	17
	With dementia	10.2	47,709	13.2	7	27
All		**100.0**	**467,857**	**8.4**	**4**	**18**
		Stays		**ELOS (days)**		
Principal diagnosis of stay[(a)]	Other	99.4	406,079	9.5	4	21
	Dementia	0.6	2,460	30.3	14	59.5
Any diagnosis of stay[(b)]	No dementia	93.8	383,266	9.0	4	20
	Dementia	6.2	25,273	18.5	9	40
Person diagnosis[(c)]	Without dementia	90.7	370,355	8.9	4	20
	With dementia	9.3	38,184	16.5	7	36
All		**100.0**	**408,539**	**9.6**	**4**	**21**

* excludes days on leave from hospital.

(a) Dementia identification based on principal diagnosis of episode or first episode of a multi-episode stay, as applicable.

(b) Dementia identification based on any diagnosis of episode or stay, as applicable.

(c) Dementia identification based on all diagnoses reported for a patient in any hospital episode in New South Wales ending between 1 July 2005 and 30 June 2007 (as used in the HDS Project).

3 Post-hospital destination

The New South Wales APDC reports the post-hospital destination of patients, nominally distinguishing between people transferring into RAC for the first time (coded to the category 'discharge/transfer to a Residential Aged Care service, unless this is the usual place of residence') and those returning to their usual place of residence. These latter are coded to an 'other' category, that includes discharge to usual residence, own accommodation, or welfare institution (such as prisons, hostels and group homes providing primarily welfare services) (AIHW 2005). However, differences between reported and actual destination have been seen in studies that have linked hospital discharges to entries into RAC. For example, in a study linking Western Australian hospital episodes to RAC data, only two-thirds of links to admissions to permanent RAC were reported as transferring to RAC for the first time, while one-fifth of links were reported as 'other'—that is, returning to their usual residence. Also, only about 85% of linked RAC leave events (that is, leave from RAC to go to hospital) that did not link to a death in hospital were reported as the patient returning to their usual residence (AIHW: Karmel & Rosman 2007, Table A6.2).

The anomalies in the APDC reported post-hospital destination seen in the Western Australian study suggest that analyses based on this data item could be misleading. Therefore, the APDC data in the HDS study were linked to RAC event data to improve information on post-hospital destination. As well as better identifying transfers to RAC, such linkage means that it is also possible to:

- distinguish between hospital discharges to permanent and respite RAC
- identify hospital stays for permanent RAC residents
- identify in-hospital deaths for RAC residents.

The linkage process used for the HDS Project is described below. Results of the linkage and comparisons of the distributions of post-hospital destination as derived through data linkage and as reported are then presented.

3.1 Linking hospital and residential aged care data

Matching individual hospital patients to RAC clients would facilitate identifying transfer events and hospital stays by RAC residents; it would also ensure that hospital stays for a particular patient would be matched only to RAC events associated with the same RAC client. Such person-based matching was possible for the HDS Project for two reasons. Firstly, both the APDC data and RAC data for the HDS Project have a client identifier. Secondly, all RAC clients and 95% of HDS patients had data suitable for person-based matching—namely, data for the statistical linkage key SLK-581 (consisting of the second, third and fifth letters of surname (S235), the second and third letters of first name (F23), date of birth, sex, region of residence and event data (see below)). People who were both HDS patients and RAC clients in 2006–07 were therefore identified through person-based data linkage centred on SLK-581. Hospital-to-RAC transfer events and hospital stays by permanent RAC residents were then identified by comparing hospital episode and RAC entry and exit dates for matched people.

Additional matches for the 5% of HDS patients without name information were identified by matching hospital stays to RAC admissions and reported periods in hospital (termed 'RAC

hospital leave') using event dates and date of birth, sex and region of residence. This type of anonymous linkage is called 'event-based matching' in the following description.

The linkage process consisted of three phases:

- Phase 1: matching hospital patients with SLK-581 data to RAC clients
- Phase 2: matching hospital and RAC events for hospital patients matched in phase 1
- Phase 3: matching hospital events for hospital patients without SLK-581 data to RAC events.

National data on RAC service use were linked to the HDS hospital patient data to allow identification of related RAC use by all HDS patients, including those using RAC services outside New South Wales. Previous studies of link accuracy for different linkage strategies are presented in AIHW: Karmel & Rosman 2007 and AIHW 2011a.

Phase 1: person matching

HDS patients were matched to RAC clients using stepwise deterministic matching with a specially selected set of statistical linkage keys. (For a general description of this method—including key selection—see Karmel et al. 2010 or AIHW 2011c.) Keys were composed of combinations of the following elements:

- match elements from SLK-581
  - surname elements based on two or three letters out of the second, third and fifth letters of surname: S235, S23, S25, S35
  - first name element, being the second and third letters of first name: F23
  - date of birth, separated into day, month, year
  - sex
- other match elements
  - region indicator based on postcode of usual residence (community and residential care postcode were both used for RAC data), using 1, 2, 3 and 4 digits: pc1, pc2, pc3, pc4
  - date of hospital entry to match to date of RAC exit (for RAC leave)
  - date of hospital exit to match to date of RAC entry (for RAC leave and admissions)
  - length of hospital stay to match to length of RAC hospital leave.

Event dates were included in the person matching process to facilitate matching between people with differences on the two data sets in reported name and demographic data. Hospital event dates were based on stays, and not episodes. These data were considered useful in identifying the best person matches because of the high use of hospital by RAC residents, and the large proportion of permanent RAC residents who get admitted from hospital (AIHW: Karmel et al. 2008). Same-day hospital stays were excluded because RAC hospital leave must last at least 1 night and such short stays are unlikely to end with admission into RAC.

RAC clients who had hospital leave reported—and so were highly likely to match—were matched before other RAC clients. Data on all events for individuals (rather than just selecting one event) were used to allow all people, including those without name information on the hospital data, to be matched. A total of 951 different keys (that is,

different combinations of the above elements) were used when matching people with RAC hospital leave; some of these keys did not include name information.

Hospital patients who did not match to an RAC client with hospital leave were then matched to RAC clients without such events in 2006–07. In this match process, 165 different keys were used; all included some name information.

Because a state-level data set was being matched with a national data set, all keys used to match people included a region indicator (at least pc1). Also, all keys had an estimated underlying false match rate (FMR) of less than 0.5%, and at least two-thirds of additional matches made by the key (given links already made) were expected to be true (see Karmel et al. 2010 for discussion of key selection).

Differences in reported SLK-581 and postcode of usual residence in the two data sets were specifically allowed for. For the RAC data, both the client postcode before admission into RAC and the postcode of the RAC facility were used for linking, with the former being given preference when linking to RAC admissions and the latter when linking to people already in permanent RAC. In the APDC data, a patient may have different name and demographic data reported across hospital episodes. All versions of a client's SLK-581 and residence postcode were retained for matching. The number of variations considered when matching using a particular key was determined by the estimated FMR of that key, with the aim being to maintain an estimated FMR below 0.5% when using variants.

Phase 2: matching events for matched people

In this phase, the related hospital and RAC events were identified for each person matched in phase 1. These included hospital stays for people living permanently in RAC and hospital stays ending with transfer to RAC. Same-day hospital stays were included in this process as the person-based matching allowed their identification; this permits the use of same-day stays by RAC residents to be quantified. Some difference in dates was allowed to account for differences in recording dates (for example, due to entry into hospital via an Emergency Department, use of RAC pre-entry leave—which allows reservation of an RAC place for up to 6 days before admission into permanent residential care, or recording errors). Related events for matched people were identified as follows:

- The date of hospital entry (that is, stay start date) was compared with the date of RAC exit (for RAC leave).
- The date of hospital exit (that is, stay end date) was compared with the date of RAC entry (for RAC leave and admissions).
- Identification of related hospital and RAC events was undertaken in the following order:
  1. RAC hospital leave events: Up to 3 days difference between hospital and RAC dates was allowed (symmetric test). Also, 'related' RAC admissions (that is, admission to a different RAC facility on leaving hospital) were identified, allowing +/–1 day date differences. These related admissions were excluded when identifying matches between hospital discharges and RAC admissions.
  2. RAC admissions: When identifying these event links, allowance was made for date-reporting issues. RAC entry dates could be up to 3 days before the hospital exit date or up to 6 days after (to allow for pre-entry leave for permanent RAC admissions). Same-day transfers (even between respite and permanent care) were combined into one RAC event.

3 Social leave (absence from RAC for non-medical reasons): Matches to social leave were made to allow for RAC residents entering hospital while visiting family and friends. For this matching, RAC entry dates (return from leave) could be up to 11 days after the end of the hospital stay; preliminary analysis had shown that very few related events had larger gaps. For a substantial majority (92%) of these matches, the resident returned to RAC within 1 day of leaving hospital.

4 Unreported RAC hospital leave (hospital stays by permanent RAC residents not reported in the RAC data): Additional hospital stays by permanent RAC residents were identified by comparing RAC admission and discharge dates with hospital stay dates for matched people; hospital stay dates had to be encompassed by the RAC dates. Note that this last step also identified the few matches to social leave missed in (3) above due to the 11-day cut-off.

The above process resulted in identifying associated RAC events for nearly 45,200 hospital stays, including same-day hospital stays and stays for a small number of people aged under 50 at 1 July 2006 on the HDS data set.

Phase 3: matching events for patients without SLK-581 data

Finally, RAC events matching hospital stays for the 5% of HDS patients without name information were identified using event-based matching (Karmel & Gibson 2007; AIHW: Karmel et al. 2008); that is, by matching events directly rather than by first matching people. Stepwise deterministic matching was again used for matches to RAC hospital leave and admissions, with keys based on the same data as the person-based matching, excluding the name elements. That is, keys were composed of combinations of the following elements:

- date of birth, separated into day, month, year
- sex
- postcode of usual residence, using 1, 2, 3 and 4 digits: pc1, pc2, pc3, pc4
- date of hospital entry matching to date of RAC exit (for RAC leave)
- date of hospital exit matching to date of RAC entry (for RAC leave and admissions)
- length of hospital stay matching to length of RAC hospital leave.

Because of the reduced information for matching, this process was expected to be less accurate than the person-based matching. Therefore, key selection was refined by comparing results from the person-based linkage process and event-based linkage for HDS patients with name information. As a result, an FMR limit of 1% was used when matching to RAC hospital leave (18 keys), and a limit of 1.5% was used when matching to RAC admissions (2 keys). Event date variation of +/– 2 days and alternative postcodes, sex and date of birth were also allowed. Additional matches to social leave were identified by matching on date of birth, sex and postcode (no variation) and finding hospital events encompassed by the social leave dates.

This linkage phase resulted in a small number of additional matches (115 events).

Results

Overall, 10% of HDS multi-day stays matched to an RAC event in 2006–07 (Table 3.1). Just over 60% of these matches were for people already living in RAC.

Table 3.1: Linkage results: multi-day hospital stays by RAC event match type, HDS patients, 2006–07

Matching RAC event	Frequency	Per cent	Per cent linked with an RAC event
None	372,052	90.2	. .
Permanent RAC admission followed the hospital stay	7,664	1.9	18.9
Respite RAC admission followed the hospital stay	5,436	1.3	13.4
RAC hospital leave corresponded to the hospital stay	24,142	5.9	59.5
RAC hospital leave corresponded to the hospital stay, but the RAC client had a new permanent admission on return to aged care	1,302	0.3	3.2
RAC hospital leave corresponded to the hospital stay, but the RAC client was admitted into respite RAC on return to aged care	120	—	0.3
Hospital stays occurred during RAC social leave	412	0.1	1.0
In hospital while permanent RAC resident (no leave reported)	1,531	0.4	3.8
Total	**412,659**	**100.0**	**100.0**

Notes

1. Table includes 4,120 stays for people aged under 50 at 1 July 2006 on the HDS input data set.
2. Percentages may not sum to 100% due to rounding.

3.2 Deriving post-hospital destination

Post-hospital destination was derived using the event matches; death in hospital was assumed to be reported accurately, and transfer to other health-care accommodation was assumed to be correct unless the hospital stay was linked to an RAC event (Table 3.2). Overall, 3.2% of HDS multi-day stays were identified as ending with the patient being newly transferred to RAC—the majority (60%) entering permanent RAC. In addition, 6% of stays ended with the patient returning to RAC—predominantly for permanent care in the facility they had left. Nearly 5% of all stays ended with the death of the patient; 15% of these deaths were for people who had been on leave from permanent RAC.

Table 3.2: Post-hospital destination derived through data linkage, multi-day hospital stays for HDS patients, 2006–07

Derived post-hospital destination	Number	Per cent
To RAC, permanent	7,651	1.9
To RAC, respite	5,426	1.3
Return to permanent RAC	23,019	5.6
Return to permanent RAC, permanent admission to a different facility	1,301	0.3
Return to RAC, in permanent RAC before hospital stay but admitted to respite RAC on discharge from hospital	120	—
Return to respite RAC	5	—
Transferred to other health-care accommodation[(a)]	3,791	0.9
To community[(b)]	346,877	84.9
Died – RAC resident[(c)]	3,062	0.7
Died – other	17,264	4.2
Unknown	23	—
Total	**408,539**	**100.0**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Percentages may not sum to 100% due to rounding.

3.3 Comparison of derived and reported post-hospital destination

Table 3.3 compares the derived post-hospital destination with that reported on the APDC. Overall, the number of people reported as transferring to RAC is slightly higher than that derived through linkage (3.8% versus 3.2%). At first glance, this could be thought to be due to missed links. However, a closer look at Table 3.3 shows that there is considerable discordance between reported transfers to RAC and those derived through data linkage. These large discrepancies are illustrated in Figure 3.1. Only 46% of stays reported as ending in transfer to RAC were linked to an RAC admission, with 42% being matched to someone already living in RAC. Similarly, 55% of stays linked to an RAC admission were reported as ending in a transfer to RAC and 37% were reported as discharged to their own accommodation. A higher proportion of people were also reported as going to other health-care accommodation (1.5 %) than was found using linked data (0.9%, assuming that this reported destination was correct unless the hospital stay was matched to an RAC event).

Previous studies on the quality of the linkage processes used for this project (AIHW: Karmel & Rosman 2007; AIHW 2011a) indicate that this level of difference is highly likely to be due to reporting issues rather than to errors in the linkage—that is, it is not due to missed and false matches. One of the possible causes could be confusion about what should be reported on the hospital data as the patient's usual residence: usual residence before or usual residence after hospitalisation.

The effect of these differences in post-hospital destination on the profiles of patients in the various movement categories is demonstrated in the following sections.

Table 3.3: Multi-day hospital stays by derived and reported post-hospital destination, HDS patients, 2006–07

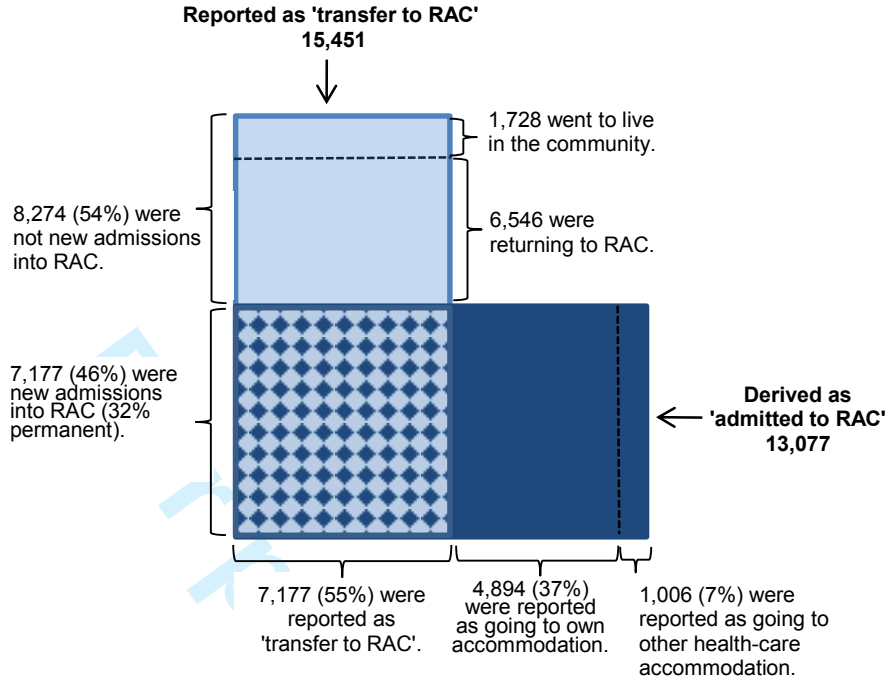
	Reported post-hospital destination					Total	
Derived post-hospital destination	Discharge/ transfer to RAC (not previous usual residence)	To other health-care accommodation[a]	To own accommodation, including discharged at own risk or while on leave	Died	Unknown	No.	Per cent
Admitted to RAC	*7,177*	*1,006*	*4,894*	. .	—	*13,077*	*3.2*
To permanent RAC	4,912	444	2,295	. .	—	7,651	1.9
To respite RAC	2,265	562	2,599	. .	—	5,426	1.3
Returned to RAC	6,546	1,135	16,763	. .	1	24,445	6.0
Transferred to other health-care accommodation[a]	. .	3,791	. .	. .	. .	3,791	0.9
To community[b]	1,728	8	345,141	. .	. .	346,877	84.9
Died – RAC resident[c]	. .	. .	. .	3,062	. .	3,062	0.7
Died – other	. .	. .	. .	17,264	. .	17,264	4.2
Unknown	. .	. .	. .	. .	23	23	—
Total (number)	**15,451**	**5,940**	**366,798**	**20,326**	**24**	**408,539**	**100.0**
Total (per cent)	**3.8**	**1.5**	**89.8**	**5.0**	**—**	**100.0**	**. .**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Percentages may not sum to 100% due to rounding.



Source: Table 3.3.

Figure 3.1: Comparing hospital stays reported as transferring to RAC and stays linking to admission into RAC, HDS patients, 2006–07

Dementia status

Using both destination classifications, patients with dementia are seen to be more likely to be transferred from hospital to RAC than those without dementia (Table 3.4). However, among patients with dementia, using the reported destination results in a 40% higher proportion being seen as a transfer to RAC (19% compared with 14%); for patients without dementia, the estimates are very similar for the two classifications (2%). The derived destination also shows that almost 30% of stays for people with dementia ended with the patient returning to RAC as their usual residence—a proportion hidden in the 'own accommodation' category in the reported data.

Table 3.4: Multi-day hospital stays: derived and reported post-hospital destination by dementia status, HDS patients, 2006–07 (per cent)

Derived post-hospital destination	With dementia	Without dementia	Total
Admitted to RAC	*13.9*	*2.1*	*3.2*
To permanent RAC	8.8	1.2	1.9
To respite RAC	5.1	0.9	1.3
Returned to RAC	29.1	3.6	6.0
Transferred to other health-care accommodation[(a)]	1.2	0.9	0.9
To community[(b)]	47.5	88.8	84.9
Died – RAC resident[(c)]	3.7	0.4	0.7
Died – other	4.6	4.2	4.2
Total	**100.0**	**100.0**	**100.0**
Total N	**38,182**	**370,334**	**408,516**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	19.4	2.2	3.8
Transfer to other health-care accommodation[(a)]	3.5	1.2	1.5
To own accommodation, including discharged at own risk or while on leave	68.7	92.0	89.8
Died	8.4	4.6	5.0
Total	**100.0**	**100.0**	**100.0**
Total N	**38,182**	**370,333**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Age and sex

People aged over 65 are more likely to be reported as transferring from hospital to RAC than to be identified through data linkage as making this move (for example, 11% versus 9% for people aged 85+; see Table 3.5). The proportion derived as returning to RAC rises with age (up to 19% among those aged 85+), leading to increasing differences with age between those reported as returning to their own home and those derived as returning to the community. Using the reported destination, the proportion seen to be transferring to other health-care accommodation increases with age. This apparent effect is marginal at most when using the derived destination.

The effects seen by dementia status and age are reflected in the distributions of post-hospital destination by sex (Table 3.6). The differences between the two distributions are more marked for women, with the reported destinations of transfer to RAC and transfer to other

health-care accommodation being relatively high compared with those based on the derived destination.

Table 3.5: Multi-day hospital stays: derived and reported post-hospital destination by age, HDS patients, 2006–07 (per cent)

	Age at 1 July 2006				
Derived post-hospital destination	**50–64**	**65–74**	**75–84**	**85+**	**Total**
Admitted to RAC	*0.5*	*1.6*	*4.5*	*9.0*	*3.2*
To permanent RAC	0.3	0.9	2.6	5.3	1.9
To respite RAC	0.2	0.6	1.9	3.7	1.3
Returned to RAC	0.8	2.5	7.6	19.4	6.0
Transferred to other health-care accommodation[(a)]	0.8	0.9	1.0	1.0	0.9
To community[(b)]	95.6	90.8	80.7	61.4	84.9
Died – RAC resident[(c)]	—	0.3	0.9	2.7	0.7
Died – other	2.3	4.0	5.3	6.5	4.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total N	**124,574**	**101,177**	**122,889**	**59,876**	**408,516**
Reported post-hospital destination					
Discharge/transfer to RAC (not previous usual residence)	0.5	1.8	5.1	11.3	3.8
Transfer to other health-care accommodation[(a)]	0.9	1.2	1.7	2.6	1.5
To own accommodation, including discharged at own risk or while on leave	96.2	92.8	87.0	76.9	89.8
Died	2.4	4.2	6.2	9.2	5.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total N	**124,573**	**101,177**	**122,889**	**59,876**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Table 3.6: Multi-day hospital stays: derived and reported post-hospital destination by sex, HDS patients, 2006–07 (per cent)

Derived post-hospital destination	Male	Female	Total
Admitted to RAC	*2.6*	*3.8*	*3.2*
To permanent RAC	1.6	2.2	1.9
To respite RAC	1.0	1.6	1.3
Returned to RAC	4.2	7.8	6.0
Transfer to other health-care accommodation[(a)]	1.0	0.9	0.9
To community[(b)]	87.0	82.9	84.9
Died – RAC resident[(c)]	0.6	0.9	0.7
Died – other	4.7	3.8	4.2
Total	**100.0**	**100.0**	**100.0**
Total N	**204,809**	**203,707**	**408,516**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	2.9	4.6	3.8
Transfer to other health-care accommodation[(a)]	1.3	1.6	1.5
To own accommodation, including discharged at own risk or while on leave	90.5	89.1	89.8
Died	5.3	4.7	5.0
Total	**100.0**	**100.0**	**100.0**
Total N	**204,808**	**203,707**	**408,515**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Notes

1. Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.
2. Percentages may not sum to 100% due to rounding.

Elapsed length of stay

The length of stay distribution is substantially different using the reported and derived post-hospital destination classifications (Table 3.7). Both mean and median ELOS were 9 days shorter among patients reported as transferring to RAC when compared with stays linked to an RAC admission. This is because people who were already RAC residents tended to have shorter stays than those who were newly admitted into such care on discharge from hospital. People reported as transferring to other health-care accommodation also had longer stays than those identified through data linkage as making this move. It is also interesting to note that the length of stay for RAC residents who died in hospital was generally less than that for non-RAC residents who died.

Table 3.7: Multi-day hospital stays: length of stay by derived and reported post-hospital destination, HDS patients, 2006–07 (days)

Derived post-hospital destination	Mean	Median	90th percentile
Admitted to RAC	*34.1*	*23*	*70*
To permanent RAC	40.5	28	81
To respite RAC	25.0	17	55
Returned to RAC	10.3	6	24
Transferred to other health-care accommodation[(a)]	15.9	7	34
To community[(b)]	7.8	4	17
Died – RAC resident[(c)]	11.6	6	25
Died – other	23.6	9	43
Total	**9.6**	**4**	**21**
Reported post-hospital destination			
Discharge/transfer to RAC (not previous usual residence)	25.0	14	56
Transfer to other health-care accommodation[(a)]	19.4	9	44
To own accommodation, including discharged at own risk or while on leave	8.1	4	18
Died	21.8	9	40
Total	**9.6**	**4**	**21**

(a) Includes unidentified hospital transfers; that is, a hospital stay for a patient with a later stay but with the earlier stay reported as ending in a hospital transfer and no associated transfer admission found in the New South Wales APDC data. Note that the receiving hospital could have been in another jurisdiction, and so not included in the HDS data set.

(b) Includes remaining unlinked records (destination reported as going to own accommodation, discharged at own risk or while on leave, or reported as transferred to RAC in the hospital data).

(c) Includes patients admitted while a permanent RAC resident. Does not include people discharged from RAC on admission to hospital without any associated RAC hospital leave, and who died in hospital.

Note: Table excludes stays with unknown destination: 23 stays using derived destination and 24 using reported destination.

Glossary

HDS patient: a person aged 50 and over who had a completed hospital stay in 2006–07 that included at least 1 night in a New South Wales public hospital

Hospital episode: a period in hospital of a particular care type in a particular hospital

Hospital stay: the period from admission into the hospital system to discharge from the hospital system, or death in hospital

Hospital visit: an episode as an admitted patient in one hospital while admitted to another

Patient with dementia: a patient with dementia recorded for any hospital episode (private or public) ending between 1 July 2005 and 30 June 2007 (definition for HDS Project)

References

AIHW (Australian Institute of Health and Welfare) 2005. METeOR: Episode of admitted patient care—separation mode, code N. Canberra: AIHW. Viewed 3 April 2008, <http://meteor.aihw.gov.au/content/index.phtml/itemId/270094>.

AIHW 2007. Australian hospital statistics 2005-06. Health services series no. 30. Cat. no. HSE 50. Canberra: AIHW.

AIHW 2008. Australian hospital statistics 2006-07. Health services series no. 31. Cat. no. HSE 55. Canberra: AIHW.

AIHW 2010. The Hospital Dementia Services Project. Canberra: AIHW. Viewed 11 October 2012, <http://www.aihw.gov.au/hospital-dementia-services-project/>.

AIHW 2011a. Comparing an SLK-based and a name-based data linkage strategy: an investigation into the PIAC linkage. Data linkage series no. 11. Cat. no. CSI 11. Canberra: AIHW.

AIHW 2011b. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2011c. Pathways in Aged Care: program use after assessment. Data linkage series no. 10. Cat. no. CSI 10. Canberra: AIHW.

AIHW 2012. People with dementia in hospitals in New South Wales 2006-07. Cat. no. AUS 165. Canberra: AIHW.

AIHW: Karmel R, Hales C & Lloyd J 2007. Older Australians in hospital. AIHW bulletin no. 53. Cat. no. AUS 92. Canberra: AIHW.

AIHW: Karmel R, Lloyd J & Anderson P 2008. Movement from hospital to residential aged care. Data linkage series no. 6. Cat. no. CSI 6. Canberra: AIHW.

AIHW: Karmel R & Rosman D 2007. Comparing name-based and event-based strategies for data linkage: a study linking hospital and residential aged care data for Western Australia. Data linkage series no. 3. Cat. no. CSI 3. Canberra: AIHW.

CHeReL (Centre for Health Record Linkage) 2009. Centre for Health Record Linkage. Sydney: CHeReL. Viewed 27 July 2010, <http://www.cherel.org.au/>.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1-10.

Karmel R, Anderson P, Gibson D, Peut A, Duckett SJ & Wells Y 2010. Empirical aspects of record linkage across multiple data sets using statistical linkage keys: the experience of the PIAC cohort study. BMC Health Services Research 10:41.

Karmel R & Gibson D 2007. Event-based record linkage in health and aged care services data: a methodological innovation. BMC Health Services Research 7:154.

NCCH (National Centre for Classification in Health) 2000. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) 2nd edn. Sydney: University of Sydney.

List of tables

List of figures

Other Hospital Dementia Services publications

AIHW 2011. The Hospital Dementia Services Project: a study description. Cat. no. AGE 67. Canberra: AIHW.

AIHW 2012. People with dementia in hospitals in New South Wales 2006–07. Cat. no. AUS 165. Canberra: AIHW.

Bail K & Draper B 2011. Blurring lines between acute and aged. Aged care Insite. Viewed 11 October 2012. <http://www.agedcareinsite.com.au/pages/section/article.php?s=Breaking+News&idArticle=22774>.

Draper B, Karmel R, Gibson D & Peut A 2011. Alcohol related cognitive impairment in NSW hospital patients aged 50 years and over. Australian and New Zealand Journal of Psychiatry 45: 985–92.

Draper B, Karmel R, Gibson D, Peut A & Anderson P 2011. The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia. International Psychogeriatrics:1–10.

This report describes the methods used for the Hospital Dementia Services Project to derive dementia status, complete hospital stays and post-hospital destination using New South Wales hospital data for 2006–07. Comparisons of estimates using these key variables show that the method used to derive the variables can substantially affect analytical results on use of hospitals. This report demonstrates the importance of using analytical data and methods that match the particular policy or research question being asked.

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	P1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	P1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	P2, 3
Objectives	3	State specific objectives, including any pre-specified hypotheses	P2, 3
Methods			
Study design	4	Present key elements of study design early in the paper	P3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P3, 4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	P3, 4, 5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	P3, 4,
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	P3, 4, 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P3, 4, 5. And Table 1.
Bias	9	Describe any efforts to address potential sources of bias	P4
Study size	10	Explain how the study size was arrived at	P3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	P3
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	P9
		(*b*) Describe any methods used to examine subgroups and interactions	P9, P10
		(*c*) Explain how missing data were addressed	P7
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	P3, 4

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P3,4
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	P9
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P9
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	P9, p10
Discussion			
Key results	18	Summarise key results with reference to study objectives	P10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P12
Generalisability	21	Discuss the generalisability (external validity) of the study results	P12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

International Psychogeriatrics: page 1 of 10 © International Psychogeriatric Association 2011
doi:10.1017/S1041610211001694

The Hospital Dementia Services Project: age differences in hospital stays for older people with and without dementia

Brian Draper,[1] Rosemary Karmel,[2] Diane Gibson,[3] Ann Peut[4] and Phil Anderson[5]

[1] *School of Psychiatry, University of New South Wales, Sydney, Australia*
[2] *Data Linkage Unit, Australian Institute of Health and Welfare, Canberra, Australia*
[3] *Faculty of Health, University of Canberra, Canberra, Australia*
[4] *Ageing and Aged Care Unit, Australian Institute of Health and Welfare, Canberra, Australia*
[5] *Australian Institute of Health and Welfare, Canbersra, Australia*

ABSTRACT

Background: People with dementia may have adverse outcomes following periods of acute hospitalization. This study aimed to explore the effects of age upon hospitalization outcomes for patients with dementia in comparison to patients without dementia.

Methods: Data extracted from the New South Wales Admitted Patient Care Database for people aged 50 years and over for the period July 2006 to June 2007 were linked to create person-based records relating to both single and multiple periods of hospitalization. This yielded nearly 409,000 multi-day periods of hospitalization relating to almost 253,000 persons. Using ICD-10-AM codes for dementia and other principal diagnoses, the relationship between age and hospitalization characteristics were examined for people with and without dementia.

Results: Dementia was age-related, with 25% of patients aged 85 years and over having dementia compared with 0.9% of patients aged 50–54 years. People with dementia were more likely to be admitted for fractured femurs, lower respiratory tract infections, urinary tract infections and head injuries than people without dementia. Mean length of stay for admissions for people with dementia was 16.4 days and 8.9 days for those without dementia. People with dementia were more likely than those without to be re-admitted within three months for another multi-day stay. Mortality rates and transfers to nursing home care were higher for people with dementia than for people without dementia. These outcomes were more pronounced in younger people with dementia.

Conclusion: Outcomes of hospitalization vary substantially for patients with dementia compared with patients without dementia and these differences are frequently most marked among patients aged under 65 years.

Key words: dementia, hospitalization, outcomes, length of stay, age effects

Introduction

People with dementia experience the full range of acute illnesses and are relatively high users of general hospitals. Common reasons for hospitalization include hip fractures and other injuries, lower respiratory tract infections, urinary tract infections, strokes and delirium (Natalwala *et al.*, 2008; Zuliani *et al.*, 2011).

There is evidence that people with dementia can experience a range of adverse outcomes in hospitals (Kurrle, 2006), including functional decline, polypharmacy, undernutrition, skin tears, pressure areas, fall-related injuries, nosocomial infections and deconditioning (Torian *et al.*, 1992; Creditor, 1993; Foreman and Gardner, 2005; Borbasi *et al.*, 2006). In some studies, the relatively high case-mix complexity of older patients with dementia contributes to longer hospital stays and this has an impact on a patient's physical and mental state (Nichol *et al.*, 2000; ACEMA, 2003; King *et al.*, 2006; Zekry *et al.*, 2009). These adverse outcomes may also result in increased mortality or increased risk of transfer to nursing home care, although there are discrepant findings (Peut *et al.*, 2007; Zekry *et al.*, 2009; Zuliani *et al.*, 2011).

Previous research into the acute hospitalization of persons with dementia has focused on older patients (Saravay *et al.*, 2004; Natalwala *et al.*, 2008;

Correspondence should be addressed to: Professor Brian Draper, Academic Department for Old Age Psychiatry, Prince of Wales Hospital, Randwick, NSW, 2031, Australia. Phone: +61 2 9382 3753; Fax: +61 2 9382 3762. Email: b.draper@unsw.edu.au. Received 19 Jan 2011; revision requested 19 Feb 2011; revised version received 30 Jun 2011; accepted 5 Jul 2011.

Zekry *et al.*, 2009; Douzenis *et al.*, 2010; Zuliani *et al.*, 2011). Early-onset dementia is clinically more heterogeneous than late-onset dementia, with a number of causes such as HIV/AIDS-related dementia, alcohol-related dementia and dementia secondary to multiple sclerosis that might require medical treatment for the dementia or related conditions (Harvey *et al.*, 2003; Withall and Draper, 2009). Hence it is possible that the hospitalization of younger people with dementia might be for different reasons and have different outcomes than those reported in older people with dementia.

The Hospital Dementia Services Project is an innovative mixed methods study that explores at the patient level how hospital experiences and outcomes vary for people with and without dementia, and at the system level how hospital-based aged care and dementia care influence outcomes for people with dementia. This paper uses internally linked existing hospital administrative data to create a dataset containing patient trajectories in hospitals. It focuses on people aged 50 years and over who had at least one multi-day stay in a public hospital in the state of New South Wales (NSW, total population 6.9 million) in Australia in 2006–2007 (termed HDS patients) and it aims to explore the effects of age upon reasons for hospitalization and outcomes in persons with dementia compared with persons without dementia. The analysis incorporates data on stays in both public and private hospitals for this cohort of patients.

Methods

For this study, data were extracted by the NSW Department of Health from the NSW Admitted Patient Care Database for hospital episodes in public and private NSW hospitals between 1 July 2005 and 30 June 2007. The Admitted Patient Care Database records new episodes for every within-hospital change in care type and each transfer between hospitals (Karmel *et al.*, 2008). A unique patient identifier, derived by the Centre for Health Record Linkage (or CHeReL), was added to the extract to permit, first, combining related hospital episodes into a single completed hospital stay (i.e. from initial admission to final discharge from hospital, allowing for movement both within and between hospitals) and, second, identification of re-admissions by individuals. Transfers and re-admissions for individual patients were identified using episode start and end dates and reported mode of episode discharge.

This linking of patients' data is a major advance on traditional analyses of national hospital statistics (Peut *et al.*, 2007; Karmel *et al.*, 2008). Of most significance is the capacity to report on the full period of hospitalization from admission to discharge as experienced by the patient, whereas national hospital data are most commonly reported in terms of separate "episodes of care", whereby a person whose care type changes from acute care to rehabilitation and then to palliation in one hospital stay is reported in national statistics as three episodes of care (with three lengths of stay and so forth). The present method also integrates hospital stays involving transfers between hospitals, creating one record per patient from admission to final discharge.

Combining the patient-level hospital episode data, we identified 253,000 persons aged at least 50 years on 1 July 2006 who had at least one multi-day stay ending between 1 July 2006 and 30 June 2007 in one of the 222 public hospitals in NSW (including seven public psychiatric hospitals). Between them, these people had 409,000 multi-day stays and 252,000 single day stays ending in that year across 222 public hospitals and 167 private hospitals.

Up to 55 diagnoses could potentially be recorded per episode of care. Diagnoses were coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) (National Centre for the Classification of Health, 1998). The principal diagnosis was defined as the diagnosis chiefly responsible for occasioning the hospitalization episode.

The group of interest was patients for whom dementia was recorded on at least one hospital stay from July 2005 to June 2007 as contributing significantly to the cost of hospital care, the criterion used by hospitals when coding medical records. Where recorded, the type of dementia was determined. If more than one dementia diagnosis was recorded in separate hospital admissions, we categorized the patient as having "dementia with mixed diagnoses".

We also investigated for the presence of comorbid delirium, which in some cases was captured with the ICD-10-AM category "dementia with delirium" and in other cases was captured as a separate diagnosis comorbid with a dementia diagnosis. Medical disorders associated with types of dementia, including alcohol abuse, HIV/AIDS, Parkinson's disease and multiple sclerosis, were determined. We also examined other comorbidities associated with hospital admission including hip (femur) fractures, head injuries, other mental and behavioral disorders, lower respiratory tract infections, urinary tract infections, stroke, subdural hematoma, epilepsy, transient ischemic attacks, collapse/syncope, septicemia and constipation.

Principal procedures that were undertaken during each hospital episode were grouped into the following broad ICD10-AM categories: nervous system; endocrine system; respiratory system; cardiovascular system; blood and blood forming organs; digestive system; urinary system; musculoskeletal system; non-invasive, cognitive and other interventions; allied health; and imaging. Some specific subcategories of procedures were examined: skull, meninges and brain; stomach; large intestine; bladder; pelvis and hip; generalized allied health; and computerized tomography.

The following outcomes of hospitalization were examined: length of stay; mortality; discharge destination; and re-admission. The data were analyzed by four age groups: 50–64 years; 65–74 years, 75–84 years; and 85 years and over. Comparisons were made between admissions with and without dementia, both overall and within age groups. In particular, this was done by fitting logistic regressions to calculate the odds ratios for principal diagnoses and procedures and destination on discharge for people with dementia compared with those without dementia, allowing for the effects of sex and age (using five-year age groups up to 95+). Both odds ratios and 95% confidence intervals are presented, and the statistical significance of age/dementia interaction effects is also reported. In addition, the statistical significance of differences in proportions cited in text for people with and without dementia were tested allowing for sex and age differences (due to the large number of comparisons being made, a significance level of $p < 0.001$ was used for these). Lengths of stay distributions were compared using non-parametric methods, and the resulting statistical significance of these tests is presented.

Institutional Ethics Committee approval was obtained from the Australian Institute of Health and Welfare Ethics Committee, the NSW Population and Health Services Research Ethics Committee, the University of NSW Human Research Ethics Committee, and 19 Site Specific Approvals that covered all of the public hospitals in NSW.

Results

Dementia occurrence was related to age with 25% of patients aged 85 years and over having dementia compared with 0.9% of patients aged 50–64 years. The majority of dementia patients were female (n = 12,489; 60%); however this increased with age, from only 38% of those aged 50–64 years to 69% of those aged 85 years and over. Overall, the type of dementia was not specified in 58% of patients with dementia but this lack of categorization of dementia type showed an association with age group, occurring for 25% of 50–64 year old patients with dementia, but for 67% of those aged 85 years and over. When the type of dementia was specified, there were significant differences in the types of dementia reported for the different age groups ($\chi^2 = 1522$, df = 12, $p < 0.0001$). Patients aged 50–64 years were more likely than others to have non-Alzheimer non-vascular dementia, with particularly high rates of alcohol-related dementia (21%, 158 out of 568). Dementia in other degenerative disorders (including Parkinson's disease and Pick's disease) and other dementias (including HIV/AIDs dementia complex and Huntington's dementia) were also more common in this age group (see Table 1).

Among people with dementia, age had a limited association with the rates of comorbid delirium, with 12% of 50–64 year olds with dementia having delirium during at least one hospital stay compared with 17% of people with dementia in the two older age groups. However, older patients who experienced delirium were more likely than younger patients to have dementia: 12% of 50–64 year olds who experienced delirium had dementia compared

Table 1. Types of dementia specified, by patient age (HDS patients, New South Wales, 2006–2007)

	50–64 YEARS N = 759		65–74 YEARS N = 2201		75–84 YEARS N = 9062		85+ YEARS N = 8771		TOTAL N = 20793	
	%	n	%	n	%	n	%	n	%	n
Alzheimer's disease	11.1	84	16.2	357	18.4	1671	14.4	1263	16.2	3375
Vascular dementia	7.9	60	9.8	215	8.0	722	5.5	486	7.1	1483
Other degenerative dementia	24.5	186	16.1	354	11.0	996	6.4	560	10.1	2096
Alcohol dementia	20.8	158	3.0	65	0.5	41	0.0	4	1.3	268
Other dementia	10.5	80	8.1	178	7.5	677	6.3	552	7.2	1487
Unspecified dementia	25.2	191	46.9	1032	54.7	4955	67.3	5906	58.1	12084
Total	100		100		100		100		100	

with 57% of patients aged 85+. Delirium was less common among people without dementia, with propensity increasing with age – from 0.8% of patients aged 50–64 to 4.1% among those aged 85+.

Reasons for admission

Dementia was the principal reason for admission in only 6% of multi-day stays for people with dementia. Excluding dementia, the principal diagnoses for this group were commonly related to the circulatory system (15%), respiratory system (11%), fractures (10%), other injury and poisoning (8%) and the digestive system (8%). There were significant differences in the principal reasons for admission when comparing people with and without dementia. In particular, people with dementia were more likely to be admitted principally because of mental and behavioral disorders (OR 3.61, 3.39–3.85), other nervous disorders (OR 1.71, 1.61–1.83), fractures (OR 1.84, 1.77–1.92) or other injury/poisoning (OR 1.32, 1.26–1.37), but were less likely to be admitted because of neoplasms (OR 0.47, 0.45–0.50), circulatory disorders (OR 0.65, 0.63–0.68) or digestive disorders (OR 0.75, 0.72–0.78).

Examining specific disorders, people with dementia were more likely to be admitted because of alcohol disorders (OR 5.05, 4.37–5.83), epilepsy (OR 4.47, 3.85–5.20), fractured femur (OR 2.62, 2.47–2.78), urinary tract infection (OR 2.61, 2.47–2.77), lower respiratory tract infections (OR 1.64, 1.57–1.72), head injuries (OR 2.16, 1.99–2.33), stroke (OR 1.25, 1.17–1.34), subdural (OR 1.83, 1.39–2.40), constipation (OR 1.33, 1.18–1.50) and septicemia (OR 2.14, 1.95–2.35) than those without dementia.

As shown in Table 2, for those with dementia, there was variation with age in the proportion of admissions attributed to particular diagnoses. For example, admissions resulting from mental and behavioral disorders, other nervous disorders and epilepsy were more prominent among 50–64 year olds than older groups, while admissions due to fractures in general, fractures of the femur, head injuries, urinary tract infections and respiratory tract infections were more common at older ages. The ORs across the age groups show that for many conditions the effect of dementia on reason for admission also varied with age. For some conditions, the ORs tended to increase with age (e.g. admissions due to fractures and genitourinary conditions); for others the ORs decreased with age (e.g. admissions due to other mental and behavioral disorders and other nervous disorders).

Principal procedures

Patients with dementia were less likely than non-dementia patients to have no procedure recorded in a hospital stay (OR 0.86, 0.84–0.89). In stays with a procedure recorded, dementia patients were more likely than non-dementia patients to have an imaging procedure as the principal procedure (OR 1.58, 1.54–1.63), in particular computer tomography brain scans (OR 2.61, 2.53–2.70). Overall, dementia patients had higher odds of having hip and pelvis procedures as the principal procedure than non-dementia patients (OR 1.69, 1.60–1.80); however, this difference was only significant for patients aged 65 and over. Also, urinary catheterization was more likely to be the principal procedure in dementia patients (OR 1.51, 1.30–1.75). Dementia patients were much less likely than other patients to have digestive system procedures (OR 0.49, 0.46–0.52, with little variation across the age groups) or cardiovascular procedures as the principal procedure (OR 0.31, 0.29–0.34); the latter were largely driven by coronary artery procedures (OR 0.20, 0.17–0.24). Dementia patients were more likely to receive allied health input than non-dementia patients (OR 1.39, 1.36–1.43); the difference was particularly marked in patients aged under 85 years. This was mainly physiotherapy and social work (Table 3).

Length of stay and readmission

Mean length of stay (LOS, including transfers within and between hospitals) for multi-day stays for persons with dementia was 16.5 days compared with 8.9 days for those without dementia (medians of 7 and 4 days, respectively) (Table 4). This difference was more pronounced in younger people with dementia, particularly those aged 55–69 years, with mean LOS for persons with dementia in this age range being over 20 days compared with less than eight days in those without dementia. In the older age groups, differences in LOS between persons with and without dementia decreased, and by age 95 the two groups had similar LOS. The much longer mean LOS in patients aged under 70 years was due to a small percentage having very long stays and thus the difference in median LOS for this younger age group was much less. Reported discharge outcomes of the long-stay 50–64 year olds with dementia showed that over two-thirds (69%) returned to their usual accommodation, while nearly 25% were transferred to residential care or a different type of accommodation.

Persons with dementia were more likely to be readmitted within three months for another multi-day stay (40%) than persons without dementia (32%) ($p < 0.001$). Among patients with dementia,

Table 2. Selected principal diagnosis for hospital admission of patients with dementia compared with patients without dementia, by age (multi-day stays for HDS patients, New South Wales, 2006–07)

PART A: DEMENTIA AS PRINCIPAL DIAGNOSIS	50–64 N = 1773 (%)	65–74 N = 4336 (%)	75–84 N = 16732 (%)	85+ N = 15205 (%)	TOTAL N = 38046 (%)	SIGNIFICANCE OF AGE/DEMENTIA INTERACTION
DEMENTIA	7.5	8.3	6.9	5.1	6.4	
OTHER DIAGNOSIS	92.5	91.7	93.1	94.9	93.6	

PART B[a]: OTHER PRINCIPAL DIAGNOSIS	50–64 N = 1640		65–74 N = 3976		75–84 N = 15573		85+ N = 14423		TOTAL N = 35612		
	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	(%)	OR; 95% CI	
Circulatory	**9.4**	0.52; 0.44–0.62	**13.6**	0.65; 0.60–0.72	**15.1**	0.66; 0.63–0.69	**15.3**	0.65; 0.62–0.68	**14.7**	0.65; 0.63–0.68	*
Stroke	**1.4**	1.26; 0.83–1.91	**3.0**	1.79; 1.48–2.17	**3.1**	1.36; 1.23–1.50	**3.0**	1.02; 0.91–1.13	**3.0**	1.25; 1.17–1.34	**
Subdural	**0.2**	3.09; 0.97–9.87	**0.3**	2.94; 1.61–5.36	**0.2**	1.55; 1.05–2.29	**0.2**	1.71; 1.03–2.84	**0.2**	1.83; 1.39–2.40	n.s.
Other mental and behavioral	**20.4**	5.39; 4.76–6.31	**6.6**	4.08; 3.56–4.67	**3.5**	3.15; 2.84–3.49	**2.1**	2.43; 2.09–2.83	**4.0**	3.61; 3.39–3.85	***
Alcohol	**9.1**	7.52; 6.29–8.99	**1.3**	4.42; 3.27–5.96	**0.3**	2.39; 1.67–3.44	**0.0**	1.12; 0.47–2.63	**0.7**	5.05; 4.37–5.83	***
Respiratory	**6.8**	0.91; 0.71–1.10	**11.2**	1.14; 1.03–1.26	**11.8**	1.10; 1.05–1.16	**11.4**	1.09; 1.02–1.15	**11.3**	1.08; 1.05–1.12	n.s.
Lower RTI	**4.0**	1.54; 1.20–1.98	**5.8**	1.80; 1.56–2.06	**7.7**	1.82; 1.71–1.95	**8.7**	1.47; 1.37–1.57	**7.8**	1.64; 1.57–1.72	***
Ill-defined conditions	**10.3**	0.91; 0.77–1.07	**12.0**	1.25; 1.13–1.28	**11.4**	1.13; 1.08–1.20	**10.2**	1.00; 0.94–1.07	**10.9**	1.08; 1.04–1.12	***
Syncope/collapse	**1.2**	1.31; 0.83–2.07	**2.0**	1.71; 1.36–2.15	**1.9**	1.08; 0.95–1.22	**1.7**	0.83; 0.72–0.95	**1.8**	1.03; 0.95–1.13	***
Fractures	**3.8**	1.08; 0.84–1.40	**5.4**	1.73; 1.50–1.99	**8.9**	1.92; 1.80–2.04	**13.0**	1.85; 1.74–1.97	**9.9**	1.84; 1.77–1.92	**
Femur	**1.3**	4.03; 2.61–6.21	**2.5**	3.57; 2.88–4.42	**4.7**	2.77; 2.54–3.03	**7.7**	2.38; 2.19–2.58	**5.5**	2.62; 2.47–2.78	**
Other injury/poisoning	**6.5**	0.97; 0.80–1.18	**6.6**	1.25; 1.10–1.43	**7.7**	1.39; 1.30–1.48	**9.0**	1.30; 1.21–1.39	**8.0**	1.32; 1.26–1.37	n.s.
Head injuries/fractures[b]	**2.3**	2.97; 2.09–4.23	**2.0**	2.86; 2.20–3.72	**2.8**	2.45; 2.17–2.76	**3.7**	1.76; 1.57–1.97	**3.1**	2.16; 1.99–2.33	***
Digestive	**10.4**	0.77; 0.65–0.90	**9.0**	0.75; 0.67–0.83	**7.5**	0.70; 0.66–0.75	**7.6**	0.81; 0.75–0.87	**7.8**	0.75; 0.72–0.78	***
Constipation	**0.8**	2.71; 1.55–4.73	**1.0**	2.04; 1.47–2.84	**0.9**	1.38; 1.15–1.65	**1.0**	1.10; 0.91–1.33	**1.0**	1.33; 1.18–1.50	**
Genitourinary	**3.5**	0.58; 0.44–0.75	**6.4**	1.08; 0.95–1.23	**7.7**	1.48; 1.38–1.58	**7.5**	1.53; 1.42–1.65	**7.3**	1.37; 1.31–1.44	***
UTI	**2.1**	3.23; 2.29–4.55	**4.4**	3.74; 3.17–4.41	**5.7**	3.02; 2.79–3.28	**5.8**	2.00; 1.83–2.18	**5.5**	2.61; 2.47–2.77	***
Neoplasms	**3.2**	0.28; 0.21–0.37	**4.9**	0.41; 0.35–0.47	**4.6**	0.47; 0.43–0.51	**4.0**	0.55; 0.51–0.61	**4.3**	0.47; 0.45–0.50	***
Endocrine, nutritional, metabolic & immunity	**5.0**	1.79; 1.43–2.24	**5.5**	1.94; 1.68–2.23	**4.0**	1.54; 1.41–1.69	**3.1**	1.28; 1.14–1.43	**3.8**	1.53; 1.44–1.63	***
Other nervous disorders	**9.6**	3.86; 3.26–4.57	**4.5**	2.11; 1.86–2.46	**3.6**	1.59; 1.45–1.75	**2.3**	1.24; 1.09–1.42	**3.4**	1.71; 1.61–1.83	***
TIAs	**1.2**	1.92; 1.22–3.04	**1.2**	1.44; 1.07–1.93	**1.4**	1.18; 1.02–1.37	**1.3**	1.06; 0.90–1.26	**1.3**	1.19; 1.07–1.31	***
Epilepsy	**4.5**	10.17; 7.93–13.05	**0.9**	3.54; 2.49–5.03	**0.7**	3.29; 2.60–4.16	**0.4**	3.24; 2.20–4.78	**0.7**	4.47; 3.85–5.20	***
Musculoskeletal	**3.3**	0.48; 0.37–0.63	**3.5**	0.45; 0.38–0.53	**3.5**	0.54; 0.49–0.59	**3.3**	0.67; 0.60–0.74	**3.4**	0.56; 0.53–0.60	**
Infectious and parasitic	**1.5**	0.97; 0.65–1.45	**2.3**	1.40; 1.13–1.74	**2.8**	1.63; 1.46–1.81	**2.5**	1.30; 1.15–1.47	**2.6**	1.44; 1.33–1.55	*
Septicemia	**0.8**	1.41; 0.81–2.45	**1.7**	2.22; 1.72–2.86	**1.9**	2.37; 2.07–2.71	**1.8**	1.93; 1.65–2.26	**1.8**	2.14; 1.95–2.35	n.s.

[a] Part B excludes stays with dementia as the principal diagnosis.
[b] A subset of Fractures and Other Injury/Poisoning combined.
*$0.01 \le p < 0.05$; **$0.001 \le p < 0.01$; ***$p < 0.001$; n.s. = not significant at 95% level.
RTI = respiratory tract infection; UTI = urinary tract infection; TIA = transient ischemic attack.
Note: This table is based on first episode of a stay and excludes 953 stays with missing principal diagnosis, and six cases with perinatal or obstetrics as the principal diagnosis.

Table 3. Selected principal procedures and interventions for patients with dementia compared with patients without dementia, by age (multi-day stays for HDS patients, New South Wales, 2006–07)

PART A: WHETHER PROCEDURE/ INTERVENTION REPORTED	50–64 N = 1774		65–74 N = 4348		75–84 N = 16761		85+ N = 15238		TOTAL N = 38121		SIGNIFICANCE OF AGE/DEMENTIA INTERACTION
	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	%	OR; 95% CI	
NONE GIVEN	26.1	0.82; 0.74–0.91	24.8	0.89; 0.83–0.95	23.0	0.85; 0.82–0.89	22.6	0.87; 0.84–0.91	23.2	0.86; 0.84–0.89	*
PART B[(a)]: PROCEDURE/ INTERVENTION REPORTED	50–64 N = 1311		65–74 N = 3269		75–84 N = 12902		85+ N = 11799		TOTAL N = 29281		
	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	%	(OR; 95% CI)	
Allied health	**29.4**	2.69; 2.39–3.04	**33.7**	2.38; 2.20–2.56	**34.9**	1.51; 1.45–1.57	**36.0**	1.00; 0.96–1.05	**35.0**	1.39; 1.36–1.43	**
Imaging services	**33.5**	2.04; 1.81–2.29	**32.1**	1.91; 1.77–2.06	**33.4**	1.63; 1.57–1.70	**32.3**	1.36; 1.30–1.43	**32.8**	1.58; 1.54–1.63	**
– CT head scans	**24.5**	4.81; 4.23–5.48	**22.5**	3.77; 3.45–4.11	**23.5**	2.77; 2.64–2.90	**22.7**	1.95; 1.84–2.05	**23.1**	2.61; 2.53–2.70	**
Non-invasive, cognitive and other interventions, not elsewhere classified	**10.1**	1.23; 1.02–1.47	**6.7**	0.86; 0.75–0.99	**8.0**	0.99; 0.92–1.06	**9.1**	1.01; 0.94–1.09	**8.4**	1.00; 0.95–1.04	*
Procedures on musculoskeletal system	**4.8**	0.42; 0.33–0.55	**6.1**	0.54; 0.47–0.63	**7.6**	0.90; 0.84–0.96	**9.8**	1.46; 1.35–1.57	**8.2**	0.97; 0.93–1.02	**
– Pelvis/hip	**1.4**	0.83; 0.52–1.33	**3.1**	1.27; 1.03–1.55	**5.0**	1.67; 1.52–1.83	**7.5**	1.88; 1.72–2.05	**5.6**	1.69; 1.60–1.80	*
Procedures on digestive system	**7.9**	0.47; 0.38–0.57	**7.4**	0.49; 0.43–0.56	**5.7**	0.48; 0.44–0.52	**4.3**	0.51; 0.47–0.57	**5.4**	0.49; 0.46–0.52	n.s.
Procedures on cardiovascular system	**2.7**	0.23; 0.16–0.32	**3.5**	0.30; 0.25–0.36	**2.5**	0.30; 0.27–0.34	**1.4**	0.38; 0.33–0.45	**2.2**	0.31; 0.29–0.34	n.s.
– Coronary arteries	**1.2**	0.18; 0.11–0.29	**1.1**	0.19; 0.14–0.27	**0.7**	0.20; 0.16–0.25	**0.2**	0.25; 0.17–0.37	**0.6**	0.20; 0.17–0.24	n.s.
Procedures on urinary system	**2.7**	0.67; 0.48–0.94	**2.9**	0.69; 0.56–0.85	**2.4**	0.76; 0.66–0.86	**1.8**	0.83; 0.71–0.98	**2.2**	0.75; 0.69–0.82	n.s.
– Urinary catheterization	**0.5**	2.28; 1.07–4.87	**0.6**	1.39; 0.86–2.24	**0.9**	1.69; 1.38–2.08	**0.8**	1.29; 1.01–1.65	**0.8**	1.51; 1.30–1.75	

(a) Part B excludes stays with no procedure/intervention reported.
*$0.001 \leq p < 0.01$.
**$p < 0.001$.
n.s. no statistical significance at 95% level.
Note: Table is based on first episode of a stay, and excludes 1576 cases with missing procedures (i.e. not reported as "none given").

Table 4. Average length of multi-day hospital stays by dementia status and age (multi-day stays for HDS patients, New South Wales, 2006–2007) (nights)

	WITH DEMENTIA		WITHOUT DEMENTIA		TOTAL	
AGE GROUP	MEAN	MEDIAN	MEAN	MEDIAN	MEAN	MEDIAN
50–54‡	15.3	5	6.6	3	6.7	3
55–59‡	20.6	7	6.8	3	6.9	3
60–64‡	23.3	7	7.4	3	7.7	4
65–69‡	21.2	7	7.8	4	8.2	4
70–74‡	17.1	7	8.5	4	8.9	4
75–79‡	16.1	7	9.6	5	10.3	5
80–84‡	15.9	8	10.7	5	11.6	6
85–89‡	16.2	8	12.5	6	13.4	6
90–94‡	15.5	7	13.3	7	13.9	7
95+	15.5	7	16.2	7	16.0	7
Total#	**16.5**	7	**8.9**	**4**	**9.6**	**4**

‡ Indicates significant difference (all at $p < 0.0001$) using the Kolmogorov-Smirnov test to compare the distribution of length of stay (LOS) for people with and without dementia. Similar results were found using reported length of stay and the log transform. For the statistical test, LOS for the patients' first stay in 2006–2007 was used to ensure independence.
# Not tested for statistical significance.

younger people were considerably more likely to be readmitted than older people ($p < 0.001$ for 50–64 group compared with 85+ group) – a pattern not seen among patients without dementia. Consequently, the difference in readmission rates for people with and without dementia was more marked for younger people. Readmission for patients aged 50–64 was almost twice as likely for persons with dementia (55%) than without dementia (29%).

Among people with a readmission within three months for another multi-day stay, 12% were readmitted within a day of leaving hospital. There were no statistically significant differences between people with and without dementia in the timing of readmission. Across age groups there were some differences, with older people a little more likely than younger people to be readmitted within a day of discharge. For example, 10% of readmissions for persons aged 50–64 were within a day compared with 13% for patients aged 85 years and over ($p < 0.001$). Similar differences were observed for patients with and without dementia; however, these differences were not statistically significant for people with dementia ($n = 503$ for 50–64 group and $n = 3001$ for 85+ group, $p>0.05$).

Discharge outcomes

Table 5 presents reported hospital discharge outcomes (non-hospital care, discharges home and deaths) for persons with and without dementia in the four age groups. Mortality rates were higher for people with dementia across all age groups, with the effect more pronounced in patients aged 50–64 years where the mortality rate in persons with dementia was about double that for people without dementia (death vs other discharge: OR 1.93; 1.55–2.41). The cause of death was not recorded in the dataset, although 22 of the 84 dementia patients aged 50–64 years who died were admitted with a respiratory condition, 15 with a digestive condition and 10 with a neoplasm. For hospital stays that did not end in death, transfer to nursing home care and other accommodation was more likely in dementia patients across the age range but more pronounced under the age of 75 (discharge to own accommodation vs discharge to non-hospital care, 50–64 years OR 0.07, 0.06–0.08; 65–74 years OR 0.08, 0.07–0.08).

Discussion

In this study we found that nearly 21,000 patients with dementia aged 50 years and over had a multi-day stay in one or more of the 222 public hospitals in the state of New South Wales, Australia, over a 12-month period, representing approximately 25% of all persons with dementia in the state. This estimate draws on prevalence data calculated by Access Economics (2009); however, given that these prevalence data used in the denominator include mild cases of dementia, and mild cases of dementia are less likely to be recorded as a hospital diagnosis, this 25% figure is almost certainly an underestimate.

Table 5. Reported destination on discharge following a multi-day hospital stays by dementia status and age (multi-day stays for HDS patients, New South Wales, 2006–2007)

DESTINATION	50–64 N = 1773 %	50–64 OR; 95% CI	65–74 N = 4340 %	65–74 OR; 95% CI	75–84 N = 16747 %	75–84 OR; 95% CI	85+ N = 15214 %	85+ OR; 95% CI	TOTAL N = 38074 %	TOTAL OR; 95% CI	SIGNIFICANCE OF AGE/DEMENTIA INTERACTION
Transfer to nursing home	8.2	(a)	15.9	(a)	18.7	(a)	22.4	(a)	19.4	(a)	(a)
Transfer to other accommodation	2.6	(a)	2.4	(a)	2.6	(a)	2.8	(a)	2.7	(a)	(a)
To usual residence (a)	84.5	0.07; 0.06–0.08	75.4	0.08; 0.07–0.08	70.7	0.14; 0.14–0.15	65.0	0.29; 0.28–0.31	69.6	0.18; 0.17–0.18	***
Died (b)	4.7	1.93; 1.55–2.41	6.3	1.51; 1.33–1.71	8.0	1.35; 1.27–1.44	9.7	1.09; 1.02–1.16	8.3	1.25; 1.20–1.31	***
Total (%)	**100**		**100**		**100**		**100**		**100**		

***$p < 0.001$.
(a) ORs and 95% CIs were calculated for whether a stay ended with discharge to own accommodation versus discharged to nursing home or other accommodation. Stays ending with death in hospital were excluded for this analysis. ORs were not derived separately for discharges to nursing home or other accommodation.
(b) ORs and 95% CIs were calculated for a stay ending in death versus other.
Note: Table provides preliminary estimates and excludes 295 cases with destination unknown. "To usual accommodation" includes a small proportion (under 2% of all multi-day stays) coded as discharged while on leave, discharged at own risk and unidentified transfer to other hospital.

Our findings indicate that the outcomes of hospitalization in terms of length of stay, mortality, readmission within three months and discharge destination are significantly different in patients with dementia, with longer periods of hospitalization, higher death rates, higher rates of transfer to nursing home care and higher re-admission rates. This pattern is most evident among patients under the age of 65 years. This disproportionate effect of dementia upon hospital outcomes in younger patients has been previously noted in terms of length of stay (Zilkens *et al.*, 2009), but not other outcomes, possibly because most other studies have been limited to older patients from one hospital site (Saravay *et al.*, 2004; Natalwala *et al.*, 2008; Zekry *et al.*, 2009; Douzenis *et al.*, 2010). Our finding that dementia has less impact upon outcomes of hospitalization in older patients is consistent with a prospective study from Switzerland of patients aged 75 years and over, which found that, apart from a higher rate of discharge to nursing homes, dementia was less important than comorbidity and functional status in predicting outcome (Zekry *et al.*, 2009).

There are a number of possible explanations for the more negative outcomes in younger people with dementia. Our analyses indicate that the longer average LOS is largely due to a small proportion of younger patients with very long admissions. In addition, in almost a third of cases the principal reason for admission in younger dementia patients is due to a mental or behavioral problem or nervous system disorder. Younger dementia patients are also more likely to have alcohol-related dementia and "other degenerative dementias" (the category that includes fronto-temporal dementia), which are dementia types known to have high rates of behavioral symptoms. We therefore suspect that behavioral and psychological symptoms of dementia (BPSD) are a factor contributing to these findings, with younger patients more likely to be admitted for BPSD and who require ongoing institutional care but prove to be difficult to place due to a combination of a lack of suitable facilities for younger people and their degree of behavioral disturbance (Zilkens *et al.*, 2009). It is possible that the higher rates of mortality in the younger group might indicate that the hospital is being used for terminal care but there is nothing in the dataset to clarify this.

Our study replicates research from the UK that found that only a small proportion of dementia patients are admitted with dementia as the principal reason and that urinary tract infections, lower respiratory tract infections, fractured femur, septicemia and epilepsy are more frequent principal reasons for admission in dementia patients than

non-dementia patients (Natalwala *et al.*, 2008). These principal reasons for admission vary with age; for example, epilepsy is prominent in patients aged 50–64 years (partly attributable to the high rates of epilepsy associated with alcohol-related dementia), while urinary tract and lower respiratory tract infections are prominent in older patients, presumably related to increased rates of falls and osteoporosis at this age.

Although rates of delirium increased with age in the overall sample, this basically reflected the higher rates of dementia in old age groups. Surprisingly, we found that in persons with dementia, older age had a very limited effect on rates of delirium and, in particular, older persons without dementia had relatively low rates of delirium. Previous research has shown delirium goes unrecognized by clinicians in between one-third to two-thirds of elderly patients (Inouye *et al.*, 1999). It is possible that the confusion and behavior change due to delirium is more easily recognized by clinicians as being abnormal in younger patients.

There are also medical diagnoses that were less frequent principal reasons for admission in dementia patients and these included neoplasms, circulatory system disorders (with principal procedures related to coronary arteries much less frequently performed on dementia patients) and digestive system disorders (fewer principal procedures related to the digestive system were performed on dementia patients). The reason for the infrequent use of coronary artery procedures in persons with dementia is not clear in this dataset and we can only speculate that this might be due to clinicians being less prepared to offer the procedure to people with dementia as there is no evidence that they have lower rates of coronary artery disease. There is not such a clear explanation for the low rates of neoplasms as the principal reason for admission in dementia patients; the use of radiation oncology and chemotherapy was lower but not enough to explain the difference.

These data lend further support to the important role that alcohol plays in early onset dementia, with alcohol-related dementia – the commonest dementia diagnosis in patients aged 50–64 years – being responsible for over 20% of cases. It is also noteworthy that in patients aged 50–64 years, an alcohol-related disorder was a much more common principal reason for admission in dementia patients than non-dementia patients. Many studies of the epidemiology of early onset dementia exclude alcohol-related cases, but those that have included alcohol-related dementia have produced similar findings to ours (Harvey *et al.*, 2003; Withall and Draper, 2009). A surprising finding, however, was that alcohol-related mental disorders were significantly more common as the reason for admission in dementia patients up to the age of 85. In most cases, alcohol was regarded as comorbid rather than the cause of the dementia and this may reflect the inadvertent misuse of alcohol by cognitively impaired patients. The challenge that this presents for families and clinicians is how to minimize the adverse effects of alcohol in order to prevent hospitalizations in this compromised population.

There are a number of limitations to this study. The NSW Admitted Patient Care Database is derived from data obtained from numerous clinicians making diagnoses and hence their validity is variable. The accuracy of coding of diagnoses and data entry by medical record staff is also unknown. There have been no published studies of the validity of routine diagnoses of dementia in Australia. It is likely that dementia is underestimated in this population due to a combination of poor recognition by medical staff, deficiencies in the medical record, and the requirement that to be recorded in the hospital admission data, the medical diagnosis has to be deemed to contribute to the cost of the hospital stay. It is also possible that, in this study, patients who had multiple or longer stays were more likely to be identified as having dementia than patients with short or single admissions and this might overestimate the effect of dementia. These two factors have opposing effects; however, it is not currently possible to measure their impact on estimates. It is also possible that cases of delirium are misdiagnosed as dementia. Nevertheless, because of the large scale of the study, it is expected that patterns seen in hospital use for HDS patients with and without dementia are robust. The age cut-off of 50 years may also have excluded some younger people with dementia.

There are also important strengths to the dataset. The sample size is large, comprising over 20,000 patients with dementia of whom more than 750 were aged 50–64 years. The database covers the whole population of admitted multi-day public hospital patients aged 50 years and over in NSW, the most populous state of Australia. In addition, all hospital stays for these people are included (public and private, multi-day and single-day) allowing comprehensive analysis of their hospital experience.

In conclusion, patients with dementia are more likely to have negative outcomes associated with hospital admission than non-dementia patients and this is accentuated in dementia patients aged 50–64 years. Further investigation of these age-related effects on hospital outcomes is warranted.

Conflict of interest

None.

Description of authors' roles

BD contributed to the study design, obtained research funds, took part in data analysis, and helped prepare the first draft and final paper. RK contributed to the study design, prepared the data for patient-based analysis, undertook the data analysis, and assisted in preparation of the final paper. AP and DG contributed to the study design, obtained research funds, and assisted in preparation of the final paper. PA contributed to the study design, involvement in data analysis, and assisted in preparation of the final paper.

Acknowledgments

This study was funded by NHMRC dementia research grant no. 465701. The authors thank the New South Wales Department of Health for permission to use data from the Admitted Patient Data Collection and for provision of the data extract with patient identifiers derived by the Centre for Health Record Linkage (or CHeReL). We thank the other members of the Hospital Dementia Services project team – Gail Brien, Le Anh Pham Lobb, Natalie Chan and Charles Hudson – for their work on the project and assistance with this paper, and the Australian Institute for Health and Welfare for hosting and supporting the project. We thank Srikar Velivela for assistance with the data analysis.

References

Access Economics (2009) *Keeping Dementia Front of Mind: Incidence and Prevalence 2009–2050*. Canberra: Alzheimer's Australia.

ACEMA (Aged Care Evaluation and Management Advisors) (2003). *Examination of Length of Stay for Older Persons in the Acute and Sub-Acute Sector.* Report for the AHMAC Working Group on the Care of Older Australians. Canberra: Department of Health.

Borbasi, S., Jones, J., Lockwood, C. and Emden, C. (2006). Health professionals' perspectives of providing care to people with dementia in the acute setting: toward better practice. *Geriatric Nursing*, 27, 300–308.

Creditor, M. C. (1993). Hazards of hospitalization of the elderly. *Annals of International Medicine*, 118, 219–223.

Douzenis, A. *et al.* (2010). Cognitive decline and dementia in elderly medical inpatients remain underestimated and underdiagnosed in a recently established university general hospital in Greece. *Archives of Gerontology and Geriatrics*, 50, 147–150.

Foreman, P. and Gardner, I. (2005). *Evaluation of Education and Training of Staff in Dementia Care and Management in Acute Settings.* Report for the Department of Human Services. Melbourne: Department of Human Services, Victoria.

Harvey, R. J., Skelton-Robinson, M. and Rossor, M. N. (2003). The prevalence and causes of dementia in people under the age of 65 years. *Journal of Neurology, Neurosurgery and Psychiatry*, 74, 1206–1209.

Inouye, S. K., Schlesinger, M. J. and Lydon, T. J. (1999). Delirium: a symptom of how hospital care is failing older persons and a window to improve quality of hospital care. *American Journal of Medicine*, 106, 565–573.

Karmel, R., Lloyd, J. and Anderson, P. (2008). *Movement from Hospital to Residential Aged Care*. Canberra: AIHW.

King, B., Jones, C. and Brand, C. (2006). Relationship between dementia and length of stay of general medical patients admitted to acute care. *Australasian Journal on Ageing*, 25, 20–23.

Kurrle, S. E. (2006). Improving acute care services for older people. *Medical Journal of Australia*, 184, 427–428.

Natalwala, A., Potluri, R., Uppal, H. and Heun, R. (2008). Reasons for hospital admissions in dementia patients in Birmingham, UK, 2002–2007. *Dementia and Geriatric Cognitive Disorders*, 26, 499–505.

National Centre for Classification in Health (1998). *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM)*. Sydney: National Centre for Classification in Health, Faculty of Health Sciences, University of Sydney.

Nichol, B., Lonergan, J. and Mould, M. (2000). *The Use of Hospitals by Older People: A Casemix Analysis.* Occasional Papers, New Series no. 11. Canberra: Commonwealth Department of Health and Aged Care.

Peut, A., Hogan, R., Goss, J., Mann, N. and Levings, B. (2007). *Dementia in Australia: National data analysis and development*. Canberra: AIHW.

Saravay, S. M. *et al.* (2004). How do delirium and dementia increase length of stay of elderly general medical inpatients? *Psychosomatics*, 45, 235–242.

Torian, L., Davidson, E., Fulop, G., Sell, L. and Fillit, H. (1992). The effect of dementia on acute care in a geriatric medical unit.*International Psychogeriatrics*, 4, 231–239.

Withall, A. and Draper, B. (2009). What is the burden of younger onset dementia in Australia? *International Psychogeriatrics*, 21 (Suppl. 2), S26.

Zekry, D. *et al.* (2009). Does dementia predict adverse hospitalization outcomes? A prospective study in aged inpatients. *International Journal of Geriatric Psychiatry*, 24, 283–291.

Zilkens, R. R., Spilsbury, K., Bruce, D. G. and Semmens, J. B. (2009). Clinical epidemiology and in-patient hospital use in the last year of life (1990–2005) of 29,884 Western Australians with dementia. *Journal of Alzheimer's Disease*, 17, 399–407.

Zuliani, G. *et al.* (2011) Discharge diagnosis and comorbidity profile in hospitalized older patients with dementia. *International Journal of Geriatric Psychiatry*. Epublished ahead of print. doi: 10.1002/gps.2722.