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Deriving key patient variables

A technical paper for the Hospital Dementia Services Project

DATA LINKAGE SERIES NO. 15

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Authoritative information and statistics to promote better health and wellbeing

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Australian Institute of Health and Welfare
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Contents

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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

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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.

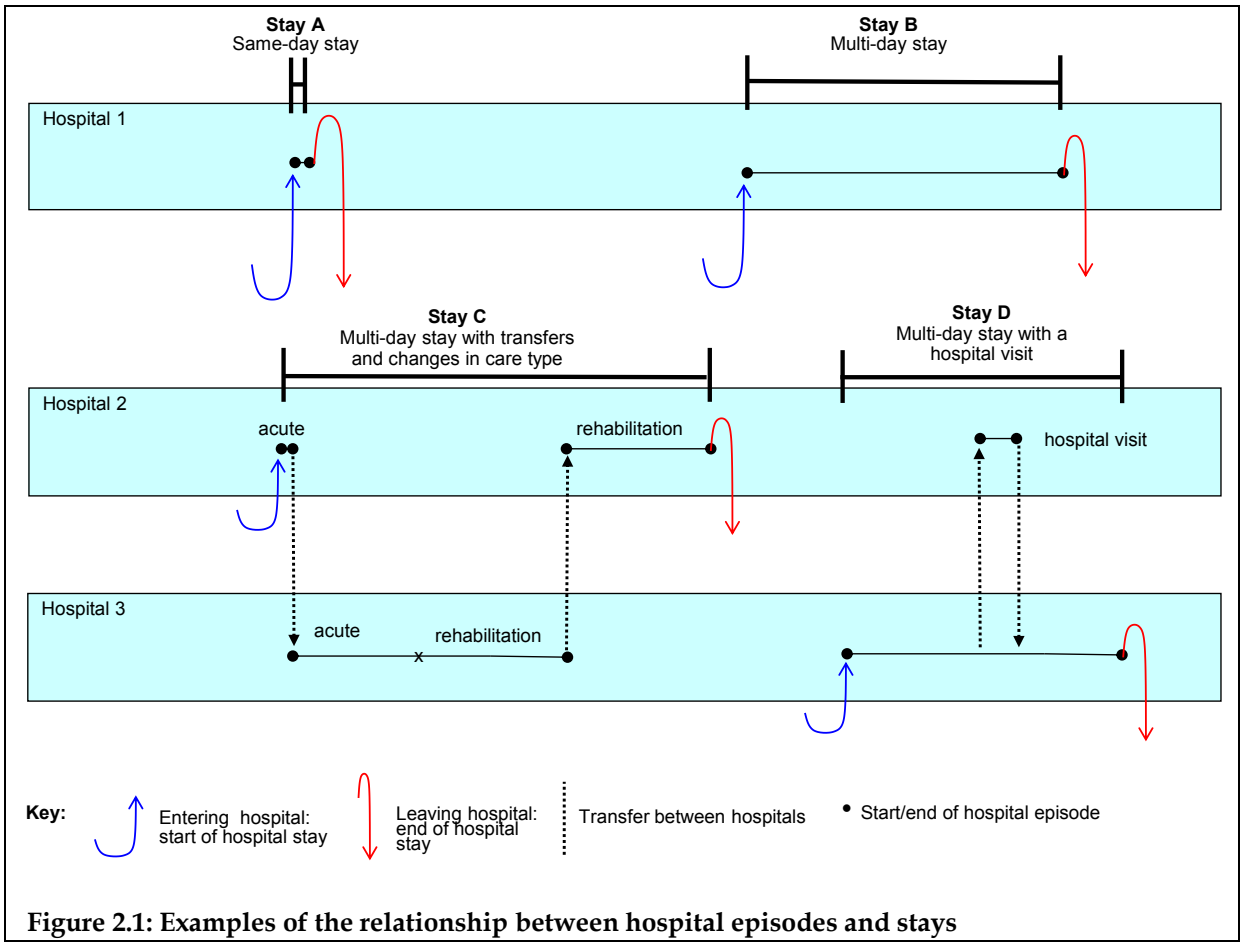


Figure 2.1: Examples of the relationship between hospital episodes and stays

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

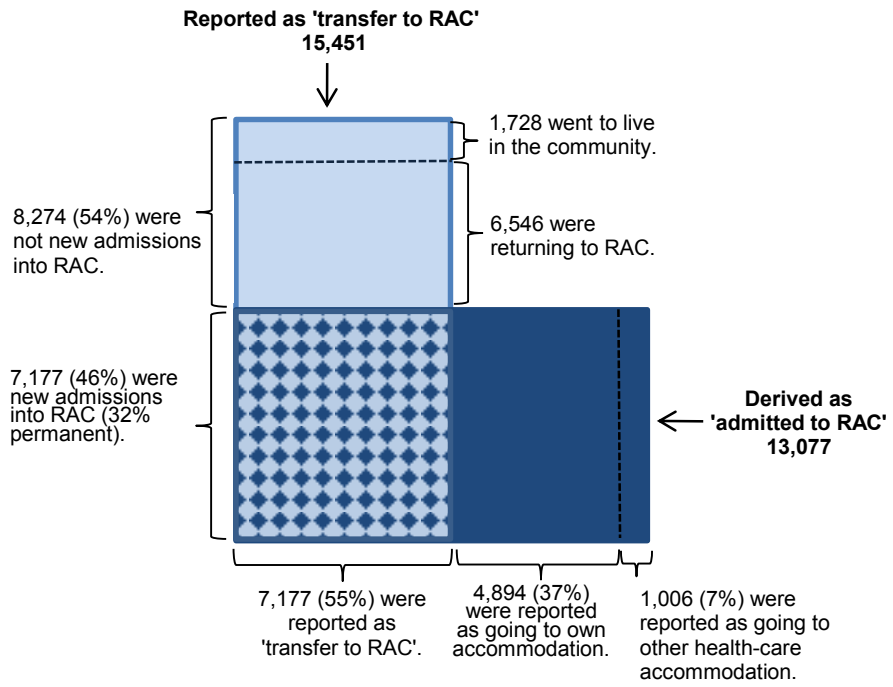
	Reported post-hospital destination					Total	
Derived post-hospital destination	**Discharge/ transfer to RAC (not previous usual residence)**	**To other health-care accommodation[a]**	**To own accommodation, including discharged at own risk or while on leave**	**Died**	**Unknown**	**No.**	**Per cent**
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)

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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.

Deriving key patient variables: a technical paper for the Hospital Dementia Services Project

AIHW