

**Table 5: The effect of age on the per cent of unique linkage keys in the linked data, using different linkage keys, NSW/ACT, 1999–00 (linked records)**

Linkage key	65–69	70–74	75–79	80–84	85–89	90–94	95+	Total
<b>Exact date</b>								
<b>Number with unique linkage keys</b>								
Date of birth and sex	589	1,202	2,305	3,046	2,964	1,540	386	12,032
Date of birth, sex and postcode	172	391	730	1,005	1,032	536	145	4,011
Date of birth, sex and SLA group	473	934	1,849	2,467	2,477	1,296	334	9,830
<b>Within 3 days</b>								
Date of birth and sex	638	1,295	2,471	3,232	3,101	1,595	398	12,730
Date of birth, sex and postcode	184	411	760	1,056	1,078	560	152	4,201
Date of birth, sex, and SLA group	497	966	1,923	2,564	2,546	1,350	345	10,191
<b>Exact date</b>								
<b>Total number of linked records</b>								
Date of birth and sex	679	1,393	2,694	3,442	3,258	1,595	398	13,459
Date of birth, sex and postcode	180	397	734	1,015	1,040	538	147	4,051
Date of birth, sex and SLA group	485	946	1,873	2,487	2,493	1,300	338	9,922
<b>Within 3 days</b>								
Date of birth and sex	892	1,996	3,803	4,684	4,116	1,834	424	17,749
Date of birth, sex and postcode	192	425	774	1,086	1,098	572	154	4,301
Date of birth, sex and SLA group	521	1,017	2,000	2,662	2,633	1,386	351	10,570
<b>Exact date</b>								
<b>Per cent with unique linkage keys</b>								
Date of birth and sex	86.7	86.3	85.6	88.5	91.0	96.6	97.0	89.4
Date of birth, sex, and postcode	95.6	98.5	99.5	99.0	99.2	99.6	98.6	99.0
Date of birth, sex and SLA group	97.5	98.7	98.7	99.2	99.4	99.7	98.8	99.1
<b>Within 3 days</b>								
Date of birth and sex	71.5	64.9	65.0	69.0	75.3	87.0	93.9	71.7
Date of birth, sex and postcode	95.8	96.7	98.2	97.2	98.2	97.9	98.7	97.7
Date of birth and sex, and SLA group	95.4	95.0	96.2	96.3	96.7	97.4	98.3	96.4

## 5 Validation of linkages using other variables

It is not currently possible to validate the above linkage strategy by comparing results with a data set where the exact links between clients of hospital and residential aged care services are known. In the future this may be possible if hospital morbidity data with information on client name for one state, say, can be obtained to compare with residential aged care data with name. Collaboration between Western Australia and AIHW is currently being investigated, with a view to developing such a data set. However, in the mean time some validation can be undertaken by looking at the consistency of client characteristics in the two source data sets for the linked records.

## 5.1 Mode of separation from hospital

The hospital morbidity database contains a variable, mode of separation, which indicates the destination of people after they leave the hospital. Intuitively, it would seem that this variable could be used either as part of the linkage process itself (to positively identify those people who leave hospital and enter residential aged care) or to check on the quality of the linkage process. However, the mode of separation variable does not, in practice, clearly identify which people who separate from the hospital enter residential aged care.

The main problem with this data item from the perspective of this project is that persons for whom a residential aged care service is their ‘usual place of residence’ are, according to the *National Health Data Dictionary*, coded to the mode of separation category ‘other’. The code for residential aged care service is to be used when this is not their usual place of residence prior to hospital entry. The picture provided by this data item is further clouded by the fact that the terms ‘nursing home’ and ‘hostel’ were only replaced with ‘residential aged care service’ in the 2001 version of the data dictionary. Allowing some time for implementation of those changes in hospital systems, it is reasonable to assume that hospitals were still using the previous definition at least until 2001. In the earlier definition, separation to a nursing home (again except where it was the usual place of residence) had a distinct code, but separation to a hostel was included under the category of ‘other health care accommodation’.

In this project we are using 1999–00 data, and so the new codes for mode of separation were not yet being used for the hospital morbidity data. Hence, persons moving from a hospital to an aged care service could receive a code of 2 (nursing home), 4 (other health care accommodation) or 9 (other, which includes discharge to usual residence—usually within the general community).

Table 6 shows the distribution of the mode of separation variable in the linked data, the unlinked or ‘residual’ hospital data, and all hospital data. The linkage keys in use in this table are based on date of birth, sex and exact date of separation/admission. The effect of adding SLA group of usual residence to the key is also shown.

Without including a geographic indicator this linkage process picked up 45.1% of those separations coded as being discharged to a ‘nursing home’, 25.7% of those coded as being discharged to ‘other health care accommodation’, and 2.0% of those coded as ‘other’. While this latter percentage appears small, it reflects the fact that most people return to the community after visiting hospital. The actual numbers associated with these three percentages are also relevant—6,707 of the linked entries were coded to the ‘nursing home’ category, 529 to ‘other health care accommodation’ and 5,674 to ‘other’. Consequently, overall 50.2% of the linked records had their separation mode recorded as ‘nursing home’, 4.0% had ‘to other health care accommodation’ and 42.5% had ‘other’ separation modes. If the return from leave records are excluded from the comparison (as they should be coded to ‘other’ if coded correctly) the percentage of linked records indicating separation to a nursing home increased to 54.6%.

Looking solely at the unlinked hospital data, only 2.6% of records were coded as leaving for a nursing home while the vast majority—87.1%—had ‘other’ as the separation mode. While 2.6% being coded as ‘to nursing home’ is a small percentage, in numerical terms it is quite significant, representing 8,167 cases. This is a significant number when compared with the total number of linked records identified in the hospital data as going to nursing homes (6,707 as given above). The discrepancy here appears to be the result of problems with recording mode of separation. From Table 1, in 1999–00 there were almost 33,000 admissions (after exclusions for this study). In general, it has been estimated by government analysts that between 40% and 60% of admissions to residential aged care services are from hospitals, with the remainder being from the community. Therefore, for 1999–00 we would have expected between about 13,200 and 19,800 admissions from hospitals. The number of hospital separations coded as going to nursing homes is within this range (14,874). However, this figure does not include those going to what were previously termed ‘hostels’ or those returning to an aged care service after a stay in hospital (on hospital leave).

Turning to the linked data, it is consistent with the recommended coding practice that the linkage strategy would pick up persons with all three of these modes of separation. However, those in the ‘other’ category should, if coded correctly, only refer to residents returning from leave. While there were 2,637 return from hospital leave linked entries, only 1,675 (64.7%) were coded to the correct separation mode of ‘other’ (although a further 32.2% were coded to nursing home). While this error could lie in the linkage process, given that it is known the person has entered the residential aged care service from a hospital, the reliance that can be placed on this aspect of the linked database is quite high. It is also of concern that the linkage strategy is picking up 436 separations (3.3% of the linked records) coded as going to another hospital, although some hospitals do contain funded residential aged care services, so the linkage in these cases may be legitimate.

Similar results were obtained when SLA group was added to the linkage key. However, as would be expected from a more rigorous linkage key, the proportion of linked records with separation mode ‘to nursing home’ was higher (56.2%) while the proportion coded to ‘other’ was lower (36.9%).

Allowing separation and admission dates to be within 3 days led to similar results, although smaller percentages of linked residential aged care admissions had been identified as going to a nursing home by the hospital (Table A3). Overall, these results suggest that there are problems with how separation mode is recorded in the hospital morbidity data, and that a better classification which clearly identifies different types of separations to residential aged care needs to be developed.

**Table 6: Hospital separation mode for exact date linked data, unlinked hospital data and all hospital data, by linkage key used, NSW/ACT, 1999–00**

Separation mode	Linked data				Unlinked hospital data	All hospital data
	Type of entry to residential aged care			All linked entries		
	Permanent admissions	Respite admissions	Return from leave			
<b>Number</b>						
<b>Linkage key = date of birth, sex and exact day</b>						
To another hospital	224	171	41	436	30,028	30,464
To nursing home	4,365	1,493	849	6,707	8,167	14,874
To other health care accommodation	169	290	70	529	1,528	2,057
Unknown	9	6	2	17	1,043	1,060
Other	2,043	1,956	1,675	5,674	274,091	279,765
<b>All</b>	<b>6,810</b>	<b>3,916</b>	<b>2,637</b>	<b>13,363</b>	<b>314,857</b>	<b>328,220</b>
<b>Linkage key = date of birth, sex, exact day and SLA group</b>						
To another hospital	128	101	14	243	30,221	30,464
To nursing home	3,729	1,284	562	5,575	9,299	14,874
To other health care accommodation	130	245	52	427	1,630	2,057
Unknown	7	3	1	11	1,049	1,060
Other	1,285	1,219	1,155	3,659	276,106	279,765
<b>All</b>	<b>5,279</b>	<b>2,852</b>	<b>1,784</b>	<b>9,915</b>	<b>318,305</b>	<b>328,220</b>
<b>Row per cent</b>						
<b>Linkage key = date of birth, sex and exact day</b>						
To another hospital	0.7	0.6	0.1	1.4	98.6	100.0
To nursing home	29.3	10.0	5.7	45.1	54.9	100.0
To other health care accommodation	8.2	14.1	3.4	25.7	74.3	100.0
Unknown	0.8	0.6	0.2	1.6	98.4	100.0
Other	0.7	0.7	0.6	2.0	98.0	100.0
<b>All</b>	<b>2.1</b>	<b>1.2</b>	<b>0.8</b>	<b>4.1</b>	<b>95.9</b>	<b>100.0</b>
<b>Linkage key = date of birth, sex, exact day and SLA group</b>						
To another hospital	0.4	0.3	0.0	0.8	99.2	100.0
To nursing home	25.1	8.6	3.8	37.5	62.5	100.0
To other health care accommodation	6.3	11.9	2.5	20.8	79.2	100.0
Unknown	0.7	0.3	0.1	1.0	99.0	100.0
Other	0.5	0.4	0.4	1.3	98.7	100.0
<b>All</b>	<b>1.6</b>	<b>0.9</b>	<b>0.5</b>	<b>3.0</b>	<b>97.0</b>	<b>100.0</b>
<b>Column per cent</b>						
<b>Linkage key = date of birth, sex and exact day</b>						
To another hospital	3.3	4.4	1.6	3.3	9.5	9.3
To nursing home	64.1	38.1	32.2	50.2	2.6	4.5
To other health care accommodation	2.5	7.4	2.7	4.0	0.5	0.6
Unknown	0.1	0.2	0.1	0.1	0.3	0.3
Other	30.0	49.9	63.5	42.5	87.1	85.2
<b>All</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Linkage key = date of birth, sex, exact day and SLA group</b>						
To another hospital	2.4	3.5	0.8	2.5	9.5	9.3
To nursing home	70.6	45.0	31.5	56.2	2.9	4.5
To other health care accommodation	2.5	8.6	2.9	4.3	0.5	0.6
Unknown	0.1	0.1	0.1	0.1	0.3	0.3
Other	24.3	42.7	64.7	36.9	86.7	85.2
<b>All</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Notes*

1. SLA group is derived from postcode. For a particular postcode, the corresponding SLA group includes all SLAs which have some residents in that postcode.
2. The linked data in this table is based on the number of unique residential aged care records linked; excess links have been excluded.

## **5.2 Place of assessment for residential aged care admissions**

There is unfortunately no variable in the residential aged care database which indicates whether a resident has been admitted from hospital or from elsewhere. The variable which is sometimes used as an indicator of admission from hospital is whether or not the Aged Care Assessment Team's (ACAT) assessment occurred in hospital. This is, of course, a very imperfect indicator, as a person assessed in hospital may, for example, return to the community and enter residential care from their own home, or alternatively he or she may be assessed at home, and enter residential aged care after admission to a hospital as a result of an episode of acute illness. It is therefore recommended that a variable which indicates where the resident has been admitted from be developed.

Regardless of these problems, as it is the only available indicator of location prior to admission the linked data set was examined in relation to this variable (for permanent and respite admissions only, as for those returning from hospital leave the ACAT assessment may have occurred at any time in the past). Using the linked data set produced by the combination of date of birth, sex and exact date of separation/admission, it is evident that the proportion of entries who had had an ACAT assessment in hospital is far higher in the linked data set (73.1%) than in the unlinked data set (20.7%) (Table 7). The corresponding numbers obtained when SLA group of usual residence was added to the linkage process are 77.4% and 24.5%.

Replacing the exact separation/admission date requirement to allowing matches when the admission date was within 3 days of the separation date, led to similar results. As expected, due to the less precise matching requirement, the proportion of linked residential aged care records with assessment taking place in a hospital was slightly lower using the less exact match. For example, 75.8% of linked records gave hospital as the place of assessment when using date of birth, sex, SLA group and admission within 3 days of separation as the linkage key, compared with 77.4% when an exact date match was used (Table A4).

The high proportion of linked records with 'hospital' as the place of assessment is an encouraging finding with regard to the validity of the linkage process.

**Table 7: Place of assessment for exact date linked and unlinked residential aged care data, by linkage key used, NSW/ACT, 1999–00**

Place of assessment	Linked data			Unlinked			All residential aged care data		
	Permanent	Respite	All	Permanent	Respite	All	Permanent	Respite	All
<b>Number</b>									
<b>Linkage key = date of birth, sex and exact date</b>									
Aged care facility	316	184	500	1,089	841	1,930	1,405	1,025	2,430
At home	980	991	1,971	4,322	7,692	12,014	5,302	8,683	13,985
Hospital	5,066	2,475	7,541	2,461	1,454	3,915	7,527	3,929	11,456
Other	183	128	311	502	552	1,054	685	680	1,365
<b>Total</b>	<b>6,545</b>	<b>3,778</b>	<b>10,323</b>	<b>8,374</b>	<b>10,539</b>	<b>18,913</b>	<b>14,919</b>	<b>14,317</b>	<b>29,236</b>
<b>Linkage key = date of birth, sex, exact date and SLA group</b>									
Aged care facility	237	138	375	1,168	887	2,055	1,405	1,025	2,430
At home	698	551	1,249	4,604	8,132	12,736	5,302	8,683	13,985
Hospital	4,194	2,080	6,274	3,333	1,849	5,182	7,527	3,929	11,456
Other	129	79	208	556	601	1,157	685	680	1,365
<b>Total</b>	<b>5,258</b>	<b>2,848</b>	<b>8,106</b>	<b>9,661</b>	<b>11,469</b>	<b>21,130</b>	<b>14,919</b>	<b>14,317</b>	<b>29,236</b>
<b>Per cent</b>									
<b>Linkage key = date of birth, sex and exact date</b>									
Aged care facility	4.8	4.9	4.8	13.0	8.0	10.2	9.4	7.2	8.3
At home	15.0	26.2	19.1	51.6	73.0	63.5	35.5	60.6	47.8
Hospital	77.4	65.5	73.1	29.4	13.8	20.7	50.5	27.4	39.2
Other	2.8	3.4	3.0	6.0	5.2	5.6	4.6	4.7	4.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Linkage key = date of birth, sex, exact date and SLA group</b>									
Aged care facility	4.5	4.8	4.6	12.1	7.7	9.7	9.4	7.2	8.3
At home	13.3	19.3	15.4	47.7	70.9	60.3	35.5	60.6	47.8
Hospital	79.8	73.0	77.4	34.5	16.1	24.5	50.5	27.4	39.2
Other	2.5	2.8	2.6	5.8	5.2	5.5	4.6	4.7	4.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Notes*

1. SLA group is derived from postcode. For a particular postcode, the corresponding SLA group includes all SLAs which have some residents in that postcode.
2. Admissions to residential aged care relating to hospital leave have been excluded.
3. The linked data in this table is based on the number of unique residential aged care records linked; excess links have been excluded.

### 5.3 Marital status

Marital status is available in both the hospital morbidity and residential aged care data sets for NSW/ACT. It can therefore provide a quality check on the data linkage results. However, marital status for residential care is collected at the time of initial entry, and therefore may be out of date for some residents, in particular for those returning from hospital leave (or around 20% of linked records—Table 6).

Table 8 presents the results of this comparison for the linked database using the exact day admission/separation variable. There was agreement on marital status in 78% of linked records when date of birth, sex and exact day was used to match, with this increasing to 83% when matching on SLA group of usual residence was incorporated into the linkage key. These percentages are based on all records. However, marital status was unknown for 1% of linked residential aged care records and for 6.1% for the hospital morbidity data. If records with marital status missing are excluded, these proportions become 84% and 89%, respectively. The largest source of disagreement was between the widowed and married categories; it is plausible that some of these would relate to less current record systems in one facility or another, given the advanced age of this group and the reasonably high likelihood of death of a spouse.

Increasing the uncertainty of the link by moving to a ‘within 3 days’ match on separation and admission dates reduced the above percentages only marginally when SLA group was still included in the linkage key, but more noticeably when the geographic restriction was not included (Table A5). Excluding cases with missing information, the percentages with matching marital status from the two data sources were 89% with SLA group in the linkage key and 77% without SLA group in the key.

**Table 8: Comparison of marital status in hospital data and marital status in aged care data by exact date linkage key used, linked data set, NSW/ACT, 1999–00**

Residential aged care	Hospital morbidity data					All
	Never married	Married including de facto	Widowed	Divorced or separated	Not stated	
	<b>Number</b>					
<b>Linkage key = date of birth, sex and exact date</b>						
Never married	804	97	155	22	126	1,204
Married including de facto	63	3,057	299	40	124	3,583
Widowed	226	567	6,245	247	525	7,810
Divorced or separated	63	106	151	362	83	765
Unknown	8	18	55	4	12	97
<b>All</b>	<b>1,164</b>	<b>3,845</b>	<b>6,905</b>	<b>675</b>	<b>870</b>	<b>13,459</b>
<b>Linkage key = date of birth, sex, exact date and SLA group</b>						
Never married	657	26	85	9	89	866
Married including de facto	30	2,474	111	18	75	2,708
Widowed	131	248	4,797	188	370	5,734
Divorced or separated	43	42	96	298	61	540
Unknown	6	12	46	2	8	74
<b>All</b>	<b>867</b>	<b>2,802</b>	<b>5,135</b>	<b>515</b>	<b>603</b>	<b>9,922</b>
	<b>Per cent</b>					
<b>Linkage key = date of birth, sex and exact date</b>						
Never married	6.0	0.7	1.2	0.2	0.9	8.9
Married including de facto	0.5	22.7	2.2	0.3	0.9	26.6
Widowed	1.7	4.2	46.4	1.8	3.9	58.0
Divorced or separated	0.5	0.8	1.1	2.7	0.6	5.7
Unknown	0.1	0.1	0.4	0.0	0.1	0.7
<b>All</b>	<b>8.6</b>	<b>28.6</b>	<b>51.3</b>	<b>5.0</b>	<b>6.5</b>	<b>100.0</b>
<b>Linkage key = date of birth, sex, exact date and SLA group</b>						
Never married	6.6	0.3	0.9	0.1	0.9	8.7
Married including de facto	0.3	24.9	1.1	0.2	0.8	27.3
Widowed	1.3	2.5	48.3	1.9	3.7	57.8
Divorced or separated	0.4	0.4	1.0	3.0	0.6	5.4
Unknown	0.1	0.1	0.5	0.0	0.1	0.7
<b>All</b>	<b>8.7</b>	<b>28.2</b>	<b>51.8</b>	<b>5.2</b>	<b>6.1</b>	<b>100.0</b>

*Note:* SLA group is derived from postcode. For a particular postcode, the corresponding SLA group includes all SLAs which have some residents in that postcode.

## 5.4 Summary

### Validation

The consistency of marital status in the hospital morbidity and residential aged care data sets among linked records, and the consistency of place of assessment among residential aged care records that have been linked to hospital separations indicate that we can have reasonable confidence that, using the proposed linkage strategy, linked records relate to people who have moved between the two sectors. This is especially true if a geographic indicator of place of usual residence is included in the linkage key, as this limits the likelihood of false matches. Inconsistencies in the mode of separation data on the hospital morbidity database with the linkage results, and identified problems with this variable, suggest that it does not provide a very good validation test of the linkage strategy. Moreover, for this variable to be useful either for use in validation or for adding to the accuracy of linkages, a new classification needs to be developed.

### Utility of linkage strategy

The above analyses indicate that a linkage strategy based on variables other than name of client could be useful in obtaining a sample of cases showing movement from hospital to residential aged care. Steps taken to reduce the number of false links, however, imply that at this stage the resulting linked data set would not be accurate enough to allow calculation of the flow between the two sectors. This is because reducing the number of false links at the same time increases the number of missed links. There is also potential for biases in the linked data set, primarily due to these missed links. The existence and extent of any biases could be examined by using named hospital and residential aged care data sets to compare results based on the current linkage strategy with those using a named-based strategy.

Among the linkage keys tested, that based on date of birth, sex, exact date of separation/admission and SLA group of usual residence appears to provide a linked data set with high confidence that identified links were correct; that is, that the incidence of false links was small. This data set could be used to examine such matters as the characteristics of people who have long stays in hospital before transferring to residential aged care.

### Data development

An important first step towards improving national information on the movements of clients between the residential and acute care sectors would be the revision of the current 'mode of separation' data item in the hospital morbidity collection, and the creation of a new variable in the residential aged care collection which indicates where the resident has come from. To this end, draft data definitions have been developed (see Section 8). Development and implementation of these items would provide greatly improved information on the size of client flows between the two

sectors, and facilitate statistical linkage by providing variables which would allow more accurate targeting of the linkage process.

## **6 Results for Western Australia, South Australia and Tasmania**

In order for the linkage strategy to be useful in a national context, its utility across a number of different states and territories needs to be established. The linkage strategy was therefore also applied to data from Western Australia, South Australia and Tasmania. The tables corresponding to those presented above for NSW/ACT are in Appendix 2 (for Western Australia), Appendix 3 (for South Australia) and Appendix 4 (for Tasmania). The results are summarised below. Unfortunately, although Queensland provided approval for use of the appropriate hospital morbidity data, it was not received in time to allow inclusion in this study. However, Queensland could be included if further analysis were to be carried out using the linked data.

### **6.1 Unique linkage keys in the unlinked data**

As stated above, as the number of records being tested for unique linkage keys decreases, the proportion of records with unique linkage keys increases. Consequently, for each linkage key in both the hospital morbidity and residential aged care data sets the proportion with unique keys was lowest for NSW/ACT and highest for Tasmania. There were few duplicates in the Western Australian, South Australian and Tasmanian data, with the proportion of duplicate keys being less than 2% for all keys incorporating geographic location. (See Table 1 and Table 2 for NSW/ACT, Table A11 and Table A12 for Western Australia, Table A19 and Table A20 for South Australia, and Table A27 and Table A28 for Tasmania).

With respect to different linkage keys, the results for the three states were generally the same as those for NSW/ACT, with linkage keys employing exact dates having fewer duplicates than similar keys using 3 day matches, and with the addition of a geographic indicator of usual residence also reducing the incidence of duplicate keys. Because of the relatively small numbers, an age effect in the number of unique linkage keys was only observed in the hospital data when using the least exact linkage key, that is using a linkage key based on date of birth, sex and separation dates within 3 days. (See Table A13 for Western Australia, Table A21 for South Australia and Table A29 for Tasmania).

### **6.2 Unique linkage keys in the linked data**

As expected, the number of linked records were considerably smaller for Western Australia, South Australia and Tasmania than for NSW/ACT. The resulting samples are shown in Table 9.