Appendix 5: Hospital morbidity costing method and under-identification studies

Hospital morbidity costing method

In the first report on expenditure on health services for Aboriginal and Torres Strait Islander people, hospital costs were estimated using a methodology developed for the Disease Costs and Impact Study, a joint project of the Australian Institute of Health and Welfare (AIHW) and the Centre for Health Program Evaluation. (See sections A1.11 to A1.20 in the first report for a detailed description of this methodology.) The second report uses a modified version of this methodology, which more fully takes account of differences in costs between hospitals.

The proportions of total public acute hospital expenditure which relate to admitted patients are given by the admitted patient fractions estimated by each State and Territory and published in *Australian Hospital Statistics*.

The hospital morbidity costing method estimates acute hospital admitted patient costs by apportioning the total admitted patient expenditure to individual episodes of hospitalisation with an adjustment for resource intensity of treatment for the specific episode (using Diagnostic Related Groups (DRGs)) and length of stay.

Length of stay adjustment within DRGs

All episode costs are adjusted for length of stay. The method estimates the cost of days for a hospital episode as proportional to the DRG weight for that episode. An additional adjustment is made for length of stay to reflect the fact that some components of the cost of the episode (for example, ward nursing care and meals) are proportional to length of stay, whereas other costs are more or less independent of length of stay (for example, theatre costs for a surgical DRG) (see Box A5.1). On average, around 75% of the episode cost varies with the length of stay across all DRGs. For particular DRGs, such as surgical DRGs, the proportion that varies with length of stay will be lower.

Box A5.1: Assumed variation of DRG cost components by length of stay within DRG

Assumption	*Component*
Independent of length of stay	*Prostheses* *Emergency Departments* *Critical Care* *Operating Rooms* *Specialised Procedure Suites*
Proportional to length of stay	*Ward Medical* *Ward Nursing* *Pathology* *Imaging* *Allied Health* *Pharmacy* *Medial and Surgical Supplies* *On Costs* *Hotel* *Depreciation*

Scaling to adjust for actual admitted patient costs of each hospital

The total expenditure for each hospital in which patients are treated is known. The overall admitted patient expenditures of the hospital are sometimes greater than the DRG State weights would imply. In these cases the costs for all patients using these hospitals is adjusted upwards. For those hospitals which are cheaper than the DRG State weights would imply, the costs for all patients using these hospitals is adjusted downwards.

This last adjustment is particularly important in ensuring that the costs of patients by region are estimated accurately. The size of these scaling factors varies by a substantial amount with the per episode model. The adjustment varied from 58 to 0.09 but the 5th percentile was 0.39 and the 95th percentile was 2.07. The third quartile was 1.17, the median 0.97 and the first quartile 0.78.

Treatment of sub- and non-acute patients

For sub- and non-acute patients, where there are no DRG weights, the most recent data on costs is the July to December 1996 Sub- and Non-Acute Patient (SNAP) Study. Per diem costs are applied and inflated to 1998–99 estimates using the implicit price deflator for final government consumption expenditure on hospital and nursing home care (AIHW 2000b).

Overnight per diem costs after scaling are as follows:

- overnight per diem costs for rehabilitation—$315.10
- overnight per diem costs for palliative care—$272.18
- overnight per diem costs for maintenance care—$199.95.

Table A5.1: Cost per sub- and non-acute patient episode by sub- and non-acute episode type, scaled to 1998–99 ($)

	Ambulatory				Ambulatory total	Ambulatory per diem
	Overnight	Same day	Outpatient	Community		
Palliative care	4935.33	812.89	448.61	807.88	573.67	99.45
Rehabilitation	6386.21	1910.36	939.34	669.01	922.27	103.64
Psychogeriatric	9159.07	7099.78	157.98	296.16	216.7	55.48
Geriatric evaluation and management	5092.04	1546.43	324.07	326.98	338.13	86.89
Maintenance care	6353.87	979.59	363.73	597.91	553.78	51.3

Investigations of reporting accuracy

Estimations of under-identification of Aboriginal and Torres Strait Islander people in 1998–99 hospital records were informed by a variety of evidence. Details of main studies to emerge since the 1995–96 report are outlined below. Final estimates of under-identification are outlined in Chapter 4 of this report.

The ABS & AIHW study of 1998

This is the only study specifically designed to measure the accuracy of Aboriginal and Torres Strait Islander identification in hospital data beyond a single state and one with a clear-cut methodology. It sampled admissions to 12 hospitals in 1998—three in the Northern Territory, five in South Australia, two in the Australian Capital Territory and one each in Victoria and Queensland. New South Wales and Western Australia were not represented. The results were not intended for use in estimating under-identification generally and they have not been used for that purpose. However, they are relevant to a number of identification issues.

Accuracy of identification was measured by comparing the data held in the hospitals' records with information re-collected by independent interviewers (Aboriginal and Torres Strait Islander and non-Indigenous) while the patients were still in hospital. Hospital record numbers or unit record numbers were used for matching. The interviewer was passive in the sense that the project was presented as a check on data quality only, with the patient being effectively asked the same question which they had been asked (or should have been asked) on admission. To put the accuracy of Aboriginal and Torres Strait Islander identification into context, the questionnaire also collected details of gender, country of birth, date of birth and place of residence, which had also been recorded on admission.

The results were as follows:

- Of 8,269 patients involved, Indigenous status was recorded in 8,157 cases. In 110 cases Indigenous status was recorded as 'unknown' in the hospital records and there were two patients who were not recorded at all.

- Of the 8,157 patients for which the hospital records included Indigenous status, 564 (6.9%) were recorded as Aboriginal and Torres Strait Islander. Only seven of these were shown not to be Indigenous at interview. Coding error was responsible.
- At interview, 635 of the patients with complete hospital records identified themselves as Aboriginal and Torres Strait Islander (7.8%). A further 13 were identified within the 'unknown' group (11.7%).
- There were therefore only 85 errors in the hospital records—78 false negatives and 7 false positives. Of those identified as Aboriginal and Torres Strait Islander by the hospitals, 98.8% were correctly classified; and of all those subsequently identified at interview, the hospitals had already identified 88.8%. Overall identification (including the unknown category) was a little lower, but if the common practice of allocating unknowns according to the 'known' proportions had been followed, the reported hospital data would have understated the 'real' number of Aboriginal and Torres Strait Islander admissions by only 11.6%.
- Even within this relatively high identification rate, there were significant differences by area. For hospitals in whose catchment area around 15% or more of the population were Aboriginal and Torres Strait Islander, the rate of correct identification was 94.4%. In hospitals serving lower proportions of Aboriginal and Torres Strait Islander people it was only 66.4%.

As might be expected from a sample with well over the average proportion of Aboriginal and Torres Strait Islander admissions and dominated by hospitals from two States for which our original estimates of under-identification were low (zero in the Northern Territory and 10% in South Australia), these are much higher levels of identification than is commonly presumed elsewhere. They also imply extraordinary levels of reliability in hospital record keeping. Just over 1% of all patients was inaccurately identified and then quite probably because some of the patients' answers changed. How this compares with other hospital recording is unknown. However, there are some indicators of underlying error in that, to check the accuracy of data recording generally in these hospitals, the ABS & AIHW study verified some additional patient information as well. Of those items, the one most comparable with race was country of birth. People born overseas are a minority—though a much larger one than Aboriginal and Torres Strait Islander people. There is a similar likelihood of error in records completed by staff rather than patients and there might also be some unwillingness to reveal it under certain circumstances.

In fact, the results for country of birth were quite different:

- In the hospital records 1,898 patients were recorded as overseas born, 23% of the 8,247 people for whom this information was recorded (only 22 unknowns);
- At interview, 1,906 were so identified (plus 7 of the unknowns).
- At the aggregate level, birthplace recording in hospital records was therefore 99.6% correct. However, there were 106 individual mistakes in the birthplace data at a rate which, relative to the majority population, was not much different from that by Aboriginality (1.6% and 1.1% respectively). The difference was that the errors in birthplace recording were unbiased, whereas those for Indigenous status were almost entirely on the false negative side.

In effect, this study of Aboriginal and Torres Strait Islander identification measured the different results obtained when the same question was asked of the same patients by different staff, at different times and in different settings—that is, before admission and in a specific survey while in hospital. There might be several reasons for this—for example, recording error, patients not having been asked before, lowered apprehension, different perceptions of consequences. Recording error *per se* seems to have been very low in these hospitals but the evidence elsewhere is different and the extent to which the results can be generalised depends on the relative importance of each factor. However, if the later identification is always believed to be correct, the net effect is all that matters. In this case it was, on average, an increase of about 13% over the initially recorded number of Aboriginal and Torres Strait Islander patients (equivalent to 11.6% under-identification).

Victorian Department of Human Services surveys of Aboriginal and Torres Strait Islander identification in high hospital users

The Koori Health Unit in the Victorian Department of Human Services has recently carried out several surveys of the accuracy of identification amongst people who have been hospitalised several times and recorded by the hospitals as Aboriginal and/or Torres Strait Islander on at least one occasion. The initial study, covering over 18,000 admissions over 5 years in hospitals, showed very low levels of consistency. However, it included hospitals which were known to have made gross errors in coding. For example, one major hospital had coded all admissions as Aboriginal and/or Torres Strait Islander for a month. A more limited subset drawn from hospitals, which did not make such gross errors, has since been analysed. (The published morbidity data for the years up to but excluding 1998–99 included these gross errors. Thus Victorian morbidity data on Indigenous status prior to 1998–99 must be treated with particular caution.)

The data in the more limited subset came from 4,342 admissions between 1994 and 1998 for 571 people who were:

(a) admitted at least twice during that period, and

(b) recorded as Aboriginal and/or Torres Strait Islander at least once.

Patients were linked through individual hospital records in the Victorian Inpatient Morbidity Data (VIMD) system and such additional information as date of birth and Medicare numbers. The accuracy of identification was assessed from hospital records, not patient inquiry, using whatever information was available in the hospital files (including the consistency of identification over multiple episodes). Patients were grouped into the five categories of:

- definitely Aboriginal, where sufficient evidence allowed that conclusion;
- probably Aboriginal, where the balance of probabilities supported it;
- uncertain, because of insufficient or conflicting evidence;

- probably not Aboriginal, again on the balance of evidence; and
- not Aboriginal.

Hospital admissions for each group were then analysed according to whether they were recorded by the hospitals as Aboriginal and/or Torres Strait Islander or non-Indigenous on each occasion. The results are shown in Table A5.2.

Table A5.2: Hospital admissions and identification by Aboriginal groupings, 1994–98

		Number of admissions		
		Hospital identification		
Indigenous status	**No. of persons**	**Indigenous**	**Non-Indigenous**	**Total**
Aboriginal	51	212	38	250
Probably Aboriginal	76	169	161	330
Uncertain	196	415	1,264	1,679
Probably not Aboriginal	144	187	1,223	1,410
Not Aboriginal	104	147	526	673
Total	**571**	**1,130**	**3,212**	**4,342**

Source: Victorian Department of Human Services, Koori Health Unit.

If these classifications were correct, the inferences are that:

- for people classified as definitely or probably Aboriginal, 381 admissions were correctly identified as Aboriginal, with 199 incorrectly identified as non-Aboriginal (false negatives) or 34.4% of the correct figure;
- for people classified as definitely or probably not Aboriginal, 1,749 admissions were correctly identified as such, with 334 wrongly recorded as Aboriginal (false positives) or 16% of the correct figure; and
- taken together, the net result was 135 false positives, 18.8% of the 715 Aboriginal admissions recorded for these categories.

The 'uncertain' group, covering nearly 39% of all admissions, could be interpreted in several ways. It presumably included a mixture of people with characteristics of both the other groups, in which case the reported Aboriginal and Torres Strait Islander figures might actually be correct; or, alternatively, the same proportion of net over-identification could be assumed for it. In the first case the 'correct' number for all Aboriginal and Torres Strait Islander admissions would be 995 (580+415) or 88% of the reported figure, in the second case 917 (580+337) or 81% of the number identified by hospitals.

Because this was far from a 'gold standard' methodology, the differences in estimated over-reporting are probably irrelevant. The classification was to some degree subjective. Hospitals were assessed for accuracy of reporting using other sources of information, and identification at a hospital with a high rating was used to judge the accuracy of identification of the same patient at other hospitals. One of the hospitals was rated very highly because it participated in the ABS & AIHW study and was judged to have 100% accuracy. The accuracy of patient record linkage must also be uncertain, given the absence of a unique and universal identifying number,

particularly when linkage is attempted over 4–5 years (see discussion of some New South Wales results below). However the survey raises some very important issues, namely that the extreme accuracy of hospital recording implicit in the ABS & AIHW study may not be true in all conditions and that the widely held assumption that all identification errors must lead to under-statement in the reported figures is not necessarily correct. Over-statement must be possible in large States with very low proportions of Aboriginal and Torres Strait Islander people in their populations where even very low rates of random recording error for non-Indigenous people can swamp any systematic understatement on the Aboriginal and Torres Strait Islander side. Victoria, where only about 1% of admissions might be expected to be Aboriginal, must be particularly vulnerable to such error. Even in New South Wales, where only 1.8% of the population are estimated to be Aboriginal, any record-based assessment of accuracy must also be suspect. Only direct and patient-centred sample surveys of the ABS & AIHW kind would give reliable results.

Despite these reservations, the Koori Unit surveys are the only available indicators of possible under-identification in Victoria and we have used some aspects of them in the estimation of under-enumeration reported later.

New South Wales Health Department patient linkage studies

As part of a broader estimation of possible under-identification, the New South Wales Department has used a technique for linking individuals within the Hospital Morbidity Data Collection. Like the Victorian study, it selects admissions for individuals who have been identified as an Aboriginal and/or Torres Strait Islander person on at least one admission in a year. Other linked admissions not identified as Aboriginal are then used as a measure of under-identification. The results for 1997–98 suggested that, for multiple admissions in a year, 12% of Aboriginal and Torres Strait Islander admissions were not identified. It implied an upward adjustment (for this category) of about 13% to the reported figures. As in the ABS & AIHW study, under-identification was much higher in the metropolitan hospitals—where the proportion of Aboriginal and Torres Strait Islander patients was very low—than in the remote areas where it was high. It was also higher for patients treated outside their local area.

The New South Wales estimate is likely to have some upward bias because, overall, the linkage technique overstates the total number of individuals using the public hospital system by about 35%. It therefore fails to correctly match some admissions with people. Because records are linked for one year only, there should be less random error than in the Victorian survey where linkage over a number of years is more likely to accumulate matching mistakes. However, the methodology assumes that every identification of an admission as Aboriginal and Torres Strait Islander must automatically be correct, and it adjusts all of the other data for that person accordingly. In other words, no false positives are contemplated, although the Victorian survey shows that it is possible and there is no clear evidence of the extreme accuracy in record keeping which was demonstrated in the ABS & AIHW study.

Future plans to assess identification

During 2001–02, a project funded by the Australian Health Ministers' Advisory Council (AHMAC) will be conducted in States and Territories to monitor the completeness and coverage of Indigenous identification in hospital separations records. The work plan is designed to include a data quality audit and an assessment of data collection practices. The audit will use a methodology which has been tested and evaluated for this purpose. The data will be collected through a sampling frame that will cover the breadth of hospital service delivery in all States and Territories, and will be in line with the established method. In addition to the audit, an assessment of hospitals data collection practices will be undertaken on the extent to which non-threatening recording methods are being used.

The work will be coordinated as an independent exercise by the Aboriginal and Torres Strait Islander Health and Welfare Information Unit, a joint work program of the Australian Bureau of Statistics and the AIHW. The project builds on work undertaken since 1999, promoting best practice and providing central health authorities and hospitals with promotional material, training and ongoing support in the collection of Aboriginal and Torres Strait Islander status information in patient records.