

Differences in the cost of admitted patient care for Indigenous people and people from remote locations

Rosalyn Malyon^{1,3} BScSci, PGradDipEc, MHEc, Health Economist

Yuejen Zhao¹ BM, MBios, PhD, Senior Health Economist

Brett Oates² BCom, Financial and Costing Accountant

¹Health Gains Planning Branch, Northern Territory Department of Health, PO Box 40596, Casuarina, NT 0811, Australia.

²Acute Care Division, Northern Territory Department of Health, PO Box 40596, Casuarina, NT 0811, Australia.

³Corresponding author. Email: rosalyn.malyon@nt.gov.au

Abstract. The introduction of activity-based funding (ABF) means that Australian Refined Diagnosis Related Groups and their relative costs will become the basis for reimbursing public hospitals for admitted patient services. This study sought to investigate the variation in admitted patient costs for Indigenous people and people from remote areas that cannot be explained by variation in the clinical mix of cases, and to interpret this variation within an ABF framework. The study used a dataset of discharges from public hospitals of Northern Territory residents between July 2007 and June 2009. Multivariate regression analysis was used to estimate the variation in average costs, using the logarithm of patient cost as the dependent variable and Major Diagnostic Categories (MDCs), hospitals and population subgroups (Indigenous *v.* non-Indigenous; urban *v.* remote) as independent variables. Although much of the additional cost of Indigenous and remote patients was found to be due to differences in severity and complexity between MDCs, there were extra costs for remote Indigenous patients that were not captured by the classification system. Hospitals servicing larger than average proportions of these patients could be systematically underfunded within an ABF framework unless a price adjustment is applied.

What is known about the topic? Indigenous people and people living in remote locations have a greater burden of disease and injury and are high users of hospital services. Past studies have quantified the relative cost of providing admitted patient services to these groups using survey data or the average length of stay as a proxy for cost.

What does this paper add? This study provides estimates of the additional costs of providing admitted patient services to Indigenous people and people from remote areas and interprets these within an activity-based funding framework.

What are the implications for practitioners? This paper provides information on the importance of recognising high cost populations in payment systems for public hospitals.

Additional keywords: DRGs, hospitals, Indigenous population, multivariate analysis, rural population.

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Introduction

Under the national health reform agenda, activity-based funding (ABF) will be implemented as a means of paying for episodes of admitted patient care provided by public hospitals in Australia in 2012.¹ ABF assumes that clinically similar patients with similar resource requirements can be grouped together and the spread of patients is normally distributed with similar numbers consuming more or less resources.^{2,3} Studies have shown, however, that within diagnosis- or service-related groups, Indigenous patients and patients from remote locations tend to have longer lengths of stay and higher costs of care than other patients.^{2,4–9} If hospitals were paid the average cost for episodes of care within a clinical grouping, ABF could disadvantage hospitals that provide services to a higher than average proportion of Indigenous and

remote patients.^{2–4,7} One means of addressing this disadvantage would be to apply a price adjustment to episodes of care for these patients. There is, however, little direct evidence on the extent of the cost differentials and what adjustment would be appropriate to apply under an ABF framework.

Several studies examined cost differentials for Indigenous inpatients during the 1990s. Harkin estimated resource use at Alice Springs Hospital over an 8-month period in 1991–92 and found that after adjusting for differences in diagnosis-related groups (casemix), the mean cost for Indigenous admitted patients was 64% higher than that for non-Indigenous patients.¹⁰ Beaver *et al.*, using length of stay data on discharges from Northern Territory (NT) public hospitals over a 3-year period (1992–95), estimated that the costs for Indigenous patients were more than a

third (37.1%) higher than those for non-Indigenous patients.⁵ The disparity was even greater (up to 93.7%) when remoteness and hospital type (teaching *v.* non-teaching) were taken into account. In 1995, the Aboriginal and Torres Strait Islander Casemix Study collected survey data from 10 hospitals across four Australian states and territories over a 3-month period. It found the casemix-adjusted cost of an inpatient episode for an Indigenous person was 19.0% higher than that for a non-Indigenous person.² The study did not investigate the impact of remoteness.

There is a lack of consistency and comparability in data collection between the studies and they differ in their methods for estimating costs, using either length of hospital stay as a proxy for cost, or collecting data on resource use through surveys. Since these studies were conducted, improvements in recording and costing systems may now enable better estimation of costs, and there have been changes in service provision and clinical practice that could have affected the relative consumption of resources. Evidence also suggests that Indigenous people may be living longer, but in poorer health,¹¹ which may impact on the complexity of treatments and duration of hospital stays.

This study examined data on episodes of admitted patient care in public hospitals in the NT over a 2-year period. Its purpose was to estimate the differences in the relative cost of providing episodes of care to Indigenous patients and patients from remote areas, and to investigate the implications of these differences for ABF.

Methods

There are five public hospitals in the NT: Royal Darwin Hospital, Alice Springs Hospital, Katherine Hospital, Gove District Hospital and Tennant Creek Hospital. A dataset comprising all discharges from these hospitals between 1 July 2007 and 30 June 2009 was extracted from the Department of Health's hospital-activity database. The dataset comprised patient demographics and clinical information including Australian Refined Diagnosis Related Group (AR-DRG), Major Diagnostic Category (MDC), and admission and discharge categories. The cost for each discharge was drawn from the Department's hospital costing system, which uses a 'bottom-up' method to apportion expenditure based on individual items of patient consumption. The costing system provides data to the National Hospital Cost Data Collection (NHCCDC) and is based on agreed methods for categorising and distributing costs.^{12,13} Corporate overheads and patient travel costs were excluded from the cost data in order to focus on differences in treatment costs.

The following discharge records were removed from the dataset: those,

- (i) for which cost data were not available (300 records);
- (ii) for which AR-DRG coding was not available (652 records);
- (iii) where the patient was not a resident of the NT (15 489 records); and
- (iv) where the patient was a guest or boarder, *i.e.* did not receive clinical care (14 833 records; includes unqualified neonates).

Following these deletions, there were 175 732 discharges (hospitalisations) available for analysis. No statistical trimming was undertaken, as this would have impacted on the objectives of

the study. All analyses were performed using Stata/IC 11 statistical software.¹⁴

The dataset contained the statistical local area (SLA) of the patient's residence at the time of each hospitalisation. SLAs were recoded as either 'urban' or 'remote' to reflect relative differences in access to health services. The urban category consisted of SLAs in the Statistical Subdivisions of Darwin City, Palmerston-East Arm and Litchfield Shire, and the SLAs comprising the Alice Springs township.¹⁵ This categorisation differs from the Australian Standard Geographical Classification (ASGC), which classifies Darwin and surrounding areas as 'outer regional', Alice Springs as 'remote' and other areas as 'very remote' based on access to a broader range of services.

Estimates by the Department of Health of the resident population by region were used to calculate the rate of hospitalisations per 1000 population.¹⁶ The average cost of hospitalisations was calculated for each hospital and the population subgroups.

A multivariate linear regression model with robust estimates of variance was used to assess the effect of Indigenous status and remoteness on admitted patient cost.¹⁷ It was assumed that AR-DRGs and MDCs could represent the differences in casemix. MDCs were chosen for use in the model to control for differences in casemix because the sample size in many AR-DRGs was too small to produce reliable results and MDCs are a higher level of the same classification. The five public hospitals were included as dummy variables to control for differences in costs between hospitals. An interaction term between Indigenous status and remoteness was used to determine whether the effect of remoteness was the same for both Indigenous and non-Indigenous patients.

Indirect standardisation was used to investigate the differences between NT costs and expected prices under ABF. The national average costs for the public hospital sector from the NHCCDC were used as the expected ABF price. Each hospitalisation was given the national average cost corresponding to its AR-DRG in the year that it occurred.^{12,13} For example, all episodes of F74Z chest pain were given a cost of \$1516 if they occurred in 2007–08 and \$1636 if they occurred in 2008–09. NT and national costs for 2008–09 were adjusted to 2007–08 prices using the percentage change in the consumer price index (CPI) for hospital and medical services between the June 2007 and 2008 quarters by capital city (Darwin CPI for NT costs; Australian CPI for national costs).¹⁸

The study was approved by the Human Research Ethics Committee of the Department of Health and Menzies School of Research (approval number HREC-2011–1508).

Results

Of the 175 732 hospitalisations in the study sample, 68.5% were for Indigenous patients compared with their population share of 30.4%,¹⁹ and 47.7% were for patients from remote areas as defined in this study. More than half of the sample (89 194 hospitalisations) was from Royal Darwin Hospital, the largest hospital in the NT.

As shown in Table 1, the rate of hospitalisations for Indigenous people was greater than that for non-Indigenous people in all MDCs except MDC 17: neoplastic disorders (haematological & solid neoplasms). The difference was greatest in MDC 11 due to the large number (70 221) of Indigenous hospitalisations for same-day renal dialysis.

Table 1. Hospitalisation rate per 1000 population by Major Diagnostic Category (MDC) and Indigenous status

MDC	Indigenous	Non-Indigenous	Ratio ^A
	Hospitalisations per 1000 population		
1. Nervous system	17.6	6.9	2.5
2. Eye	5.4	4.1	1.3
3. Ear, nose, mouth & throat	25.5	8.0	3.2
4. Respiratory system	43.8	9.8	4.5
5. Circulatory system	21.3	12.2	1.8
6. Digestive system	28.1	19.0	1.5
7. Hepatobiliary system & pancreas	9.0	3.2	2.8
8. Musculoskeletal system & connective tissue	25.8	13.2	2.0
9. Skin, subcutaneous tissue & breast	27.3	8.5	3.2
10. Endocrine, nutritional & metabolic	10.0	3.4	2.9
11. Kidney & urinary tract	550.7	21.4	25.7
12. Reproductive system - male	5.6	3.3	1.7
13. Reproductive system - female	16.0	9.9	1.6
14. Pregnancy, childbirth & the puerperium	138.0	75.9	1.8
15. Newborns & other neonates	1098.1	862.6	1.3
16. Blood, blood-forming organs, immunological disorders	4.1	2.5	1.7
17. Neoplastic disorders	3.3	5.4	0.6
18. Infectious & parasitic diseases	8.9	2.6	3.5
19. Mental	7.3	4.1	1.8
20. Alcohol/drug	5.0	1.0	4.9
21. Injuries, poisonings & toxic effects of drugs	20.6	6.4	3.2
22. Burns	2.3	1.0	2.4
23. Factors influencing health status	11.7	6.6	1.8
Ungroupable	2.2	0.7	3.1

^ARatio of hospitalisation rates between Indigenous and non-Indigenous patients.

Without adjustment for casemix, the average cost across all hospitalisations in the study sample was \$3136 (95% confidence interval (CI), \$3095–3178) and cost was strongly correlated with length of stay ($r=0.78$). Average cost was highest at Gove District Hospital (\$4269; 95% CI, \$4145–4393), the most remote facility, and lowest at Tennant Creek Hospital (\$1139; 95% CI, \$1091–1188), the smallest facility. Before controlling for case-mix, the cost of Indigenous hospitalisations was lower than for non-Indigenous hospitalisations. Among urban patients, the average cost of non-Indigenous hospitalisations was \$4277 (95% CI, \$4177–4376) compared with \$2250 (95% CI, \$2183–2317) for Indigenous hospitalisations. Among remote patients, the average cost for non-Indigenous hospitalisations was \$4258 (95% CI, \$4083–4434) compared with \$2829 (95% CI, \$2771–2887) for Indigenous hospitalisations. A key driver of the lower average cost of Indigenous hospitalisations was the large number of hospitalisations for renal dialysis (AR-DRG L61Z) and the relatively low cost (\$664; 95% CI, \$659–669).

To adjust for casemix, the hospitalisation data were analysed using multivariate linear regression with the logarithm of actual inpatient cost as a dependent variable, as it more closely resembled a normal distribution than did actual cost, and MDCs, hospitals, Indigenous status and remoteness as independent variables. A robust estimator of variance was used due to heteroscedasticity in the data.¹⁷ After controlling for differences in treatment costs between MDCs and hospitals, the cost of an urban Indigenous hospitalisation was estimated to be 5.1% higher than the cost of an urban non-Indigenous hospitalisation (Fig. 1). The cost differentials for remote non-Indigenous hospitalisations

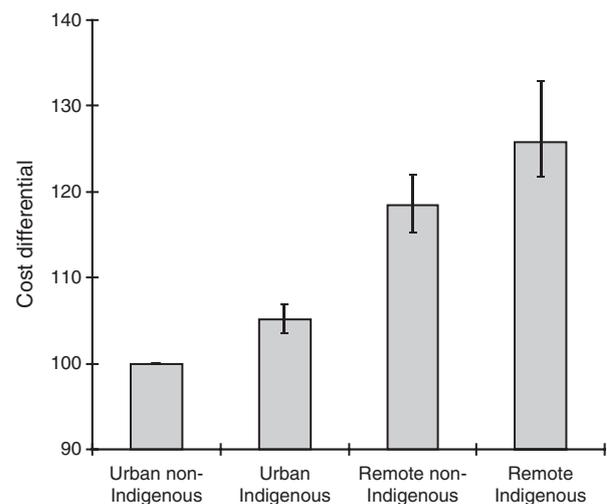


Fig. 1. Cost differentials in admitted patient care and 95% confidence intervals (%) by Indigenous status and locality.

and remote Indigenous hospitalisations were 18.5% and 25.7%, respectively.

Cost differentials under ABF

Under ABF a nationally 'efficient' price will be determined for each AR-DRG. It will form the basis for payments for public hospital services.¹ To determine the impact of ABF for NT

hospitals, the national average cost for each AR-DRG was assumed to be the efficient price. Without adjustment for casemix, the average efficient price across all hospitalisations in the study sample was \$2796 (95% CI, \$2770–2821). The average difference between the NT cost and the efficient price was \$341 (95% CI, \$308–373). When the difference between the NT cost and the efficient price was used as the dependent variable in the model, there was no significant difference in average shortfall between urban non-Indigenous, remote non-Indigenous and urban Indigenous hospitalisations after controlling for differences between MDCs and hospitals ($P > 0.05$). For remote Indigenous hospitalisations, however, the average amount of the shortfall was \$545 (95% CI, \$356–735) more than the average shortfall for the other groups ($P < 0.05$). Assuming the ABF price for those hospitalisations was the average efficient price of \$2796, the additional shortfall for remote Indigenous hospitalisations equated to a surcharge of 19.5% (95% CI, 12.9–26.1%).

Table 2 demonstrates the application of this surcharge to the efficient price. If the efficient price was paid for all hospitalisations in the sample, there would have been a shortfall of \$59.9 million between the efficient price and actual costs over the 2 years of the study. Application of the surcharge to remote Indigenous hospitalisations would decrease the deficit to \$25.0 million.

Sensitivity analysis

The effect of using MDCs rather than AR-DRGs in the models was examined by including AR-DRGs with 100 or more cases ($n = 212$) and grouping remaining AR-DRGs ($n = 415$) into a single category. This alternative model did not substantially affect the earlier results. The effect of Indigenous status was slightly stronger, but the impact of remoteness was weaker. In the ABF model, the additional shortfall for remote Indigenous hospitalisations reduced to 17.6%, which was within the 95% CI of the earlier result (12.9–26.1%). The shortfall for other groups did not differ significantly from one another ($P > 0.05$).

Discussion and conclusion

This study showed that after controlling for differences in casemix and treatment location, the average cost of a hospitalisation for an Indigenous patient from a remote area could be up to a third higher than the cost for an urban non-Indigenous patient. Remote non-Indigenous patients and urban Indigenous patients were also more expensive to treat, but the additional cost was less than that for remote Indigenous patients. Much of the additional cost of Indigenous and remote patients was due to their clustering in high cost AR-DRGs, for example, where there were complications or severity was greater. ABF would partially reimburse hospitals for these costs as these AR-DRGs will have a higher price. The adequacy of the reimbursement will, however, depend on the

degree of distinction in the classification system for severity and complexity. This study demonstrated that remoteness and Indigenous status are important drivers of average costs under the current AR-DRG classifications. A simplified classification system could disadvantage hospitals with greater than average proportions of Indigenous patients or patients from remote areas, because the price paid for their episodes of care could be well below the cost.

A substantial proportion of the additional cost for remote Indigenous hospitalisations would not be reimbursed through differences in classification. The study estimated that the price for these hospitalisations would need to be about a fifth higher than the efficient price (assuming an efficient price based on the national average cost). These adjustments may need, however, to occur at a state or Local Hospital Network, rather than individual hospital level, due to differences in the capacity of hospitals to treat the more complex and severe cases and the location of specialist services. In the NT, these cases are transferred to Royal Darwin Hospital so application of a cost adjustment at a hospital level could undercompensate Royal Darwin Hospital and overcompensate other hospitals unless hospital transfers were adequately taken into account.

The cost differentials in this study were consistent with the results of previous studies that showed the costs of Indigenous and remote patients were higher; however, only Beaver *et al.*⁵ estimated costs for Indigenous and non-Indigenous patients by remoteness and their cost differentials were higher. The difference may arise from this study’s use of cost data rather than length of stay and its larger sample, which included records removed by Beaver *et al.* such as hospital transfers and discharges due to death. This study’s sample was, however, intended to be representative of the episodes of care that would be reimbursed under ABF.

The much higher cost of remote Indigenous patients is likely to reflect both clinical and non-clinical factors. Burden of disease and injury studies indicated this group had greater levels of ill-health and higher levels of severity, comorbidity and mortality.²⁰ Accordingly, they are likely to require more protracted and intensive care. Furthermore, it is not always possible to readily discharge these patients when there are few transport options available to remote areas,²¹ access to adequate post-operative care may be unavailable or only offered infrequently in the community,^{22,23} or there may be a lack of suitable conditions, people or services to facilitate recovery or avoid relapse (e.g. poor living conditions and limited capacity among family members or primary-care services to assist with care, compliance and psychosocial support).^{10,22–26}

There were several limitations of the study. The results are dependent on the accuracy of hospital administrative data. A validation study in 2008 found the accuracy of Indigenous status was high (97%), but locality (health district of residence)

Table 2. Northern Territory (NT) cost, efficient price payment and adjusted payment to the NT, 2007–08 to 2008–09 (constant prices)
Excludes boarders and guests. Base year for costs is 2007–08

	Actual NT cost \$m	Efficient price payment \$m	Adjusted payment \$m
Hospitalisations of NT residents	551.2	491.3	526.2

was less well recorded (88%) in the NT.²⁷ Underidentification of Indigenous status and inaccurate recording of locality may mean the cost estimates are conservative. A second issue was a lack of a gradient in locality. The urban areas in this study are distant from major population centres and most townships in the NT are classified as remote or very remote under the ASGC system. This remoteness may contribute to the NT average being higher than the national average. Further studies using improved geographical classifications more suitable to the NT or national data may enable a more sophisticated geographical comparison. Third, the study only examined costs for NT residents; costs for interstate and overseas patients were excluded. Many interstate patients are from cross-border areas in South Australia and Western Australia and it would be reasonable to expect that their costs would be similar to those for remote groups in the study. Other interstate and overseas patients will be tourists or business visitors admitted to hospital for emergency care. Inclusion of their costs would be likely to bias the differentials in a downward manner due to the expensive nature of emergency care. Finally, the use of MDCs in the model may overstate the impact of remoteness and understate the effect of Indigenous status. AR-DRG level analysis would be desirable using national data provided the issue of Indigenous underidentification is addressed.

Patient travel and the cost of boarders were excluded from the cost data. They are a substantial and unavoidable component of providing hospital services to Indigenous and remote patients; however, it is not clear how these costs will be accommodated within ABF. Other factors that are important influences on the cost of hospital services in the NT, but were not specifically analysed in this study, are higher input costs (wages, consumables and other goods) for hospitals in remote areas, workforce turnover and shortages, and economic factors including economies of scale and scope and sustainability of services.^{28,29}

Health disparities in Indigenous and remote populations have been well documented. Consequently, their demand for hospital services is high and as this study showed, they are more costly to treat. There is a desire in society to reduce disparities in health as evidenced by the commitment to close the gap in Indigenous life expectancy within a generation.³⁰ Methods for allocating funding need to support such goals while also ensuring that resources are used efficiently. There is a risk that ABF, with its focus on efficiency, could systematically underfund hospitals that provide treatment to large proportions of Indigenous and remote patients. To mitigate this risk, it will be necessary to ensure that the classification systems account for differences in severity and complexity and the ABF price is adjusted for population subgroups that have particularly high costs within AR-DRGs. This study provided evidence on the extent of such adjustments. Beyond these steps, however, there may be a need to consider how ABF will support hospitals and the broader health system to improve health outcomes for Indigenous and remote people. For the gap in health outcomes between Indigenous and non-Indigenous people to be closed, this policy needs to be a component in the formulation of the ABF and other health reforms.

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