

Investigation of leukaemia and lymphoma AR-DRGs at a Sydney teaching hospital

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Abstract

Using non-blinded methodology, this study checked the coding of acute leukaemia, non-acute leukaemia and lymphoma episodes assigned to the AR-DRGs R60 A, B, C and R61 A, B during the fiscal year 2000–2001 at a Sydney teaching hospital. The purpose was to investigate whether the assignment of fewer episodes of these diseases to the highest complexity AR-DRGs during that year compared to 1999–2000 was due to miscoding, or due to a true decrease in episodes. A check of all 242 episodes revealed a degree of miscoding (mainly under-coding) of complications and comorbidities that had caused a 15% DRG error rate; nevertheless, there was a true decrease in the highest complexity episodes. The error in DRG assignment may have caused some financial disadvantage to the hospital.

Key words: *Coding; leukaemia; lymphoma; AR-DRGs*

Introduction

The Australian Refined Diagnosis Related Groups (AR-DRGs) is a classification system that categorises acute in-patient episodes in New South Wales hospitals. Each AR-DRG represents a class of patients with similar clinical conditions requiring similar hospital resources. Variables such as an additional diagnosis if it qualifies as a complication and/or comorbidity (CC), are used for AR-DRG assignment. CCs can cause considerably higher resource consumption (Australian Refined Diagnosis Related Groups Version 4.1 Definitions Manual 1998: 3), and although clinically they may vary widely, their impact on resource use is similar (Zhang et al. 1997). A severity weight, the Complication and Comorbidity Level (CCL), is given to all additional diagnoses. CCL values in medical episodes range from 0 (the additional diagnosis is not a CC) through 1 (minor CC), 2 (moderate CC), to 3 (severe CC) (Commonwealth Department of Health and Aged Care 1998: 7). The Patient Clinical Complexity Level (PCCL) has been developed to measure the cumulative effect of CCs in an episode. The PCCL value, which indicates the overall severity of an episode, is based on combinations of CCL values, and ranges (both for medical and surgical episodes) from 0 (no CC effect) to 4 (catastrophic CC effect) (Commonwealth Department of Health and Aged Care 1998: 7).

At a teaching hospital in metropolitan Sydney, Australia, statistics showed that when the time period 1 July 2000 – 30 June, 2001 was compared to 1 July 1999 – 30 June 2000, assignment of episodes to the high complexity AR-DRGs R60A (acute leukaemia with catastrophic CC effect) and R61A (lymphoma or non-acute leukaemia with catastrophic CC effect) was down by 56% and 33% respectively. Despite the drop in the highest complexity episodes, clinical staff in the hospital's Haematology Department had the impression (though only anecdotal) that the clinical complexity of their workload relating to leukaemia and lymphoma was not lower in 2000–2001 than in 1999–2000. Clearly, factors such as staff changes may have accounted for this impression, and the Haematology Department had taken that into account. On the assumption that the haematological workload was related to episode complexity, and that there really was no decrease in highest complexity episodes, it was

possible that the decreased assignment of episodes to the highest complexity (that is, highest cost weighted) AR-DRGs was due to miscoding, in terms of neglecting to code additional diagnoses which happened to be complications or comorbidities; this could have caused episodes to be incorrectly assigned to less complex (lower weighted) AR-DRGs.

The first aim of this study was to investigate the accuracy of the coding of CCs within episodes assigned to the AR-DRGs R60 A, B, C, and R61 A and B during the fiscal year 2000–2001. R60B and R60C are the AR-DRGs to which episodes of acute leukaemia are assigned where the CC effect is severe but not catastrophic (R60B), and less than severe (R60C). Episodes of lymphoma or non-acute leukaemia where the CC effect is severe but not catastrophic are assigned to the AR-DRG R61B.

The second aim of the study was to compare the years 1999–2000 and 2000–2001 as regards the number and complexity of R60 and R61 episodes. The coding for 1999–2000 was not checked because of time constraints as the research had to be completed within an Honours year.

The third aim of the study was to check for the presence of internal coherence of R60 and R61 in 2000–2001. Internal coherence would be seen to be present if there was indication of a positive correlation between the clinical complexity or severity of the episode (as represented by A, B, C), the average length of stay in hospital (LOS) per episode, and the average number of additional diagnosis codes per episode. The number of additional diagnoses was used as a proxy for severity because this is similar to the 'unexplained severity index' used previously to adjust funding in South Australia (Moss 2002). LOS is increased by the presence of a CC (Eagar & Hindle 1994) and thus LOS together with codes per episode should reflect severity; this combination can therefore be used as a quasi measure. Absence of internal coherence would suggest there had been miscoding involving some form of systematic bias.

Definitive testing of whether there was any allocation of inadequate PCCL values to episodes was beyond the scope of this study. This was because the algorithm used to determine the PCCL was too complex to replicate manually.

The clinical profiles for each AR-DRG for the years 1999–2000 and 2000–2001 are described to provide background on the patients and shed light on possible differences found. These profiles include: number and demographic features of patients admitted; number of episodes and mean LOS; type and frequency of the principal diagnoses within the AR-DRGs. Type and frequency of additional diagnoses associated with 2000–2001 episodes are also presented.

Methods

At a major teaching hospital in metropolitan Sydney during June and July 2003, all episodes assigned to the AR-DRGs R60 A, B, C (n=175), and R61 A and B (n=67) during the fiscal year 1 July 2000 to 30 June 2001 were investigated for miscoding of additional diagnoses. The original codes assigned to each episode were checked by a second coder against relevant documentation in the patients' medical records, which included discharge summary, progress notes, correspondence, and test results. This check revealed whether all justified additional diagnoses (i.e. those present during the episode) had been coded, and whether an additional diagnosis had been coded unjustifiably, that is, coded as being present when it was not. In cases where investigation revealed that an additional diagnosis originally omitted should have been included, note was made of where in the medical record there was evidence to support the inclusion. Where the second coder disagreed with the original codes, the coding was arbitrated by a gold-standard coder who adjudicated on the correct codes and ensured that any changed codes met the Australian Coding Standards criteria for additional diagnoses. If an additional diagnosis code was included or deleted, the episode was re-classified using AR-DRG Version 4.1, the same grouper as was used for the original coding. The possible reasons for any coding discrepancies were not addressed because this was not a re-coding study. A blind re-coding study was not done because of time constraints.

The Australian Coding Standard 0002 provides guidance for coders on which conditions should be coded as additional diagnoses. The definition used during 1999–2000 differed slightly from that used for the 2000–2001 period (National Centre for Disease Classification 2000) by removing 'clinical evaluation' from the criteria used to justify the coding of an additional diagnosis. This change, however, had no impact on final codes approved by the gold standard coder for 2000–2001 because no code had been justified on the basis of clinical evaluation alone. Hence the difference in this coding standard had no impact on the results.

A structured form was used to record the data for each episode, which included: patient's age and gender; LOS; discharge status; diagnoses codes — both what they were originally and after the check was made; location in medical record of evidence to support any code additions; and AR-DRG assignment — both original and after checking.

The internal coherence of the AR-DRG classification of the checked 2000–2001 R60 and R61 episodes was investigated, and for this it was necessary to re-determine episode complexity (severity). In place of

the PCCL value (the original PCCL value having not been checked), a proxy for severity was used which was the mean LOS plus the mean number of additional diagnosis codes per episode.

Statistical analysis

All data collected were entered into a Microsoft Access database, from which descriptive statistics were generated.

Standard chi-squared (χ^2) tests with degrees of freedom (df) were used to test the significance of difference between (a) the distributions of the 2000–2001 R60 and R61 episodes before and after checking for miscoding, (b) the distributions of the 1999–2000 episodes and the checked 2000–2001 episodes, and (c) remission status of the principal diagnosis in 1999–2000 versus 2000–2001.

The normal approximation to the binomial distribution (Colton 1974) was used to test whether there was a significant difference between 1999–2000 and 2000–2001 with regard to: (a) the numbers of episodes assigned to the individual R60 and R61 AR-DRGs, and (b) the numbers of patients admitted for episodes assigned to the individual AR-DRGs.

The two-sample *t* test (with df) was used to estimate the significance of difference between the 1999–2000 and 2000–2001 episodes with regard to LOS and age of patients. Comparisons were made by individual AR-DRG.

The alpha level of significance for all statistical testing was 0.05.

The purpose of the statistical testing was to quantify the extent of any differences found.

Results

Testing for coding accuracy

Table 1: Distribution of 2000–2001 episodes within the AR-DRGs R60 (A, B, C) and R61 (A, B) before and after coding check

AR-DRG	No. episodes (% of total)	No. episodes (% of total)
	Before coding check	After coding check
R60A	27 (15%)	30 (17%)
R60B	41 (23%)	35 (17%)
R60C	107 (61%)	110 (63%)
Total	175 (100%)	175 (100%)
R61A	14 (21%)	23 (34%)
R61B	53 (79%)	44 (66%)
Total	67 (100%)	67 (100%)

Table 1 shows the number, before and after checking, of episodes assigned to the individual AR-DRGs R60A, B and C, and R61 A and B from 1 July 2000 to 30 June 2001. It is seen that the check did not cause any change to the total number of episodes assigned to the R60 AR-DRGs but did bring about a change in their distribution amongst A, B, and C. Checking resulted in there being three (11%) more R60A episodes, six

Table 2: Frequency of R60 (A, B, C) and R61 (A, B) episodes in 1999–2000 and 2000–2001

AR-DRG	1 July 1999 – 30 June 2000 No. (% of total)	1 July 2000 – 30 June 2001 No. (% of total)
R60A	62 (43%)	30 (17%)
R60B	63 (43%)	35 (20%)
R60C	20 (14%)	110 (63%)
Total	145 (100%)	175 (100%)
R61A	27 (28%)	23 (34%)
R61B	68 (72%)	44 (66%)
Total	95 (100%)	67 (100%)

(14.6%) fewer R60B episodes, and three (2.8%) more R60C episodes than originally shown. This change in distribution was not statistically significant (χ^2 (2df) = 0.67, P = 0.7).

It is also seen that checking resulted in no change to the total number of episodes assigned to the R61 AR-DRGs (A + B), but R61A episodes increased by nine (64.3%) and R61B episodes decreased by nine (17%). This change in distribution approached statistical significance (χ^2 (1df) = 3.02, 0.05 < P < 0.1).

Checking also increased the total number of 2000-2001 highest complexity episodes (R60A + R61A) by 29% (from 41 to 53) and decreased the second highest complexity episodes (R60 B + R61B) by 16% (from 94 to 79).

Checking the records revealed that 205 (85%) of all 242 2000–2001 R60 and R61 episodes under study had originally been coded correctly with regard to A, B and C classification (84% of R60, and 87% of R61). Of the remaining 37 (15%) episodes that had originally been assigned an incorrect DRG, the checking process resulted in 24 (65%) being allocated to a higher weighted DRG. A total of 50 codes for additional diagnoses that were CCs needed to be added to, and 15 to be deleted from, 2000-2001 episodes; this shows that more than three times as many CC codes were omit-

ted from episodes erroneously as were added to them unjustifiably.

Frequency of R60 and R61 episodes in 1999-2000 and 2000-2001

Table 2 shows the numbers of R60 A, B and C and R61 A, B episodes in 1999–2000 and in 2000–2001 (after checking). The total number of R60 episodes was 20% higher in 2000–2001 than in 1999–2000 (175 as against 145); however, this increase was not statistically significant at P=0.05. It is seen that in 2000–2001 compared to 1999–2000, there were over five times as many R60C episodes (P<0.05), less than half the number of R60A episodes (P<0.05), and just over half the number of R60B episodes (P<0.05). In 1999–2000, R60A and R60B episodes were approximately three times more frequent than R60C episodes, whereas in 2000–2001 the reverse was true. The difference between the 1999–2000 and 2000–2001 distributions of the R60 A, B and C episodes was highly significant (χ^2 (2df) = 75.9, P<0.001). With regard to AR-DRG R61, the total number of episodes (A+B) was nearly one third (29%) fewer in 2000-2001 than in 1999–2000 (67 as against 95) (P<0.05); there were 15% fewer A episodes (P>0.05) and 35% fewer B episodes (P<0.05). However, the 1999–2000 and 2000–2001 distributions of R61 A and B episodes were similar (χ^2 (1df) = 0.64, P>0.4).

There were 48% fewer R60 A+B episodes and 29% fewer R61 A+B episodes in 2000–2001 than in 1999–2000. However, the total number of R60 and R61 episodes for the two years was similar (240 and 242).

Table 3 shows for 1999–2000 and 2000–2001 the numbers of patients admitted per complexity level of episodes, the mean number of episodes per patient, mean LOS per episode, mean age and the male-to-female ratio. With regard to the number of patients, the only significant difference between the two years was that fewer patients were hospitalised with R61B episodes in 2000–2001 than in 1999–2000 (P<0.05). It is recognised that during one or

Table 3: Clinical profiles of the AR-DRGs R60 (A, B, C) and R61 (A, B) for 1999–2000 and 2000–2001

AR-DRG	No. of Patients	Episodes per patient	Average LOS in days (SD)	Average age in years (SD)	M: F ratio
R60A					
1999-2000	24	2.5	15.1 (16.7)	50 (16.0)	2.6:1
2000-2001	20	1.5	18.1 (13.6)	53 (13.3)	1.7:1
R60B					
1999-2000	19	3.3	4.1 (6.6)	54 (17.9)	2.5:1
2000-2001	11	3.2	2.8 (5.9)	53 (8.4)	1.5:1
R60C					
1999-2000	8	2.5	3.2 (3.3)	56 (12.8)	0.8:1
2000-2001	11	10	1.6 (91.9)	58 (10.4)	0.2:1
R61A					
1999-2000	21	1.3	12.9 (9.2)	56 (19.3)	0.7:1
2000-2001	21	1.1	17.6 (11.5)	62 (14.4)	2.8:1
R61B					
1999-2000	48	1.4	6.6 (7.5)	60 (15.2)	0.8:1
2000-2001	27	1.6	4.1 (4.1)	57 (10.7)	3.4:1

both years, the same patient could be hospitalised for different complexity levels of illness (A, B, C). The mean number, within DRGs, of episodes per patient was similar for the two years except for R60C where it was four times higher in 2000–2001 than in 1999–2000. It is seen that over each of the two years the average LOS for episodes decreased in accordance with the decrease in clinical complexity level. The mean LOS for R61B episodes was significantly shorter in 2000–2001 than in 1999–2000 (t value = -2.75 (110df), $P < 0.01$) while within the other AR-DRGs it was similar for the two years (all P values > 0.05). Patients' mean age was similar across AR-DRGs for each of the two years and there were no significant age differences between 1999–2000 and 2000–2001 episodes (all P values > 0.05). The male-to-female ratio varied widely across the AR-DRGs over the two years but with no directional tendencies.

In 2000–2001, there were, on average, respectively, 13 and 14 additional diagnosis codes per R60A and R61A episode, five and seven codes per R60B and 61B episode, and four per R60C episode.

For 2000–2001, there was indication of a positive correlation between episode complexity level (A, B, C), mean LOS per episode, and mean number of codes per episode. This demonstrates internal coherence of the AR-DRG classification system for that year.

Principal diagnosis and CCs

Table 4 shows there were some differences between 1999–2000 and 2000–2001 in the mix of principal diagnoses. It is seen that among acute leukaemia (R60) episodes, the most frequent principal diagnosis both in 1999–2000 and 2000–2001 was myeloid leukaemia. However, among R61 episodes the most frequent principal diagnosis was non-Hodgkin's lymphoma in 1999–2000 and multiple myeloma in 2000–2001.

Acute leukaemia, across all types, was in remission in 1.4% of 1999–2000 episodes compared to 19.4% of 2000–2001 episodes ($\chi^2 = 11.07(1df)$, $P < 0.001$). A new coding standard ACS 0245 (NCCH 2000) introduced in the 2000–2001 period may account for the increased coding of remission status. Over the two years, acute leukaemia was in remission in 5% of R60A episodes, 13% of R60B episodes and 8% of R60C episodes. This demonstrates that remission status in acute leukaemia was not associated with CC effect (catastrophic, severe, less than severe).

There were no R61 episodes in either 1999–2000 or 2000–2001 where multiple myeloma or non-acute leukaemia was in remission. It was not known whether there were any episodes where lymphoma was in remission; this is because within the AR-DRG R61 there are no separate principal diagnosis codes to allow differentiation between a lymphoma in remission and a lymphoma without mention of remission. (For the acute leukaemias, non-acute leukaemias, and multiple myeloma there are separate diagnosis codes to allow this differentiation).

The number of R60 plus R61 episodes where the principal disease was reported to be in remission was significantly higher in 2000–2001 than in 1999–2000

(23 as against four) ($\chi^2 = 14.00(1df)$, $P < 0.001$). However, the number of episodes where disease was not reported to be in remission was only 7% lower in 2000–2001 ($n=219$) than in 1999–2000 ($n=236$). Also, despite there being proportionately more acute leukaemia episodes in remission in 2000–2001 than in 1999–2000, the increase in acute leukaemia episodes in 2000–2001 (175, as against 145 in 1999–2000) resulted in there being more episodes in 2000–2001 than 1999–2000 where acute leukaemia was not in remission (152 versus 141).

The three most frequent additional diagnoses that were CCs among the 2000–2001 R60 episodes were agranulocytosis, other transplanted organ and tissue status, and anaemia in neoplastic disease (in respectively, 21%, 19%, and 7% of episodes). These three additional diagnoses were present in, respectively, 50%, 10%, and 30% of A episodes, and 60%, 37%, and 9% of B episodes. Of these CCs, only other transplanted organ and tissue status was present in C episodes (15.5%).

The three most frequent additional diagnoses among 2000–2001 R61 episodes were anaemia in neoplastic disease, atrial fibrillation and flutter, and agranulocytosis (in, respectively, 18%, 13%, and 12% of episodes). These additional diagnoses were present in, respectively, 26%, 17%, and 30% of A episodes and 14%, 9%, and 2% of B episodes.

In the original coding, agranulocytosis, other transplanted organ and tissue status, and anaemia in neoplastic disease had been missed in, respectively, 20%, 6%, and 21% of the episodes in which they were present.

Discussion

The results of this study serve to confirm that at the hospital under study there were, in reality, markedly fewer inpatient episodes within the higher complexity R60 and R61 AR-DRGs in the year 2000–2001 compared to 1999–2000. Miscoding, which caused a 15% DRG error rate, was seen to have little impact on the difference between the two years in this regard. Nevertheless, because under-coding of CCs was more frequent than over-coding, the 2000–2001 resource consumption for the study diseases would have appeared somewhat lower than it actually was, which may have resulted in some financial disadvantage to the hospital. Coding audits in Victorian public hospitals (MacIntyre et al. 1997) and in seven Western Australian hospitals (Stevens, Unwin & Codde 1998), and a recoding study across three Sydney teaching hospitals (Donoghue 1992) revealed that on average, respectively, 13.6%, 13.3%, and 9.25% of DRGs had been incorrectly assigned. In two of the surveys (Stevens et al. 1998; Donoghue 1992) incorrect coding would have caused financial loss to most of the hospitals under study. The DRG error rate found by Donoghue (1992) — less than two-thirds that found in our study — was claimed by that author to be too high in view of the financial implications. However it is likely that the rate of error in DRG assignment found in our study is not representative of that across all of the study hospital's records; the present study focused on particular diseases and it has been

shown that the DRG error rate can vary widely by diagnosis group (Donoghue 1992) and may increase with increasing complexity of the case (MacIntyre et al. 1997). It is noted that when Donoghue (1992) investigated different diagnosis groups she found a DRG error rate of 27% for 'lymphoma or leukaemia age 18-69 without CCs'; this was three times higher than the error rate overall for Donoghue's study, and nearly twice that found in our study for leukaemia and lymphoma both with and without CCs. However, as implied by Donoghue (1992), having access to the original codes when checking the records, as was the case in our study, can bias towards finding a lower number of discrepancies. The probability of such bias in the present study serves as a limitation because it renders uncertain whether the true rate of incorrect DRG assignment was found; the true rate could, in fact, have been much higher than 15%. In our study, random rather than systematic miscoding of additional diagnoses is indicated in view of the finding of internal coherence of the DRG classification, and of unjustified additional diagnosis additions as well as omissions. (There had been no hint of deliberate false over-coding). The reason why there were fewer higher complexity episodes in 2000–2001 is not readily explained; the brief time frame and limited area of study (one hospital only) prevent any inferences concerning trends over time in respect of the occurrence or severity of complications associated with these diseases, or the presence of comorbidities.

In respect of the perception of the Haematology Department staff that despite statistical evidence of fewer complex episodes in 2000–2001 their clinical workload for the diseases under study was not lower in that year than during the previous one, there are two possible contributing factors. Firstly, for both 1999–2000 and 2000–2001, the total number of inpatient episodes was virtually identical; and secondly, the total number of episodes where disease was not reported to be in remission was similar for the two years, being only slightly lower in 2000–2001. Another circumstance of possible relevance

haematologically was that the mix of principal diagnoses within the DRGs differed between the two years, especially with regard to multiple myeloma and non-Hodgkins lymphoma. It may be that haematology work tended to be generated by the principal diagnosis rather than by the CCs; and that some diseases within the DRGs under study generated more work than others; if so, such could explain the impression that there was no true decrease in the haematology workload during the second year, because in fact there was none. There is a large difference between the cost weights for these AR-DRGs, but it should be borne in mind that workload and cost weights are different concepts.

Our finding that most admissions for acute leukaemia were for acute myeloid leukaemia is in line with previous reports that this is the most common form of acute leukaemia in adults (Redaelli et al. 2004). The frequency of the additional diagnoses agranulocytosis and anaemia in neoplastic disease is also understandable given that toxicity to bone marrow cells due to chemotherapy can result in agranulocytosis (Guest & Utrecht 2001; Karp, Merz & Charache 1991), and anaemia is strongly associated with haematological malignancies (Beguin 1998).

In conclusion, the findings of this study suggest that in major hospitals miscoding continues to occur to an important degree. If, as found in this and previous studies, the bulk of coding errors are in the area of under-coding, financial disadvantage to hospitals might be considerable. It is apparent that measures to improve coding accuracy such as continuing education and training for coders need to continue at an enhanced level. In order to ascertain whether the marked differences in leukaemia and lymphoma AR-DRG distribution found over 2 years in the present study were due to the beginning of a trend or just to an aberration or random fluctuation, the frequency distributions of the AR-DRGs would need to be examined over at least a 5-year-period. Trends over time in these AR-DRGs could also be studied at a state (NSW) level using cancer registry data.

Table 4: Principal diagnosis among R60 and R61 episodes in 1999–2000 and 2000–2001

Principal diagnosis		1999–2000 (% of all episodes)	2000–2001 (% of all episodes)
R60 episodes			
Acute Leukaemia	myeloid	59.3	57.7
	promyelocytic	11.0	29.1
	lymphoblastic	18.6	13.7
	myelomonocytic	9.7	0.0
	unspecified	1.4	0.0
R61 episodes			
Multiple myeloma		23.2	35.8
Non-Hodgkins lymphoma (diffuse — large cell, lymphoblastic, unspecified; follicular — small cleaved cell, mixed small cleaved and large cell, large cell; other types; unspecified type)		31.6	22.4
Hodgkins lymphoma (lymphocytic depletion, unspecified)		4.2	4.5
Other lymphoma (B-cell, Burkitt's)		10.5	14.9
Non-acute leukaemia (prolymphocytic, chronic lymphocytic, chronic myeloid, mast cell, adult T-cell, plasma cell)		20.5	11.6
Myelodysplastic syndrome; chronic myeloproliferative disease; Waldenström's macroglobulinaemia without mention of remission		8.4	10.5

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References

- Beguín, Y. A. (1998). Risk-benefit assessment of epoetin in the management of anaemia associated with cancer. *Drug Safety* 19(4): 269-282.
- Colton, T. (1974). *Statistics in Medicine*. Boston, Little, Brown & Co.
- Commonwealth Department of Health and Aged Care (1998). *Australian Refined Diagnosis Related Groups, version 4.1. Definitions Manual. Vol. 1*. Canberra, Commonwealth of Australia.
- Donoghue, M. (1992). The prevalence and cost of documentation and coding errors. *Australian Medical Record Journal* 22(3): 91-97.
- Eagar, K. and Hindle, D. (1994). *Casemix in Australia: an overview*. Canberra, Commonwealth of Australia.
- Guest, I. and Utrecht J. (2001). Bone marrow cell protection from chemotherapy by low-molecular-weight compounds. *Experimental Hematology* 29(2): 123-137.
- Karp, J.E., Merz, W.G. and Charache, P. (1991). Response to empiric amphotericin B during antileukemic therapy-induced granulocytopenia. *Reviews of Infectious Diseases* 13(4): 592-599.
- MacIntyre, C.R., Ackland, M.J., Chandraraj, E.J. and Pilla, J.E. (1997). Accuracy of ICD-9-CM codes in hospital morbidity data, Victoria: implications for public health research. *Australian and New Zealand Journal of Public Health* 21: 477-482.
- Moss, J. (2002). Funding of South Australian public hospitals. *Australian Health Review* 25(1): 156-172.
- National Centre for Classification in Health (2000). *International Classification of Diseases 10th Revision, Australian Modification, 2nd edition, vol 5*. Sydney, National Centre for Classification in Health.
- Redaelli, A., Botteman, M.F., Stephens, J.M., Brandt, S. and Pashos, C.L. (2004). Economic burden of acute myeloid leukaemia. *Cancer Treatment Review* 30(3): 237-247.
- Stevens, S., Unwin, C.E. and Codde, J.P. (1998). A review of hospital medical record audits: implications for funding and training. *Australian Health Review* 21: 78-91.
- Zhang, X., Marshall, R., McAlister, S. and Hirsch, N. (1997). The diagnosis severity indicators in Australia. *Australian Casemix Bulletin* 8(4): 9-11.

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