

Asthma terminology and classification in hospital records

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Abstract

Asthma is a national health priority area in Australia, and there is significant interest in capturing relevant detail about hospitalisations as a result of asthma. A public submission received by the National Centre for Classification in Health from a large teaching hospital in Victoria suggested that current classification terminology in ICD-10-AM did not adequately reflect the terms recorded in clinical inpatient records, and that patterns and severity of asthma better reflected current clinical terminology in Australian hospitals. The purpose of this study was to determine the validity of the public submission and inform future changes to ICD-10-AM. A representative sample of over 3000 asthma records across Australia and New Zealand were extracted, and the asthma terminology documented and codes assigned were recorded and analysed. The study concluded that there was little support for either pattern terminology or the current classification terminology; however, severity of asthma was commonly used in asthma documentation.

Keywords: *Asthma; classification; terminology; International Classification of Diseases*

Asthma is a national health priority area in Australia, and there is significant interest in capturing relevant detail about hospitalisations as a result of asthma. The prevalence of asthma in Australia is high by international comparisons, with 14% to 16% of children and 10% to 12% of adults reporting asthma as a current problem (Australian Centre for Asthma Monitoring 2003; Australian Centre for Asthma Monitoring 2004). Since 1996, hospitalisation rates for children have reduced, whilst the rate for people aged 15 years and over has remained unchanged (Australian Institute of Health and Welfare 2002). In 2000/01, 0.8% of all hospital separations were for people with a principal diagnosis of asthma, with over half of all separations for asthma occurring in the 1–14-years age group (Australian Centre for Asthma Monitoring 2003). According to the Australian Centre for Asthma Monitoring, the average length of hospital stay for asthma has reduced over the same time period. It has also been reported that asthma mortality rates have steadily declined from 1994 (Dobbin et al. 2004).

Frequency and severity of asthma symptoms vary from mild episodic asthma to chronic severe asthma (Australian Institute of Health and Welfare 2002). Generally, asthma is clinically classified as either intermittent or persistent, and measurement of airway hyper-responsiveness is often used to determine asthma severity in persistent asthma (Robertson 2002; Woolcock et al. 2001). Clinical assessment of asthma severity (mild, moderate or severe) helps to determine individual patient treatment (National Asthma Council Australia 2002). Patterns of asthma are significant in terms of determining the need for preventive therapy and in determining the outcome of childhood asthma. The National Asthma Council (2002) defines patterns of asthma in childhood as:

Infrequent episodic asthma: isolated episodes of asthma; lasts from 1–2 days up to 1–2 weeks; usually triggered by an upper respiratory tract infection (URTI) or an environmental allergen; has a wide range of severity, although mostly mild; accounts for up to 60% of childhood hospital admissions for asthma.

Frequent episodic asthma: shorter interval between episodes; lasts less than 6–8 weeks; minimal symptoms, such as exercise-induced wheeze in the interval period.

Persistent asthma: patients may exhibit acute episodes like the categories above, but also show symptoms on most days in the interval period; wide range of severity.

Historically, the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)* (World Health Organization 1994) has described asthma with terms such as intrinsic (non-allergic) and extrinsic (allergic), and these terms from the parent classification are included in the Australian modification, *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM)* (National Centre for Classification in Health 2004). Australian clinical coders utilise the *Australian Coding Standards (ACS) for the ICD-10-AM* (Volume 5) to guide them in making sound decisions pertaining to the coding of asthma (National Centre for Classification in Health 2004). The ACS guidelines for asthma state that J45 should be assigned for diagnoses such as 'asthma', 'severe asthma', 'acute asthma' or other terminological variations not included in J46. J46 should be assigned only if asthma is documented as 'acute severe' or 'refractory'. Asthma terminology in other classification modifications of ICD-10 varies. For example, the Canadian classification (ICD-10-CA) uses the same codes as ICD-10-AM but includes a fifth character to indicate with or without status asthmaticus (Canadian Institute for Health Information 2003). In contrast, the June 2003 pre-release draft of the American classification (ICD-10-CM) contains codes for intermittent and persistent asthma (National Center for Health Statistics 2003). ICD-10-CM also captures asthma severity and includes a fifth character to identify 'uncomplicated', 'with acute exacerbation' and 'with status asthmaticus'.

A public submission received by the National Centre for Classification in Health (NCCH) from a large Victorian teaching hospital asserts that the management of asthma in an inpatient setting is determined by the

pattern of asthma rather than the terms included in ICD-10-AM at present.¹ It was further suggested that ICD-10-AM codes should also reflect asthma severity. In terms of the Australian Refined Diagnosis Related Group (AR-DRG) allocation, coding for severity of asthma is currently insignificant. A principal diagnosis of J45.0 (Predominantly allergic asthma), J45.1 (Non-allergic asthma), J45.8 (Mixed asthma), J45.9 (Asthma, unspecified) or J46 (Status asthmaticus) would place a patient in AR-DRG E69 *Bronchitis and Asthma*. This AR-DRG is further broken down according to age and/or the presence of complication or comorbidity codes, as follows:

- E69A Bronchitis and Asthma Age > 49 W CC
- E69B Bronchitis and Asthma Age > 49 or W CC
- E69C Bronchitis and Asthma Age < 50 W/O CC

Diagnostic inaccuracies and changes to coding classifications may affect trends in asthma reporting. Misclassification of asthma in the elderly can occur due to clinical confusion between asthma and chronic obstructive pulmonary disease, and the presence of other medical conditions (Australian Centre for Asthma Monitoring 2005; Dobbin et al. 2004). Osborne, Vollmer and Buist (1992) reported that incorrect clinical assessment and incomplete or insufficient record documentation impacts on the diagnostic accuracy of asthma. Furthermore, coding of asthma in Australian hospitals may be affected by ICD revisions, variations in coding practice, and clinical misdiagnosis (Australian Centre for Asthma Monitoring 2005). However, an American study reported by Krueger, Armstrong and Langley (2001) which addressed asthma coding errors, reported an 85.4% level of agreement between diagnoses documented in clinical records and diagnostic codes.

This study was undertaken to review the asthma terminology suggested in the public submission to establish if it existed in clinical records, which would inform changes to asthma codes for ICD-10-AM. The research questions addressed were:

- Are patterns of asthma (infrequent, frequent, episodic, chronic, persistent) used widely and regularly documented in hospital records?
- Can patterns of asthma be applied to both children and adults?
- How regularly is asthma documented as mild, moderate or severe?
- Are other asthma terms used widely in hospital records?
- Does the current asthma classification reflect the terminology present in hospital records?

Method

Data Collection

Representatives from the NCCH's Coding Standards Advisory Committee (CSAC) from all Australian states and territories were involved in the facilitation of access to data for this study.

These representatives presented the study proposal to the state and territory health authorities to gain approval for state and territory participation in the study.

Using 2001-2002 Australian hospital morbidity data from the Australian Institute of Health and Welfare, numbers of records per state, age group, and public or private hospital were ascertained to be reflective of the general distribution of asthma separations within each of these categories and sample size guidelines were provided to the CSAC representatives. The aim of these guidelines was to ensure the sample selected was a representative coverage of asthma coding and clinical terminology used across Australia.

The CSAC representatives approached suitable hospitals within their state, ensuring the sample of hospitals included a range of rural and metropolitan centres, children's and general hospitals, and in small, medium and large hospitals. CSAC representatives were directed to request a sample of recent asthma records, ensuring adequate numbers of each of the asthma codes in the range J45 to J46.

Health Information Managers at the hospital level then extracted hospital records with a principal diagnosis in the desired range. HIMs were advised to record the clinical terms used to describe asthma in each of the documents present in the hospital records using a standard data collection form. Data were entered into a database and analysed using SPSS Version 13.0.

Results

Sample Characteristics

The final sample of Australian records obtained was 2711, representing 101% of the original Australian sample requested, and approximately 6.3% of the asthma separations across Australia using 2001/02 data (Australian Centre for Asthma Monitoring, 2003) (total N=48 812). New Zealand supplied an additional 360 records, representing 78.3% of the original New Zealand sample requested, and 4.3% of the asthma separations across New Zealand using 2003 data supplied by the New Zealand Health Information Service (total N=8359).

Table 1: Sample size by state and age group

State	n	%	Total Asthma %
ACT	110	3.58	1.15
NSW	961	31.29	34.99
NT	97	3.16	1.00
Qld	419	13.64	17.88
SA	336	10.94	11.33
Tas	120	3.91	1.28
Vic	411	13.38	22.29
WA	257	8.37	10.18
NZ	360	11.72	
Age	n	%	Total Asthma %
<5yrs	1010	32.89	30.50
5-15yrs	746	24.29	23.49
>15yrs	1315	42.82	46.01
TOTAL	3071	100.00	100.00

¹ For more information on the public submission process for modification of ICD-10-AM, refer to the guidelines on the NCCH website at: <http://www3.fhs.usyd.edu.au/ncchwww/site/4.7.1.htm>.

Table 2: Percentage distribution of ICD-10-AM codes by state, locality, type and age group

		J45.0	J45.1	J45.8	J45.9	J46
State	ACT	0.91%	0.00%	0.00%	81.82%	17.27%
	NSW	0.94%	0.10%	0.00%	77.11%	21.85%
	NT	0.00%	0.00%	0.00%	86.60%	13.40%
	QLD	8.59%	4.77%	5.25%	60.62%	20.76%
	SA	0.60%	0.00%	0.00%	83.33%	16.07%
	Tas	3.33%	2.50%	0.00%	85.00%	9.17%
	Vic	0.49%	0.49%	0.49%	89.54%	9.00%
	WA	2.72%	0.39%	0.00%	76.26%	20.62%
	NZ	1.39%	0.28%	0.00%	91.94%	6.39%
	TOTAL	2.15%	0.91%	0.78%	79.65%	16.51%
Hospital Location	Regional	2.15%	1.40%	0.16%	77.93%	18.35%
	Rural	2.14%	0.16%	1.73%	82.28%	13.69%
	TOTAL	2.15%	0.91%	0.78%	79.65%	16.51%
Hospital Type	Children's	4.48%	2.49%	0.00%	52.99%	40.05%
	General	1.80%	0.67%	0.90%	83.66%	12.96%
	TOTAL	2.15%	0.91%	0.78%	79.65%	16.51%
Age Group	<5yrs	2.87%	0.89%	0.59%	80.69%	14.95%
	5–15yrs	2.28%	0.67%	0.67%	77.21%	19.17%
	>15yrs	1.52%	1.06%	0.99%	80.23%	16.20%
	TOTAL	2.15%	0.91%	0.78%	79.65%	16.51%

*Percentages may not always equal 100 because of rounding.

Table 1 shows the sample size by state and by age group. Both sets of information provide number of cases, percentage of total, and the percentage distribution of asthma cases nationally in each category. Approximately 60% of records were extracted from regional hospitals and the remaining 40% extracted from rural hospitals. Almost 13% of records were extracted from designated children's hospitals and 87% extracted from general hospitals.

Table 2 shows a detailed breakdown of the percentage distribution of ICD-10-AM codes by state, hospital location, hospital type and age group. The use of J46 varies by state from a minimum of 6% in New Zealand to a maximum of 22% in NSW. Queensland had a considerably lower percentage of J45.9 cases (61%) compared with an average of 84% for all other states. Queensland, however, had a much higher percentage of codes in the range J45.0-J45.8 than all other states.

There was also considerable variation in utilisation of codes between children's hospitals and general hospitals with 40% of the asthma codes in children's hospitals being J46 compared with just 13% of the codes in general hospitals (correspondingly, only 53% of the asthma codes in children's hospitals were J45.9 compared to 84% of the codes in general hospitals).

Are patterns of asthma used widely and regularly documented in hospital records?

Table 3: Presence of pattern or severity terminology in any documentation source

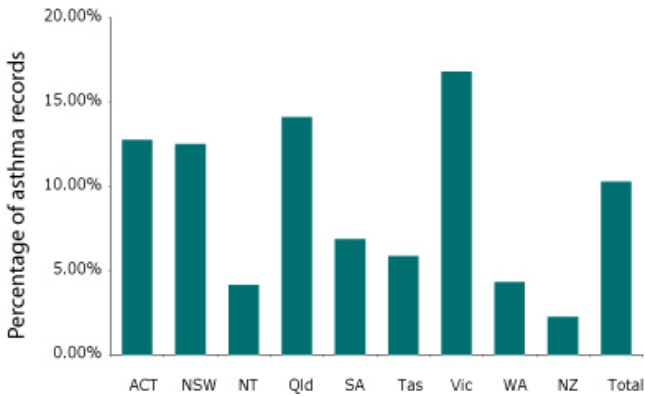
Patterns	n	%
Infrequent	69	2.25
Frequent	108	3.52
Episodic	127	4.14
Chronic	168	5.47
Persistent	44	1.43
Any Pattern	315	10.26
Severity	n	%
Mild	247	8.04
Moderate	689	22.44
Severe	743	24.19
Any severity level	1225	39.89

Table 3 presents the number and percentage of cases using pattern terminology of infrequent, frequent, episodic, chronic, and persistent in any documentation source. Only 10% of cases had one or more of these pattern terms present in any documentation source.

These pattern terms were examined by state, hospital location, hospital type, and age group with some significant variations in term usage identified (See Figure 1). While 17% of cases in Victoria had some pattern terminology documented in the hospital re-

records, less than 5% of cases in NT, WA and NZ reported patterns in the hospital records.

Figure 1: Patterns of asthma terminology by state/territory



No significant differences were identified for pattern terminology by hospital location, although significant variations were identified by hospital type and age group. Pattern terminology was present in 21% of hospital records from children’s hospitals, but just 9% of hospital records from general hospitals. Pattern terminology by age group varied depending on hospital type, with 28% of records for 5 to 15 years olds in children’s hospitals documenting patterns, compared with just 12% of records in general hospitals.

How regularly is asthma documented as mild, moderate or severe?

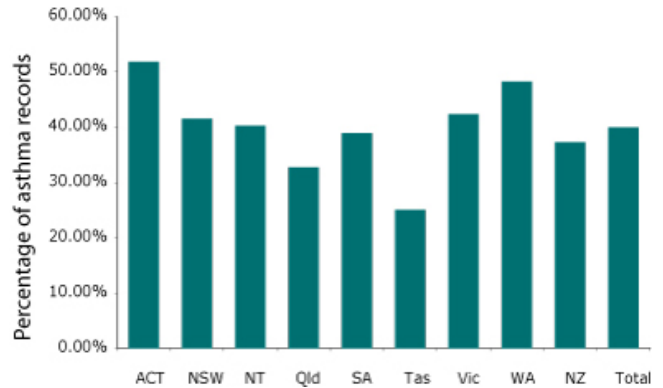
Table 3 also presents the number and percentage of cases using severity terminology of mild, moderate, or severe. Almost 40% of records contained documentation of severity levels, with ‘severe’ being the most common severity level reported. However, of those cases with severity levels documented, 34.8% of cases had multiple severity levels documented in the hospital records, with moderate/severe being the most common multiple severity level recorded (representing over 70% of cases with multiple severity levels reported and 25% of all severity cases overall) (See Table 4).

Severity level	n	%
Mild	128	10.45
Mild/Moderate	79	6.45
Mild/Severe	13	1.06
Mild/Moderate/Severe	27	2.20
Moderate	275	22.45
Moderate/Severe	308	25.14
Severe	395	32.24
TOTAL	1225	100.00

These severity terms were examined by state, hospital location, hospital type, and age group with some significant variations in severity term usage identified (See Figure 2). While over 50% of cases in the ACT

included severity terminology, only 25% of cases in Tasmania included severity terminology in the hospital records.

Figure 2: Severity of asthma terminology by state/territory



Significant variations were also evident by locality, with 43% of regional hospitals documenting severity levels compared with 36% of rural hospitals. Similarly, records from children’s hospitals had severity levels documented in half of the cases, compared with 38% of the records from general hospitals. Severity levels were most widely reported in records for children aged between 5 and 15 (52%) compared with 38% of records for children aged under 5 years and 35% of records for people aged over 15 years.

Are there other asthma terms used widely in hospital records?

Data were explored to identify other common terminologies present in hospital records for asthma admissions. There were four main categories of common asthma terms in hospital records, which included the following:

- exacerbation terms:* worsening, exacerbation, increasing
- viral terms:* respiratory tract infection (RTI), pneumonia, bronchitis/bronchiolitis, viral, infection, respiratory syncytial virus (RSV)
- symptom terms:* shortness of breath, breathing difficulties, wheeze, respiratory distress, cough, tight, recession, retraction, tachypnoea
- asthma history terms:* asthmatic, known, history, first

Table 5 presents the number and percentage of cases using other common asthma terminology.

Terminology	n	%
Exacerbation terms	2051	66.80
Viral terms	1562	50.90
Symptom terms	1009	32.90
Asthma history terms	791	25.80

Less than 5% of cases had no terminology beyond the terms 'asthma' or 'asthma, unspecified'. Tasmania had the highest proportion of cases with no descriptive terminology, with 12.5% of cases, followed by NZ with 8.1% of cases and the ACT with 6.4% of cases. All other states had 5% or fewer cases with no descriptive terminology. There were no significant differences for cases with no descriptive terminology by hospital locality, hospital type or age group. While 95% of cases with no descriptive terminology were coded to 'J45.9 Asthma, unspecified', five cases were allocated to J46 and two cases were coded to J45.0.

Does the current asthma classification reflect the terminology present in hospital records?

Table 6 presents the number of cases using any of the terminology required for current ICD-10-AM asthma classification. Two additional terms are included in this list for comparison, being 'Severe Acute' and 'status' (without asthmaticus specified), as these terms were identified in the documentation.

Table 6: Presence of any terminology required for current ICD-10-AM asthma classification

Term	n	%
Allergic	43	1.40
Infective	489	15.92
Acute Severe	176	5.73
Status Asthmaticus	85	2.77
Severe Acute	58	1.89
Status (alone)	7	0.23

Table 7 reports the number and percentage of cases that have any documentation in any source to support the assignment of J46 using both strict and broader interpretations of the Australian Coding Standards (ACS). Broader interpretations of the ACS reflect queries received by NCCH in relation to asthma classifications. The NCCH compiles a database of these queries and responses which can be viewed on the NCCH website at: <http://www3.fhs.usyd.edu.au/ncchwww/site/4.3.htm>. A summary of the various interpretations of the ACS pertaining to asthma are as follows:

J46 – presence of any of the terms 'acute severe', 'status asthmaticus', OR 'refractory'.

J46 term variants – presence of any of the terms from *J46* OR 'severe acute' OR 'status' (as 'severe acute' indexed in ICD-10-AM and some evidence of abbreviation of status asthmaticus in sample).

J46 acute and severe – presence of any of the terms from *J46* OR 'acute' and 'severe' (NCCH query database no. 2068 suggests some confusion as to whether acute and severe need to be present or whether acute or severe is sufficient for coding *J46* based on ICD-10-AM index (National Centre of Classification in Health 2005).

J46 acute or severe – presence of any of the terms from *J46* OR 'acute' OR 'severe' (NCCH Query database no. 2068).

J46 exacerbation – presence of any of the terms from *J46* OR 'exacerbation' and 'acute' OR 'severe' and 'acute' (NCCH query database no. 894 guides coders to assign *J46* if acute exacerbation present in documentation, despite ACS guidelines).

Table 7: Presence of documentation in any source to support the assignment of J46

J46 Documentation	n	%
1. J46	242	7.88
2. J46 Term Variants	285	9.28
3. J46 Acute and Severe	498	16.22
4. J46 Acute or Severe	1532	49.89
5. J46 Exacerbation	1074	34.97

Less than 8% of cases had the terms 'acute severe', 'status asthmaticus' and/or 'refractory' documented in the hospital records, which are required to assign the code 'J46 status asthmaticus' according to the Australian Coding Standards. However, the *J46* code was assigned in approximately 16% of cases in the sample.

Figure 3 provides a detailed breakdown of the percentage distribution of ICD-10-AM codes for those cases with documentation supporting the use of *J46* compared with those cases without documentation supporting *J46* using the five ACS interpretations listed previously. In almost 60% of cases that were coded to *J46*, there was insufficient documentation to support the use of the code (using the strict ACS guidelines). This figure decreased to 51% of cases without supporting documentation when accepting term variants such as 'severe acute' or 'status'. While over 80% of *J46* coded cases had supporting documentation when using the broad criteria of interpretation no.4, there is also a corresponding increase in the number of *J45* coded cases that should be *J46* (44% of cases using interpretation no.4 compared to just 1% of *J45* coded cases using the strict interpretation of ACS). Including acute exacerbation (interpretation no.5) appears to provide an appropriate balance, with 73% of *J46* cases having supporting documentation and only 27% of *J45* coded cases having *J46* documentation included in the records.

Further examination of the *J46* coded cases was conducted by state, hospital location, hospital type, and age group, with *J46* coded cases being categorised as either having supportive documentation or no supportive documentation (using interpretation 2 from the previous step). Figure 4 shows the percentage of *J46* coded and supported cases by *J46* coded and not supported cases, by state. Significant variations were present with a minimum of only 31% of NSW *J46* coded cases being supported with documentation to a maximum of 89% of SA *J46* coded cases being supported with documentation. Furthermore, while 55% of *J46* coded cases in regional hospitals were supported with documentation, only 36% of *J46* coded cases in rural hospitals were supported with documentation. There was no significant difference in the distribution of supported/not supported *J46* coded cases by hospital type or age group.

Figure 3: Percentage of supported and unsupported J46 cases by state/territory

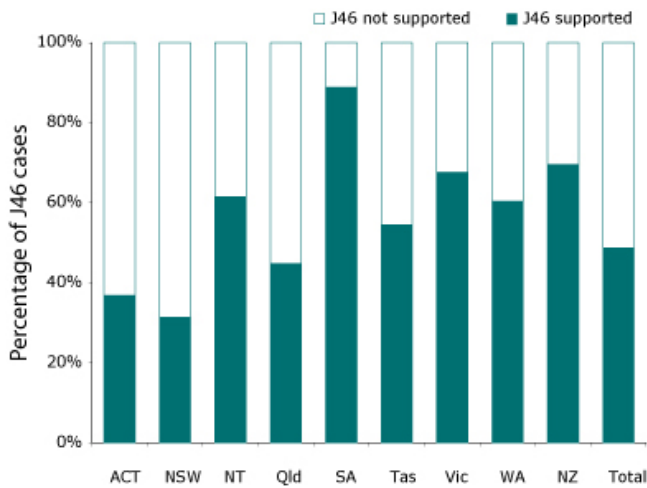
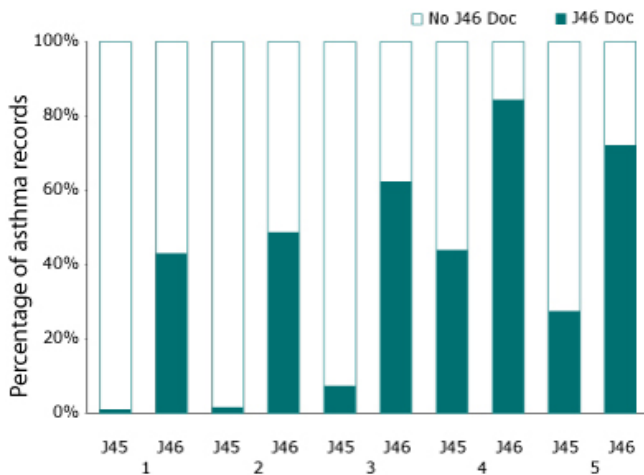


Figure 4: Distribution of ICD-10-AM codes for each ACS interpretation of J46



Discussion

With asthma being a national health priority area, there has been considerable interest in capturing relevant detail about hospitalisations as a result of asthma. On account of a public submission received by the NCCH recommending changes to the asthma classification, this study examined the terminology used in a representative sample of hospital records with a principal diagnosis of asthma to assess (a) whether patterns of asthma are used widely and regularly documented in hospital records, (b) whether asthma severity is regularly documented, (c) other common asthma terms in hospital records, and (d) whether the terminology supports the current classification.

There appears to be little support for the introduction of pattern terminology into the asthma classification with only 10% of cases having asthma patterns documented in the hospital records. Pattern terminology varied significantly by state, with Victoria using pattern terminology the most of all states (17% of cases). Patterns were also documented at varying rates by hospital type and age group with 5 to 15 year olds in children’s hospitals having the highest rate of pattern documentation (28%).

Severity levels were commonly documented in hospital records with almost 40% of records having some documentation pertaining to severity. However, this varied significantly by state, locality, hospital type and age group. Furthermore, over one-third of cases had multiple severity levels documented in the hospital records. Therefore, any changes to asthma classification would need to consider these findings.

The research identified other common terms present in the hospital records for asthma cases, with four main categories of asthma terms found including: exacerbation terms, viral terms, symptom terms, and asthma history terms. All of these categories appeared in considerable proportions through the sample, and may warrant further attention in any considerations for changes to the asthma classification.

Finally, the study provided evidence that the asthma terminology in ICD-10-AM is outdated and not used clinically. Documentation to support the use of J46 was present in less than 10% of cases, and only 40% of cases assigned J46 had supporting documentation using the current classification terminology. There has been considerable confusion as to the interpretation of the ACS and NCCH query responses in relation to the acceptance of ‘exacerbation’ for the assignment of J46. Expanding the current terminology to include ‘acute and exacerbation’ increased the percentage of cases with supporting documentation to over 70% of cases.

There were significant differences between states in relation to the presence of documentation to support J46 code assignment. While some of these could be explained by the widening of the terminology to include ‘exacerbation’, significant variation still remains between states and warrants further attention.

Conclusion

In summary, this study found little support for the introduction of pattern terminology but considerable support for the utilisation of severity level terminology in asthma classifications. Furthermore, this research found little supporting documentation to justify the current asthma classification terminology, suggesting that changes to future editions of ICD-10-AM in relation to asthma classification will need to be considered. In order to advance the changes to ICD-10-AM, the NCCH will be circulating study results more widely amongst key stakeholders in the asthma field (e.g. Australian Centre for Asthma Monitoring and Australian Institute of Health and Welfare) so that experts in asthma research and clinical care can assist in deciding the next steps in relation to the classification and clinical documentation of asthma.

Acknowledgements

We gratefully acknowledge the contributions of Kerry Innes and Donna Truran from the NCCH, Sydney, and Sue Walker from the NCCH, Brisbane, to the design of the study, review of draft reports, and advice regarding classification issues.

References

- Australian Centre for Asthma Monitoring (2003). *Asthma in Australia 2003. AIHW Asthma Series 1. AIHW cat. no. ACM 1*. Canberra, AIHW.
- Australian Centre for Asthma Monitoring (2004). *Measuring the impact of asthma on quality of life in the Australian population*. Canberra, AIHW.
- Australian Centre for Asthma Monitoring (2005). *Enhancing asthma-related information for population monitoring - Asthma Data Development Plan*. Canberra, AIHW.
- Australian Institute of Health and Welfare (2002). *Chronic diseases and associated risk factors in Australia*. Canberra, AIHW.
- Canadian Institute for Health Information (2003). *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada (ICD-10-CA)*. Canada, CJHI.
- Dobbin, C. J., Miller, J., van der Hoek, R., Baker, D. F., Cumming, R. and Marks, G. B. (2004). The effects of age, death and birth cohort on asthma mortality rates in Australia. *International Journal of Tuberculosis and Lung Disease* 812: 1429-1436.
- Krueger, K. P., Armstrong, E. P. and Langley, P. C. (2001). The accuracy of asthma and respiratory disease diagnostic codes in a managed care medical claims database. *Disease Management* 44: 155-161.
- National Asthma Council Australia (2002). *Asthma management handbook 2002*. Melbourne, National Asthma Council Australia.
- National Center for Health Statistics (2003). *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification (ICD-10-CM)*. Hyattsville, NCHS.
- National Centre for Classification in Health (2004). *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM). Fourth Edition*. Sydney, University of Sydney Press.
- National Centre for Classification in Health. NCCH Query Database [Online] 2005 (accessed 12 April 2005). Available at: <<http://pc-ncc23.fhs.usyd.edu.au/queries>>.
- Osborne, M. L., Vollmer, W. M. and Buist, S. A. (1992). Diagnostic accuracy of asthma within a health maintenance organization. *Journal of Clinical Epidemiology* 454: 403-411.
- Robertson, C. F. (2002). Long-term outcome of childhood asthma. *Medical Journal of Australia* 177: S42-S44.
- Woolcock, A. J., Bastiampillai, S. A., Marks, G. B. and Keena, V.A. (2001). The burden of asthma in Australia. *Medical Journal of Australia* 175: 141-145.
- World Health Organization (1994). *International statistical classification of diseases and related health problems, 10th Revision (ICD-10)*. Geneva, WHO.

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Kirsten McKenzie is a Research Fellow at the Brisbane office of the National Centre for Classification in Health, where she has worked since the start of 2001. She has completed an Honours degree and a PhD in Psychology. She is involved in research on the quality of morbidity and mortality coding. She was recently awarded a three-year Australian Research Council grant to examine the quality of national injury-related hospital morbidity data. Some examples of her previous research include a survey of the Australian Clinical Coder workforce, examining the effects of classification change on long-term mortality trends, the impact of the change from ICD-9 to ICD-10 on mortality statistics, and the international comparability of the World Health Organization's mortality databases.

Sue Wood is a Health Information Manager with a postgraduate qualification in statistics who has worked for the National Centre for Classification in Health since December 2001. Initially, Sue was seconded to the Victorian Institute of Forensic Medicine where she was responsible for auditing the data quality of the national coronial database and educating staff in coronial jurisdictions in the application of the International Classification of External Causes of Injury (ICECI). Sue relocated from Melbourne to Sydney in 2004, and conducts regular analyses of national morbidity data to check for compliance with the Australian Coding Standards and coding conventions, and reviews coding practice within and between states and territories. The analyses assist with decisions to make ICD-10-AM code changes and help to target coder education.