Do we have enough information? How ICD-10-AM Activity codes measure up

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Abstract
This research explored the usage of activity codes introduced into the *International Statistical Classification of Diseases and Related Health Problems, Tenth revision, Australian Modification* (ICD-10-AM) Third Edition and examined the data quality of activity coding, explicitly, completeness and specificity. Injury separations for years 2001/02 to 2005/06 specifying a 'true injury' were extracted for descriptive analyses. Part A investigated the usage of activity codes and compared the usage of the 236 activity codes available in the *Activity* block (U50-U73) present in the ICD-10-AM Third Edition against the 16 codes present in the second edition. Part B examined the level of completeness of external cause coding and the degree of activity coding specificity in the 2005/06 dataset. It was found that the additional activity codes were used extensively with only 46 codes seldom assigned. Codes present in the second edition were extensively used in the third and fourth editions and the new additional activity codes represent 10% of all activity codes assigned per year. All five datasets demonstrated high levels of completeness, recording completeness levels greater than 97%, where missing activity codes attributed to the majority of missing codes. Fourteen out of the 24 activity categories demonstrated a strong reliance on non-specific codes and *Team ball sports* and *Wheeled non-motor sports* illustrated that activity codes assigned lacked detail in the code. Clinicians and coders need to acknowledge the importance of quality clinical documentation for research and policy-making purposes so that circumstances surrounding injury events can be coded to the highest level of specificity to improve injury prevention and control activities. Missing activity codes and the abundance of non-specific coding hinders the usefulness of the data.

Keywords (MeSH*)*:
Clinical Coding; International Classification of Diseases; ICD-10-AM; Hospital Administration Data; Data Quality; Morbidity.

Introduction
Globally, injuries result in over five million injury-related deaths annually and have been shown to contribute significantly to the health burden on all populations, irrespective of age, sex, income or geographical location (Krug, Sharma & Lozano 2000). Injury is an important public health problem and is increasingly being acknowledged as a major but often preventable cause of morbidity worldwide (Australian Institute of Health and Welfare 2008). In Australia, injury is a leading cause of death, illness and disability, costing the health system approximately $3.4 billion for the year 2004/05 (Australian Institute of Health and Welfare 2008). In 2004/05, injuries accounted for over 1 in 20 hospital admissions and almost 7.5% of all deaths occurring in Australia were injury-related deaths (Australian Institute of Health and Welfare 2008). Explicitly, there were 9,768 fatalities within that financial year or about 27 fatalities every day, where persons aged 1 to 44 years accounted for half of these deaths and consequently, injury prevention and control was proclaimed one of Australia's National Health Priority Areas (Australian Institute of Health and Welfare 2008).

National hospital morbidity data have gained importance in shaping injury prevention policies and practice worldwide. Injury hospitalisation data together with external cause of injury coding have been documented as a valuable and cost-effective source of information for popula-

tion-based non-fatal injury surveillance (Langlois et al. 1995). Therefore, for the data to be useful, it is imperative that there is complete and accurate documentation in the medical record so that hospital morbidity datasets contain high quality information available for injury prevention experts and policy makers.

The *International Statistical Classification of Diseases and Related Health Problems, Tenth revision, Australian Modification* (ICD-10-AM) is used nationally to capture morbidity data. The National Centre for Classification in Health (NCCH) is responsible for the development, introduction and maintenance of ICD-10-AM, which is revised biennially to ensure currency and appropriateness for use within clinical practice in Australia (National Centre for Classification in Health 2004). New editions of ICD-10-AM amend and clarify the previous edition and address new and emerging trends based on advice from expert bodies about themes within the classification that would increase the value of hospital data to relevant stakeholders (National Centre for Classification in Health 2004).

There have been significant changes in the ICD-10-AM framework, particularly Chapter XX *External Causes of Morbidity and Mortality*, largely in the form of additional comprehensive codes to capture additional external causes of injury information. Sports and work-related injuries are now beginning to be described to a higher level of detail consistent with the significance of these activities as a setting for injuries (Harrison 2001). Activity codes are of particular interest as they indicate the different types of activities, such as sports-, leisure- or work-related activities that were undertaken at time of injury (National Centre for Classification in Health 2004). Previously located at Y93 with 16 available codes, activity codes now occupy an *Activity* block (U50-U73) within Chapter XX *External Causes of Morbidity and Mortality* from third edition onwards, with 236 mutually exclusive codes present (Harrison 2001; National Centre for Classification in Health 2000, 2002). A forward map of the second edition activity codes to third edition activity codes has been provided to detail the changes in activity codes (Table 1).

Table 1: Forward one-to-one map of ICD-10-AM Second Edition activity codes to Third Edition

ICD-10-AM SECOND EDITION	CODE DESCRIPTION	ICD-10-AM THIRD EDITION
Y93.00	Football, Rugby	U50.03
Y93.01	Football, Australian	U50.00
Y93.02	Football, Soccer	U50.04
Y93.03	Hockey	U51.29
Y93.04	Squash	U59.2
Y93.05	Basketball	U50.1
Y93.06	Netball	U50.39
Y93.07	Cricket	U51.1
Y93.08	In-line skating and rollerblading	U66.1
Y93.09	Other and unspecified sporting activity	U71
Y93.1	While engaged in leisure	U72
Y93.2	While working for income	U73.09
Y93.3	While engaged in other types of work	U73.1
Y93.4	While resting, sleeping, eating or engaging in other vital activities	U73.2
Y93.8	Other specified activity	U73.8
Y93.9	Unspecified activity	U73.9

In order to provide information that is useful in aiding injury initiatives, data must be collected in a consistent fashion. When used in conjunction with the *Australian Coding Standards* (ACS) guidelines, the ICD-10-AM codes enable morbidity data to be collected in a standardised manner (National Centre for Classification in Health 2004). This ensures consistency and quality of data nationwide so that comparisons of these standardised codes can be made across hospitals, states and countries (McKenzie et al. 2006). Despite the presence of these guidelines, the reliability and integrity of medical record documentation and coded hospitalisation data are potentially questionable since data often lack specificity or are missing. Data quality issues have been the focus of much research (Mitchell & Hayen 2006), with previous studies indicating that the accuracy of injury coding ranges from 82% to 87% (Langley et al. 2006; LeMier, Cummings & West 2001; MacIntyre, Ackland & Chandraraj 1997).

To assess injury data, three particularly important data attributes relating to coding reliability must be addressed: accuracy, specificity and completeness. Accuracy assesses the validity and correctness of the data. Specificity refers to

the data value being defined to the correct level of precision or granularity permitted by documentation in the medical record (AHIMA Data Quality Task Force 1998). Completeness ensures that the entire scope of data items are collected to code all necessary factors; especially, in the case of injury admissions, information regarding injury mechanism, place of occurrence (POO) and activity at time of injury (AHIMA Data Quality Task Force 1998; National Centre for Classification in Health 2004). Previous studies have explored the quality of injury coding, especially the accuracy of injury mechanism codes assigned (Hunt et al. 2007; LeMier, Cummings & West 2001), completeness of external cause code coding (Lawrence et al. 2007; Coben et al. 2006) and the specificity of external cause coding (Langley, Davie & Simpson 2007; McKenzie et al. 2006; Finch & Boufous 2008) within ICD-10-AM or its predecessor the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM).

Nationally, the ACS is used in conjunction with the ICD-10-AM and *Australian Classification of Health Interventions* (ACHI) to provide standards for clinical coding. It mandates that all records assigned an injury code must include one or more of the ICD-10-AM external cause codes sequenced directly after the diagnosis code(s) to which they relate (National Centre for Classification in Health 2004). The National Hospital Morbidity Database (NHMD) collects multiple codes for all hospital separations and for this study we examined injury codes in the Principal Diagnosis (PDx) field only. It is assumed that the injury PDx correlates with the first code in the injury mechanism field, place of occurrence field and activity field. For the purpose of this study, coding completeness is defined as the presence of the whole set of external cause codes (i.e. injury mechanism, place of occurrence and activity at the time of injury [as required for all injury mechanisms where V01-Y34 is assigned]) (National Centre for Classification in Health 2004). All of this information is necessary to describe the injury circumstances.

The ACS also provides guidance to the use of residual codes, stating that the convention used to indicate 'Other specified' or 'Not elsewhere classified' (NEC) in most categories is represented by the final digit '8', where there is exact information documented in the medical record for which there is no unique code available (McKenzie et al. 2006; National Centre for Classification in Health 2004). A final digit of '9' represents 'Unspecified' or 'Not Otherwise Specified' (NOS) and is chiefly used when it is reasonably obvious that no information is available that would authorise a more specific assignment elsewhere (National Centre for Classification in Health 2004; McKenzie et al. 2006). Occasionally, 'Other specified' and 'Unspecified' are combined into the one code to form 'Other and Unspecified' and because of this it is difficult to verify whether the use of the residual category is due to a lack of available codes or lack of clinical documentation (National Centre for Classification in Health 2004; McKenzie et al. 2006). Subsequently in this study, specificity will be described in terms of the use of specific and non-specific codes, encompassing, 'Other specified', 'Unspecified' and 'Other and unspecified'.

The authors are not aware of any other studies that have previously examined the usage of activity codes for injuries and the impact of activity coding on injury data in countries utilising the ICD-10-AM. Due to the strong user demand for the expansion of the activity codes and the fact that external cause codes provide the only available information regarding injury circumstances, it would be useful to determine the level of usage of the additional activity codes.

Aims

The current study sought to examine the effects of the additional activity codes on data quality within the NHMD. The specific aims of the study were to:

- ascertain whether additional activity codes have a profound impact on the usage of activity codes
- examine the effects of activity coding completeness on injury data
- investigate the usage of activity codes being assigned to specific and non-specific categories.

Methods

Data on hospital separations for years 2001/02 to 2005/06 provided by the Australian Institute

of Health and Welfare (AIHW) obtained from the NHMD were examined. The 2001/02 dataset consists of approximately 6.4 million separations and separations have since increased gradually per annum to 7.3 million separations in 2005/06.

Cases extracted were all injury episodes of inpatient care provided by acute hospital facilities in Australia with an ICD-10-AM Principle Diagnosis (PDx) specifying a 'true injury' using Chapter XIX *Injury, poisoning and certain other consequences of external causes* within the code range S00-T75 and T79. 'Complications of surgical and medical care' result from the action(s) of persons employed within the healthcare system and are assigned codes from categories T80 to T88 and are therefore excluded from the study (Berry & Harrison 2007). The ACS defines PDx as the 'diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care…' (National Centre for Classification in Health 2004). For this reason, cases without an injury as a PDx were excluded from analysis because injury was not recorded as being the main reason for the hospitalisation. The complete set of external cause codes were also extracted from the first external cause, POO and activity fields, that is fields E01, PL01 and A01 as these codes are required by ACS guidelines to be assigned when an injury diagnosis is present.

A data extraction program was written using SPSS. All selected injury records were exported from the SPSS source file and imported into Microsoft Access database table and/or Microsoft Excel where descriptive analyses were performed. There were 363,376 records that satisfied the criteria for 2001/02 dataset, 366,890 records for 2002/03 dataset, 372,533 records for 2003/04 dataset, 384,104 records for 2004/05 dataset and 400,019 records for 2005/06 dataset and these records were extracted for analysis.

Part 1. Activity code usage

A. Impact of external cause coding usage

To determine whether the additional activity codes have an impact on external cause coding:

1. Third and fourth edition activity codes present in 2002/03 to 2005/06 datasets were examined separately.
2. Codes present in the second edition and logically mapped to the third and subsequent fourth edition (Table 1) were extracted from 2001/02 to 2005/06 datasets and analysed across the five-year period so that comparisons of usage can be made. 'Other codes' denote codes that are available in the third edition onwards but not in the second edition.

B. ICD-10-AM activity code usage, 2001/02 – 2005/06

To investigate the usage of ICD-10-AM activity codes, data collected on the third edition is made compatible with the second edition by collapsing new categories into broader categories available in the second edition (Berry & Harrison 2007; National Centre for Classification in Health 2004)

Part 2. Data quality

A. Completeness of external cause coding, 2001/02 – 2005/06

External cause coding completeness were examined for the five-year period and the presence of the first external cause code, POO and activity code were evaluated.

B. Specificity of activity codes, 2005/06

To assess specificity of activity codes, the use of specific and non-specific codes (namely, 'Other specified', 'Unspecified' and 'Other and unspecified') were explored for the year 2005/06 only. The U71 code indicates that the activity was sports/leisure related but the specific activity was unknown and U72 indicates the activity was leisure related and not identified as a sport (National Centre for Classification in Health 2004).

C. Usage of non-specific of activity codes, 2005/06

In this stage the usage of non-specific activity codes for 2005/06 dataset was examined.

Results

Part 1. Activity code usage

A. Impact of external cause coding usage

1. Impact of additional activity codes, 2002/03 to 2005/06

There are 16 activity codes available for selection in ICD-10-AM Second Edition and 236 activity codes available for selection in ICD-10-AM Third and Fourth Editions. Within the 2002/03 dataset, 94 separations were coded using ICD-10-AM Second Edition. These codes were logically mapped to the ICD-10-AM Third Edition activity codes so that they could be examined. Across the four-year period, there are 39 codes that are rarely used (frequency of 5 or less) (data not shown). Of the 39 codes that are rarely used, 16 codes are residual categories, that is Other specified and Unspecified categories.

The most frequent category to be repetitively assigned a code less than 5 times annually over the four-year period was *Power sports* (U62) where 5 of the 7 available codes were infrequently used followed by *Combative sports* (U61) where 9 of the 20 codes available within the category were infrequently used. Interestingly, 8 out of 10 codes available within *Multidiscipline sports* (U67) were also seldom used with 3 codes having a frequency of zero over the four-year period.

Of the 236 codes available, 7 codes have never been used since the introduction of the of *Activity* block in ICD-10-AM Third Edition, explicitly *Synchronised swimming* (U52.0), *Curling* (U55.7), *Unspecified aesthetic sport* (U58.9), *Winter biathlon* (U67.0), *Heptathlon* (U67.2), *Modern pentathlon* (U67.3) and *Hot air ballooning* (U68.6). Altogether, the 46 codes

Table 2: Usage of activity codes from ICD-10-AM Second Edition made compatible with later editions, 2001/02 – 2005/06

		2001/02		2002/03		2003/04		2004/05		2005/06	
CODE	DESCRIPTION	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
U50.00	Australian Rules	4911	1.36	3959	1.09	3895	1.05	4335	1.14	4156	1.17
U50.03	Rugby, unspecified	6403	1.78	695	0.19	1424	0.38	1619	0.42	1741	0.49
U50.04	Soccer	3981	1.11	3284	0.90	3285	0.89	3386	0.89	3424	0.96
U50.1	Basketball	1504	0.42	1206	0.33	1204	0.33	1383	0.36	1436	0.40
U50.39	Netball, other and unspecified	1275	0.35	992	0.27	1011	0.27	1022	0.27	1153	0.32
U51.1	Cricket	1102	0.31	987	0.27	883	0.24	943	0.25	1033	0.29
U51.29	Hockey, unspecified	417	0.12	178	0.05	199	0.05	225	0.06	270	0.08
U59.2	Squash	232	0.06	192	0.05	202	0.05	190	0.05	177	0.05
U66.1	In-line skating and rollerblading	1672	0.46	567	0.16	561	0.15	440	0.12	388	0.11
U71	Unspecified sport and exercise activity	9976	2.77	879	0.24	896	0.24	953	0.25	1251	0.35
U72	Leisure activity, not elsewhere classified	20135	5.59	8856	2.44	7949	2.15	6999	1.83	6715	1.89
U73.09	While working for income, unspecified	23616	6.56	7189	1.98	7546	2.04	8019	2.10	8739	2.46
U73.1	While engaged in other types of work	12848	3.57	13554	3.73	13377	3.61	13572	3.55	13719	3.86
U73.2	While resting, sleeping, eating or engaging in other vital activities	16707	4.64	18179	5.01	18593	5.02	19260	5.04	19890	5.60
U73.8	Other specified activity	82560	22.94	84085	23.16	83617	22.59	76635	20.07	66241	18.64
U73.9	Unspecified activity	172090	47.81	175104	48.23	183897	49.67	200873	52.61	225048	63.33
	Other Codes			39193	10.80	40433	10.92	41272	10.81	41767	11.75
	Missing	519	0.14	3957	1.09	1235	0.33	704	0.18	671	0.19
	Total	**359948**	**100.00**	**363056**	**100.00**	**370207**	**100.00**	**381830**	**100.00**	**397819**	**100.00**

Table 3: Patterns of Activity code usage when injury occurred, 2001/02 to 2005/06

		2001/02		2002/03		2003/04		2004/05		2005/06	
CODE	ACTIVITY	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
U50-U71	While engaged in sports	31473	8.74	36536	10.06	38173	10.31	39621	10.38	40234	10.11
U72	While engaged in leisure	20135	5.59	8856	2.44	7949	2.15	6999	1.83	6715	1.69
U73.0	While working for income	23616	6.56	22785	6.28	23366	6.31	24166	6.33	25301	6.36
U73.1	While engaged in other types of work	12848	3.57	13554	3.73	13377	3.61	13572	3.55	13719	3.45
U73.2	While resting, sleeping, eating or engaging in other vital activities	16707	4.64	18179	5.01	18593	5.02	19260	5.04	19890	5.00
U73.8	Other specified activity	82560	22.94	84085	23.16	83617	22.59	76635	20.07	66241	16.65
U73.9	Unspecified activity	172090	47.81	175104	48.23	183897	49.67	200873	52.61	225048	56.57
	Activity code not reported or missing	519	0.14	3957	1.09	1235	0.33	704	0.18	671	0.17
	Total	**359948**	**100.00**	**363056**	**100.00**	**370207**	**100.00**	**381830**	**100.00**	**397819**	**100.00**

represent nearly one-fifth of codes available for coding but are seldom assigned where 26 of these codes were specified and 17 were residual codes.

2. Usage of ICD-10-AM Second Edition activity codes, 2001/02 to 2005/06

By comparing the ICD-10-AM Second Edition activity codes to Third and Fourth editions, we found that the usage of the second edition activity codes in 2001/02 was much higher in a majority of cases compared to the same activities extracted in 2002/03 to 2005/06. The additional activity codes ('Other codes') represent a tenth of all codes assigned (Table 2).

B. ICD-10-AM activity code usage, 2001/02 – 2005/06

Table 3 summarises results for annual patterns in activity code usage across the five-year study period. *While engaged in sports* (U50-U71), *While resting, sleeping, eating or engaging in other vital activities* (U73.2), and *Unspecified activity* (U73.9) showed an overall upward trend, *Other specified activity* (U73.8) and missing activity codes declined. Specified activity codes (U50-U73.2) were assigned in less than 30% of all injury admissions across the five-year period and residual (U73.8 and U73.9) and missing activity codes accounted for the majority of activity codes assigned. The abundance of non-specific codes provides little or no information surrounding the injury circumstances.

Prior to the introduction of ICD-10-AM Third Edition, 2001/02 data depicted results fairly consistent with those of later years except that *While engaged in leisure* (U72) showed higher than average percentages. Figure 1 illustrates that across the study period, missing activity codes remained relatively low apart from 2002/03.

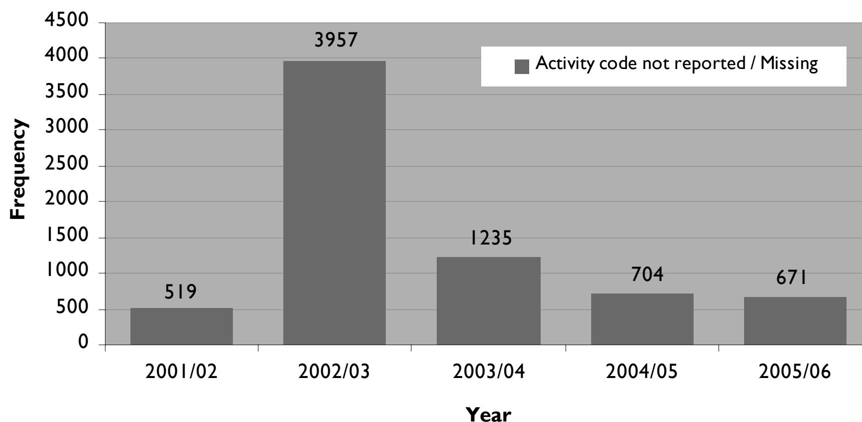

Figure 1: Frequency of missing Activity codes, 2001/02 to 2005/06

Part 2. Data quality

A. Completeness of External Cause coding

The five datasets under study demonstrated very high levels of completeness, with all years recording a completeness level greater than 97% (data not shown). Injury mechanism possessed the lowest frequency of missing codes followed by POO (data not shown) and missing activity codes comprise the majority of missing external cause codes highlighted in Table 3.

Further analysis of the missing activity codes reveals the PDx, injury mechanism and POO categories contribute consistently across the five-year period although the pattern varies. For 2004/05 and 2005/06, the high number of cases of *Injury to the head* (S00-S09) and *Poisoning by drugs, medicaments and biological substances* (T36-T50) as the PDx are responsible for the lack of activity codes (Figure 2). Injury mechanisms *Accidents* (V01-X59) and missing injury mechanism justified a majority of missing activity codes assigned (Figure 3). Missing POO codes and POO of *Home* (Y92.0) were pinpointed as the bulk of missing activity codes, followed by other POO codes for *Unspecified place of occurrence* (Y92.9) and *Street and highway* (Y92.4) (Figure 4).

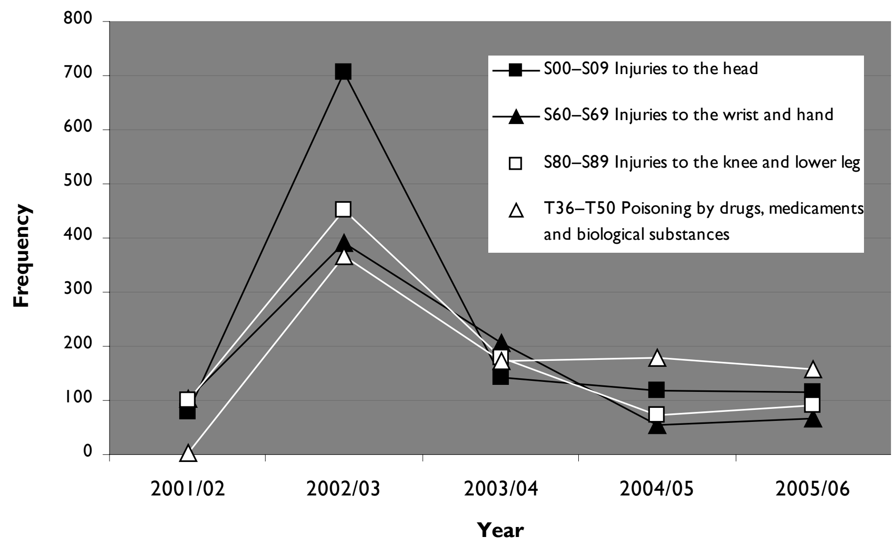

Figure 2: Principal Diagnosis codes reported when Activity code is missing, 2001/02 to 2005/06

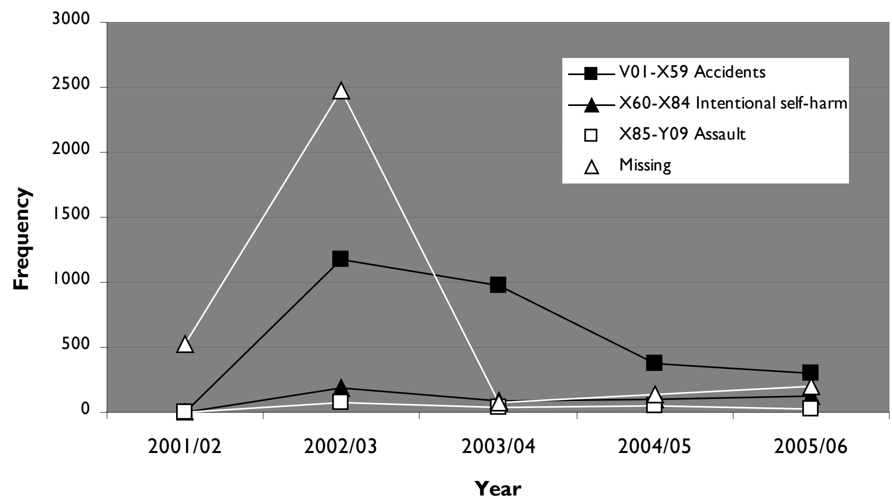

Figure 3: Injury mechanism reported when Activity code is missing, 2001/02 to 2005/06

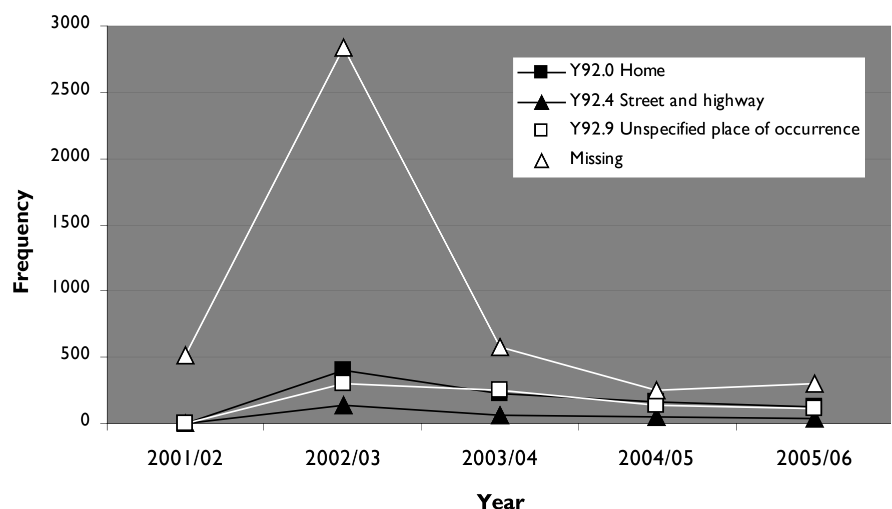

Figure 4: Place of occurrence reported when Activity code is missing, 2001/02 to 2005/06

B. Specificity of data across activity categories, 2005/06

The *Activity* block is organised into two broad categories, namely *While engaged in sports or leisure* (U50-U72) and *While engaged in other activity* (U73). Within these broad categories are 24 specific categories from which there are comprehensive codes to describe the activity at time of injury and non-specific residual codes to capture information that cannot be assigned a more detailed code within the classification.

Ten of the 24 categories showed high levels of specificity, with more than 90% of cases assigned specific activity code, therefore these activities are not reported in Table 4. The remaining 14 Activity code categories demonstrated a strong reliance of non-specific codes (Table 4).

C. Usage of non-specific activity codes, 2005/06

Due to the high frequencies of unspecified codes within sports categories, further examination of activity categories was conducted. *Team ball sports* (U50) and *Wheeled non-motored sports* (U66) were chosen for their high levels of non-specific code coding of 34.4% and 44.6% respectively. These categories were examined in greater detail to ascertain the usage of residual categories. Both categories utilised available specified codes but it was found that the usage of residual categories within particular sports, for example, *Football unspecified* (U50.09), *Rugby unspecified* (U50.03) and *Cycling unspecified* (U66.09) were allocated frequently in contrast to the category's residual codes (Figure 5 and 6). Other specified and unspecified Team ball sports (U50.8 and U50.9) and Other specified and unspecified Wheeled non-motor sports (U66.8 and U66.9) only represents 0.18% and 0.38% of all codes assigned to each category respectively. *Football unspecified* (U50.09) and *Rugby unspecified* (U50.03) represents 16.9% and 9.98% of all *Team ball sport* (U50) injuries. *Cycling unspecified* (U66.09) accounts for 65.55% of all cycling injuries and 38.15% of all *Wheeled non-motored sport* (U66) injuries.

Table 4: Specificity of data across Activity categories, 2005/06

CODE	DESCRIPTIONS	SPECIFIED		OTHER SPECIFIED		UNSPECIFIED		OTHER SPECIFIED & UNSPECIFIED		TOTAL
		n	%	n	%	n	%	n	%	
U50	Team ball sports	11446	65.63	128	0.73	4712	27.02	1153	6.61	17439
U51	Team bat or stick sports	1551	83.66	32	1.73	271	14.62			1854
U52	Team water sports	7	87.50	1	12.50					8
U53	Boating sports	235	66.20	31	8.73	89	25.07			355
U54	Individual water sports	1878	71.82	200	7.65	537	20.54			2615
U55	Ice and snow sports	771	67.34	43	3.76	331	28.91			1145
U57	Acrobatic sports	230	61.50	47	12.57	97	25.94			374
U61	Combative sports	378	67.14	30	5.33	155	27.53			563
U63	Equestrian activities	1661	89.93	48	2.60	138	7.47			1847
U66	Wheeled non-motor sports	2820	55.42	119	2.34	1955	38.42	194	3.81	5088
U67	Multidiscipline sports	23	79.31	1	3.45	5	17.24			29
U69	Other school-related recreational activities	434	56.00	91	11.74	250	32.26			775
U70	Other specified sport and exercise activity	126	12.88	852	87.12					978
U73	Other activity	45394	12.96	71018	20.28	233787	66.76			350199

In addition, further analysis of *Unspecified activity* (U73.9) was conducted to determine the injury mechanisms responsible for the high frequency of this activity code (N = 225,048) (Table 5). *Accidents* (V01-X59) accounted for more than 85% of all injury mechanisms assigned an *Unspecified activity* (U73.9) code. *Falls* (W00-W19), *Transport accidents* (V01-V99), *Exposure to inanimate mechanical forces* (W20-W49) and *Accidental exposure to other and unspecified factors* (X58-X59) constituted the majority of injury mechanisms assigned an *Unspecified activity* (U73.9) code.

Discussion

ICD-10-AM provides a valuable means of standardising cause of injury data on a national and international level. Hospital morbidity datasets are used extensively in Australia (Berry & Harrison 2007), New Zealand (Langley et al. 2006), the United Kingdom (Campbell et al. 2007) and the United States (Lawrence et al. 2007), and contain information valuable to injury control professionals. The availability of quality external cause of injury information, and comprehensive analysis and reporting of this information enables identification of significant injury risks for injury prevention activities. It establishes the magnitude of injury hospitalisations and facilitates the comparison of external cause code information across hospitals, states and countries

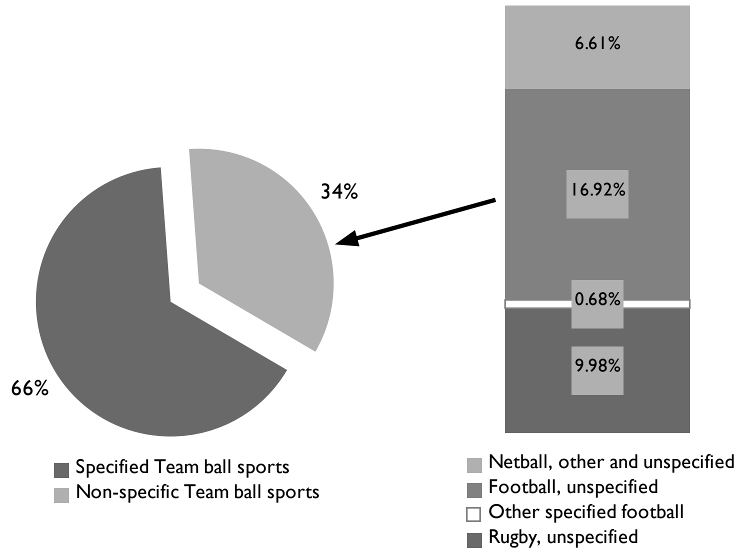

Figure 5: Specificity of Team ball sports, 2005/06

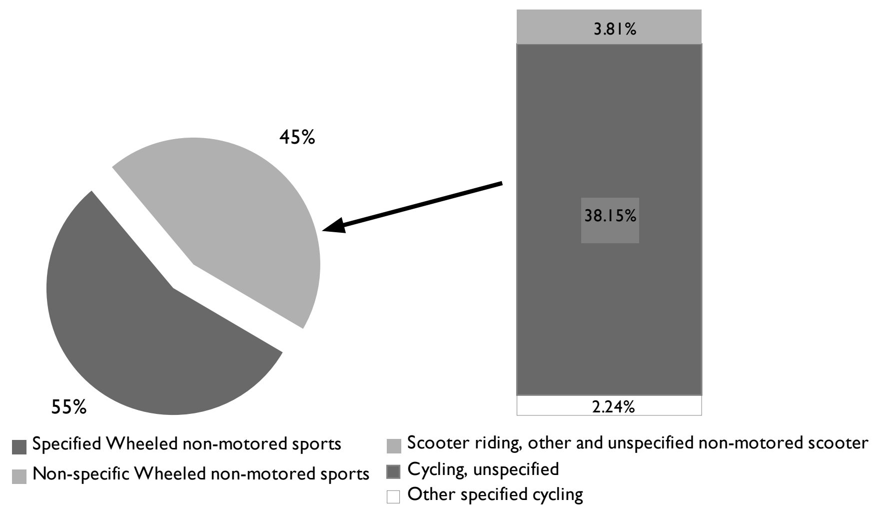

Figure 6: Specificity of Wheeled non-motored sports, 2005/06

(Hayen & Mitchell 2006; McKenzie et al. 2006).

Since its inception in 1998, NCCH has released a new edition of ICD-10-AM every two years. Numerous revisions to the coding framework have been made following the release of the ICD-10-AM First Edition that improves upon each edition. Emerging trends are addressed to capture valuable data pertaining to the circumstances surrounding injury hospitalisations in a more specific manner through the addition of new codes (National Centre for Classification in Health 2004). The third edition expands upon the 16 activity codes available in the second edition to a comprehensive 236 code *Activity* block that provides greater specificity, keeping abreast of the significance of these activities as a setting for injuries (National Centre for Classification in Health 2004).

This study demonstrates that the expanded *Activity* block provides a sufficient amount of codes to illustrate the activity at time of injury. Over 80% of the codes available have been utilised with only 39 codes that are infrequently used and 7 codes never used since the introduction of the *Activity* block in ICD-10-AM Third Edition. *Combative sports* (U61), *Power sports* (U62) and *Multidiscipline sports* (U67) were found to be the least used categories within the Activity block and should be examined to ensure codes within the Activity block are current for clinical practice. The ICD-10-AM Second Edition activity codes proved to be a valuable means of assessing the usage of the additional activity codes. Activity codes available in the second edition were used substantially from 2002/03 to 2005/06 datasets in contrast to the additional activity codes present in third and fourth editions only, comprised of approximately 10% of all activity codes assigned per year.

Furthermore, the research indicates that there is a high level of completeness for external cause coding across the five-year period, similar to that reported in other studies (Coben et al. 2006; MacIntyre,

Table 5: Analysis of injury mechanism responsible for high frequency of Unspecified activity, 2005/06

CODE RANGE	DESCRIPTION		COUNT	%
V01-X59	**Accidents**		**196617**	**87.37**
	V01-V99	Transport accidents	36519	18.57
	W00-W19	Falls	86849	44.17
	W20-W49	Exposure to inanimate mechanical forces	27144	13.81
	W50-W64	Exposure to animate mechanical forces	5839	2.97
	W65-W74	Accidental drowning and submersion	214	0.11
	W75-W84	Other accidental threats to breathing	270	0.14
	W85-W99	Exposure to electric current, radiation and extreme ambient air temperature and pressure	205	0.10
	X00-X09	Exposure to smoke, fire and flames	1226	0.62
	X10-X19	Contact with heat and hot substances	1963	1.00
	X20-X29	Contact with venomous animals and plants	2171	1.10
	X30-X39	Exposure to forces of nature	395	0.20
	X40-X49	Accidental poisoning by and exposure to noxious substances	4704	2.39
	X50-X57	Overexertion, travel and privation	2436	1.24
	X58-59	Accidental exposure to other and unspecified factors	26682	13.57
X60-X84	**Intentional self-harm**		**6904**	**3.07**
X85-Y09	**Assault**		**18736**	**8.33**
Y10-Y34	**Event of undetermined intent**		**2741**	**1.22**
	Missing		50	0.02
	Total		**225048**	**100.00**

Ackland & Chandraraj 1997). It is concerning that missing activity codes are responsible for the bulk of missing codes. The introduction of the *Activity* block in 2002/03 saw injury data containing numerous missing activity codes (*N* = 3,957) but has declined in later years as coders are more familiar with these codes (Figure 1). Results reveal for years 2004/05 to 2005/06 that *Injury to the Head* (S00-S09) and *Poisoning by drugs, medicaments and other substances* (T36-T50) are the PDx responsible for the lack of activity codes. Corresponding injury mechanism *Accidents* (V01-X59) and missing injury mechanism justify the majority of missing activity codes. Missing POO and *Home* (Y92.0) were the POO where the majority of these cases happened.

The high levels of missing activity codes prove to be a major obstacle to developing injury prevention policies when the exact circumstances surrounding injury events are not present. It is necessary that the specific type of activity be documented so that effective prevention strategies can be targeted for specific sports. Langley, Davie and Simpson (2007) suggest that the relatively high use of *Unspecified activity* could be due to the fact that some hospitals deem this aspect not as important as injury mechanism. Our results support this notion, indicating injury mechanism codes had the lowest amount of missing codes compared to POO and activity at time of injury.

The broad *Activity* categories illustrate reasonable usage of activity codes (Table 3). Unfortunately, the results demonstrate that activity codes assigned lacked precision. The relatively high use of non-specific sports activity codes within the specified categories such as *Football unspecified* (U50.09), *Rugby unspecified* (U50.03) and *Cycling unspecified* (U66.09) demonstrates activity codes are not being assigned to the highest level of specificity available in the classification. Similar results were found in studies focusing on injury mechanism (Lawrence et al. 2007; McKenzie et al. 2006).

Moreover, our analysis also found that over the five-year period, specified activity codes were overshadowed by the abundance of non-specific activity coding. Although there was a decline in *Other specified* and missing activity codes, this was made up by the ever increasing number of *Unspecified activity* (U73.9) codes despite the availability of over 230 activity codes. The results indicate that 47%-56% of activity codes were assigned an *Unspecified activity* code over the five-year period, a result much higher than that reported by Finch and Boufous (2008) who reported an Unspecified activity code of less than 30% for the state of New South Wales. Our study shows *Falls* (W00-W19), *Transport accidents* (V01-V99), *Exposure to inanimate mechanical forces* (W20-W49) and *Accidental exposure to other and unspecified factors* (X58-X59) were the injury mechanisms that accounted for the majority of *Unspecified activity* (U73.9) codes.

The findings here support previous studies in the United States where Lawrence et al. (2007) established that the high levels of external cause coding completeness was achieved by excessive use of non-specific codes. The high level of non-specific coding reflects a need to acquire additional information regarding the circumstances surrounding the injury admission. Also, coders surveyed in the study by McKenzie and colleagues (2008) insinuate missing documentation and missing external cause information impact significantly on the external cause codes allocated.

Causes for the high level of non-specific ICD-10-AM activity codes must be addressed so that solutions can be developed and implemented to decrease these data inadequacies. The large quantity of non-specific activity codes offers a significant amount of non-meaningful information regarding the specific cause of injuries. This provides limited benefit for injury prevention professionals in determining the cause of the injury, where the results imply that the level of specificity of injury coding can be improved. The high percentage of 'Other specified' codes, especially within *Other specified sport and exercise activity* (U70.8, 87.1%) indicates an area of potential classification development. The high proportion of 'Unspecified' code represents insufficient documentation to permit more specific code assignment (McKenzie et al. 2006) as this study highlights the insufficient clinical documentation within the medical records by clinicians. Unfortunately, clinicians may be unaware of the level of documentation necessary to detail the complete circumstances surrounding the injury event in the medical records because their

priorities lie in the immediate clinical care of the patient especially if the patient was admitted for an injury.

Conclusion

Injuries are preventable occurrences and in order for injury prevention and control organisations to identify and implement mechanisms to effectively reduce injury events, access to quality information is necessary. This determines the degree of injury hospitalisations and enables the identification of priority areas for injury prevention initiatives (Hayen & Mitchell 2006).

In 2002, the NCCH released an update on the revision of activity codes. The expanded classification provides a variety of mutually exclusive categories for a large number of specific types of sport and related activities applicable to the Australian environment. The results illustrate that the new *Activity* categories have been used extensively and that the resultant data were adequate to warrant detailed analysis of activity code usage and the quality of external cause code coding, in particular, specificity and completeness.

The comprehensive nature of ICD-10-AM allows non-specific information to be captured in residual categories when documentation in the medical record is insufficient to permit a more detailed code assignment (Bramley 2005). It is essential for injury prevention activities that there is minimal use of these non-specific codes to develop tailored prevention policies and strategies as the results imply that improvements in the quality of injury coding are required.

Clinicians and coders need to acknowledge the importance of quality clinical documentation for research purposes so that circumstances surrounding injury events can be coded to the highest level of detail possible to improve injury prevention and control initiatives and monitor injury incidence among Australians nationally. The results highlighted in this study indicate that the completeness of external cause coding is high but found that missing activity codes and non-specific coding hinders the usefulness of the data to make specific recommendations for injury initiatives.

Recommendations and further research

Some recommendations and further research activities that would aid in improving injury prevention activities include but are not limited to the following:

- Medical records/admissions should be validated by an external coder to determine whether more appropriate codes can be assigned or new codes created to accommodate activities assigned to *Other specified sport and exercise* activity and *Unspecified activity*.
- Improvement of communication among stakeholders regarding external cause codes by addressing the need and uses of high quality injury data for injury prevention purposes would be beneficial.
- Further research and education to examine state-specific external cause coding accuracy, specificity and completeness to explore issues and address the overuse of non-specific codes to enable more specific code assignment are indicated. Efforts to make coding of external cause of injury required data elements in medical record forms, electronic patient records and associated software mandatory for injury separations (McKenzie et al. 2006) should be considered.

Acknowledgements

Data for this project were provided by the AIHW as part of the work program under the AIHW and NCCH collaboration agreement.

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