Organisational factors affecting the quality of hospital clinical coding

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Abstract

The influence of organisational factors on the quality of hospital coding using the International Statistical Classification of Diseases and Health Related Problems, 10th Revision, Australian Modification (ICD-10-AM) was investigated using a mixed quantitative-qualitative approach. The organisational variables studied were: hospital specialty; geographical locality; structural characteristics of the coding unit; education, training and resource supports for Clinical Coders; and quality control mechanisms. Baseline data on the hospitals' coding quality, measured by the Performance Indicators for Coding Quality tool, were used as an independent index measure. No differences were found in error rates between rural and metropolitan hospitals, or general and specialist hospitals. Clinical Coder allocation to 'general' rather than 'specialist' unit coding resulted in fewer errors. Coding Managers reported that coding quality can be improved by: Coders engaging in a variety of role behaviours; improved Coder career opportunities; higher staffing levels; reduced throughput; fewer time constraints on coding outputs and associated work; and increased Coder interactions with medical staff.

Key Words (MeSH):

Information Management; Medical Records Department, Hospital; International Classification of Diseases; Clinical Coding; Hospital Records; Health Information Managers

Introduction

Clinical coding errors impede the efficient operation and financial management of hospitals and potentially lead to inaccurate state and national statistics on hospital morbidity. The foci of this research were selected organisational factors that might adversely affect the quality of Clinical Coders' coding work and its outcomes.

The relationship between error rates (clinical and other errors) in hospitals and hospital characteristics is well-established; for example, Berthelsen (2000) found that teaching hospitals and large hospitals had higher error rates than smaller hospitals. In a review of organisational factors and quality, Flood (1994) reported that numerous studies have shown strong evidence that the greater the volume of similar cases treated (specialisation), the better the outcomes: efficiencies can be introduced and staff can become more practiced in managing certain case-types.

The literature on clinical coding error rates and organisational factors is comparatively sparse. Green and Benjamin (in Murphy-Muth 1987), in their 1984 study of Illinois, United States of America (USA) hospitals, identified patterns and combinations of factors that affect coding quality; they found improved coding agreement in the majority of hospitals that employed credentialled Coders, utilised feedback as a data quality method and offered coding staff continuing education opportunities; however, statistical tests to identify if these factors affected data quality were inconclusive.

Wendler and Slovensky (1987), also in the USA, found that increased staff allocations resulted in a decrease in coding error rates from an average of 7.1% to 2.7%. Oncology coding error rates were lower in rural areas than in metropolitan areas, and in newly merged organisations (Lorence, Spink & Jameson 2002). In a more recent American study, Lorence and Ibrahim

(2003) measured the consistency of coded data through Health Information Managers' (HIM) reports of overall coding error levels in patients' records. This study suffered from the limitation of using respondents' perceptions of error rates; however, the findings included significant variation in the 'accuracy of coding practice and associated data validity across key demographic and organisational variables' (Lorence & Ibrahim 2003: 29).

A New South Wales study compared the quality of procedure coding by operating theatre staff with that of Clinical Coders from the Health Information Service; this revealed a theatre staff error rate of 86% compared with a Clinical Coder error rate of 18%, and indicated a direct correlation between coding error rates and different organisational environments (Callen et al. 1998). Factors reported to contribute to the high level of theatre coding error rates were: the lack of formal training in coding; old or inadequate tools available; lack of networking with other coders and with Australia's National Centre for Classification in Health (NCCH)[1]; and lack of theatre coding audits (Callen et al. 1998). The authors emphasised the importance of coder education, identified as an organisational factor; they also suggested that addressing factors that vary between these environments may lead to improvement in coding quality.

In the Australian Coder Workforce Study (ACWS), a nation-wide survey of hospital Clinical Coders, a large proportion of the respondents agreed on several organisational factors affecting the accuracy, completeness, and timeliness of coding, including: a lack of continuing coder education; distractions caused by the work environment; and having to perform multiple tasks (McKenzie & Walker 2003). In contrast to Green and Benjamin's Illinois study, the ACWS methodology used a larger sample size and achieved a high response rate, thereby enhancing the validity of the findings; however, a limitation was that respondents' perceptions were used without objective, substantiating measures.

Organisational factors that the Australian NCCH believes may impact upon coding quality include: communication with clinicians; ongoing coder education; review of the coding and documentation process by peers or a superior; coder environment and workload; availability of reference materials to guide code allocation; ongoing coder education; and resource support from management (Williamson et al. 1999). These appear to be founded on results from Australian and American studies which recognised the importance of ongoing education for quality coding, such as induction programs for new coders (Groom 2000; Hassan, Meara & Bhowmick 1995; Osborn 1999; Stevens, Unwin & Codde 1998, Thompson & Koch 1999), and to reflect findings from other studies (Demlo & Campbell 1981; Green & Benjamin 1986; Mehanni et al. 1995). Several authors have further advocated the use of credentialled staff, in-service education, initial orientation and training, and appropriate communication and interaction between coders and healthcare professionals (Fletcher 2002; Mears et al. 2002; Waterstraat 1990).

The American Health Information Management Association's (AHIMA) Coding Practice Team suggests that 'current coding manuals must be readily accessible …, dialogue between coding professionals and clinicians is encouraged… and … coding should be performed by credentialled HIM professionals' (AHIMA 2001; Prophet 2001). Fletcher (2002) recommended the use of appropriate resources including coding books, guidelines, and electronic encoder software.

Current practice suggests that a number of these resources and practices are in use in Australian Health Information Services (Groom 2000). We determined that it was timely to investigate the contribution of organisational structures and processes to the production of high quality coded health data, and to identify the most successful of these.

1 The National Centre for Classification in Health (NCCH) is an expert centre in health classification theory and coding systems. It has close links with the Australian Department of Human Services, the Australian Bureau of Statistics and the Australian Institute of Health and Welfare. It is charged with the development and maintenance of the Australian version of the World Health Organization's International Classification of Diseases.

Areas of study

The research question

Our research addressed the following question: To what extent is a selected group of organisational factors affecting hospital coding quality, as measured by error indicators, using the Performance Indicators in Coding Quality (PICQ) tool (NCCH, 2003).[2]

Hypothesis, aim and objectives

Our working hypothesis was that selected organisational factors influence the quality of coding in participating hospitals in the state of Victoria, Australia. The aim of our research was to investigate the extent to which a group of organisational factors affects the quality of ICD-10-AM[3] coding of admitted episodes in selected hospitals in Victoria, when the coding quality is measured by the rate of error indicators detected using PICQ.

The objectives of the study were to determine whether the following factors influence the quality of clinical coding:

- hospital specialty
- geographical locality of the hospital
- structural characteristics of the Coding Unit
- support provided to the Clinical Coders by way of education, training and resources
- coding quality control mechanisms.

Method

Definitions

For the purposes of the study, the term 'coding' was used to include the following activities: abstracting terms from the health information in the medical records; allocating ICD-10-AM codes; sequencing of codes to identify the principal diagnosis; indexing of codes or entering coded data into a morbidity database; and updating the coding books. The term 'Clinical Coder' was considered to be inclusive of the professional Health Information Managers whose university-degree qualification enables them to undertake complex clinical coding, and others who work as Clinical Coders and whose coding education is sub-tertiary or non-university based.

The study participants

A criterion sampling approach was used to include hospitals belonging to an existing benchmarking group of metropolitan hospitals, which establish and compare standards for health information-related processes, plus additional specialist and rural hospitals (McBurney 1994). In order to investigate whether 'hospital specialty' was a factor influencing coding quality, all Victorian public specialist hospitals were included in the sample. Four large, public rural hospitals were also recruited to enable exploration of the study objective pertaining to 'geographic locality' as a potential factor influencing coding quality. The criteria for selection of the rural hospitals into the sample were the highest Weighted Inlier Equivalent Separation (WIES) targets for the most recent (2003-2004) financial year, identified for the different regions within the state (where WIES is an independent measure of the number of discharges and the complexity of a hospital's case mix within the state's casemix-based hospital funding system).

Of the hospitals approached for recruitment into the study, 14 of the 15 agreed to participate, yielding a participation rate of 93%. The sample comprised six large, public general hospitals with substantial resource consumption, four specialist hospitals in Melbourne, and four rural hospitals. We assumed that the selected hospitals would have multiple coders and a broader casemix than smaller hospitals with fewer discharges.

Study design and procedure

The study data, which collectively described the 14 hospitals' coding performance, were obtained via a self-administered survey instrument. A combined quantitative-qualitative approach to the investigation of organisational factors and coding quality was utilised. The 'mixed-methods' approach, also known as triangulation, was used to produce richer and more insightful analyses of the study data (Denzin 1978; Flick 1992).

Performance Indicators in Coding Quality (PICQ) is a set of indicators that can identify incorrectly coded records in datasets. PICQ was

2 The PICQ tool was developed by the NCCH for use in hospital clinical coding.

3 ICD-10-AM is the 10th edition of the Australian modification of the World Health Organization's International Classification of Diseases. This is used in Australia, New Zealand, and a number of other countries around the globe.

developed by the NCCH and is based on the Australian Coding Standards (ACS) and the *International Statistical Classification of Diseases, Tenth Revision, Australian Modification* (ICD-10-AM) coding conventions. The indicators provide a standard 'language' for describing variation in coded data, enabling outcomes to be compared between facilities and over time (Waller & Watts 2002).

Approval to conduct the research was given by the La Trobe University Faculty of Health Sciences Human Research Ethics Committee, and consent was obtained from each participating hospital for access to their coding performance data held by the Victorian state Department of Human Services (DHS). The research comprised two phases, each incorporating different data collection techniques.

Phase 1: survey.

In Phase 1, study data were collected in a survey of the Coding Unit Managers of the participating hospitals' Health Information Services (HIS). The Coding Managers' contact details were identified through a Professional Practice Program database in the Health Information Management Program at La Trobe University, and through professional networks. We contacted the Coding Managers initially via email to explain the purpose of the study and obtain preliminary consent.

The survey documents included an instruction sheet, consent form, terms defined for the purpose of the study, a three-part survey instrument designed to assist in improving the researchers' understanding of the structural functioning of each sample hospital's HIS, and a reply-paid envelope; these were mailed to the participating Coding Managers, for return within a three-week timeframe. The questionnaire contained both open and closed questions which queried the structure, specifically the physical arrangement, of the coding unit. The literature supports clinical coders having regular interaction with clinical (medical) staff; therefore, the questions were designed also to enable an analysis of current practice in coder-clinician communication.

Phase 2: interview.

In Phase 2, data were collected in a structured, follow-up telephone interview with the Coding Manager of each hospital in the sample; the responses were recorded and then transcribed for analysis. The telephone interviews, previously demonstrated to be an effective, efficient and economically feasible approach (Fenig et al.1993), permitted direct communication with sample members in remote areas, allowed the researchers access to Coding Managers with a demanding workload, and created a sense of partial anonymity. Additional information about hospital organisation and processes was elicited, as well as the respondents' perspectives on organisational issues impacting upon coding quality and the relative importance of particular organisational structures or events.

Data analysis

PICQ: an index measure of coding quality

Following phases 1 and 2, the PICQ data were obtained from the Victorian DHS for the most recent financial year. The rate of 'fatal' indicators detected through PICQ was used as the measure of coding quality. PICQ categorises coded data according to degree of problem (fatal, warning, and relative) and type of problem (edit, completeness, redundancy, specificity, and sequencing). The data provided in this research contained all numerators and denominators by degree 'A' (fatal), by all types of problem, for all hospitals in the sample. The PICQ data, therefore, were used as an independent index measure of coding quality.

The PICQ data from DHS covered only 10 of the 12 months requested and this was considered to be sufficiently representative to conduct the research. The data were collected on a hospital basis and specific, individual cases were not identified.

The quantitative data

The *t* test formula was used to test the two principal organisational variables, specifically hospital specialty and geographical locality; the other main statistical test employed was the Fisher exact test, used in preference to chi-square analysis because *N* was less than 20 (Siegel 1956:115, 110). For most of the analyses using the Fisher test, the set of hospitals was divided into two categories: the mean PICQ score for all hospitals was calculated and if the individual hospital's score was at or above the mean, it

was categorised as 'PICQ ≥ Average'; a hospital's score below the mean was classified as 'PICQ < Average'. Splitting the hospitals thus enabled the creation of a series of 'two by two' contingency tables, to which the Fisher test could be applied. (While a large number of contingency tables was created, no adjustments to alpha levels were made as this was an exploratory study in a little-researched area). Additionally, Pearson's measure of correlation was used to determine the degree of significance of the observed association between the number of staff employed (expressed in terms of equivalent full-time [EFT] staff members) and error rates (per Lumsden 1971; Nunnally 1970).

The qualitative data

Patterns of relationships between the different hospitals were identified through thematic analysis. The qualitative data were coded, the categories were identified and relationships observed, and themes were identified and explored. An independent assessor participated in the allocation, in order to enhance the reliability of categorisation.

The PICQ data

Pivot tables from MS Excel were used to assist the extraction of PICQ data. These data were linked to responses obtained from the surveys and interviews to identify the existence of any correlations between quality variables and organisational variables. PICQ scores range from 00-100%, with lower scores indicating higher quality. Most scores for the participating hospitals ranged from 0-1%.

Results

Characteristics of the Coding Managers

All respondent Coding Managers were qualified Health Information Managers responsible for the coding and casemix functions in their hospitals. Some held the position of Manager, Health Information Services; Table 1 shows their occupational titles and professional experience. The respondents' mean industry experience was 15.46 years, with a standard deviation of 11.19 years, and a sample range of 4.5 – 40.0 years. The mean tenure of the participants' current position was 3.99 years, with a standard deviation of 2.93 years, and a range of 4 months to 10 years.

Table 1: Coding Managers' titles, industry experience, and tenure

HOSPITAL CODE	INDUSTRY EXPERIENCE YRS	CURRENT OCCUPATION TITLE
1	4.5	Health Information Manager
2	9.0	Health Information Manager
3	5.5	Coding Co-ordinator
4	6.0	Data Manager - Coding
5	14.0	Manager, Health Information Services
6	15.0	Manager, Health Information Services
7	25.0	Coding & Casemix Education Manager
8	13.0	Coding Manager
9	32.0	Manager Coding & Casemix Service (HIS)*
10	5.5	Deputy Casemix Co-ordinator
11	5.0	Health Information Manager
12	40.0	Acting Manager, Health Information Services
13	25.0	Health Information Manager
14	17.0	Manager, Health Information Services
Mean	15.6	
SD	11.19	

* HIS: Health Information Service

Table 2 shows the number of EFT Clinical Coders employed in each participating hospital and the PICQ scores. The number of EFTs reported from the surveys was adjusted in line with the number of annual separations[4] (per 100,000) per hospital (data obtained from the Victorian DHS). It can be observed that the number of EFT Clinical Coders varies between hospitals, with a range of 0.79 to 2.79 EFT coders per 10,000 separations.

The hospitals' PICQ scores ranged from .036 – .958%, where lower scores indicate better quality. The PICQ mean was .320% and the standard deviation was .217%.

4 Hospital discharges

Table 2: Hospitals' PICQ scores, Clinical Coder complement, and ratio of Coder to (adjusted) separations

HOSPITAL IDENTIFICATION	EFT* CLINICAL CODERS	EFT* CLINICAL CODERS ADJUSTED PER 10,000 SEPARATIONS	PICQ %
1	4.00	2.30	.205
2	1.00	0.79	.320
3	6.50	2.30	.958
4	7.10	2.21	.408
5	5.20	1.68	.492
6	6.49	1.76	.299
7	10.11	1.77	.192
8	11.96	1.43	.211
9	12.43	2.15	.036
10	9.00	1.78	.258
11	2.50	1.03	.242
12	7.00	2.79	.303
13	4.90	2.37	.400
14	4.50	1.84	.150
Mean	–	–	.320

* EFT: equivalent full-time

Note. $r = .201$, $p > .05$, two-tailed test, $df = 12$ (Refer Nunnally 1970)

The results of the *t* test, when applied to the error rate figures between the groups of hospitals examined, indicated that there were no statistically significant differences in error rates for: (a) specialist versus general hospitals ($t[12] = 2.179$, $p < .05$, two-tailed test); and (b) metropolitan versus rural hospitals ($t[12] = 2.179$, $p < .05$, two-tailed test).

Organisational variable 3: structural characteristics of the Coding Unit

Findings from the quantitative data

A low positive correlation was found ($r=.201$) between coding quality and the number of EFT Coders employed; see Table 2. This result indicates that there is no statistically significant relationship between a higher density of coding staff and lower (i.e. 'better') PICQ scores.

There was no statistically significant relationship identified between a hospital having a designated Coding Manager and its PICQ score. Similarly, there was no statistically significant relationship between the physical location of Coders and the PICQ quality score, nor between regular (minimum, monthly) Coder-clinician interaction and (improved) PICQ quality score. Coding Managers reported that the main forms of Coder interaction with clinical staff to discuss coding issues were: unit meetings, clinical coding meetings, 'query' forms, clinical partnership, and other meetings as required. Coders in hospitals with PICQ scores above average (*i.e.* scores indicating poorer quality) demonstrated only irregular, 'as-needs' interaction with clinicians.

There was no statistically significant relationship identified between a hospital providing feedback to clinical staff about the adequacy of clinical documentation, and PICQ quality. Coders (86%) provided feedback to clinical staff about the adequacy of clinical documentation, primarily via the following means: clinical unit meetings on documentation deficiencies and effects on DRG grouping; one-to-one basis as required; documentation requirements outlined to new doctors at orientation; casemix/coding education; discussion with unit manager; verbal comments; 'Casemix and Documentation' information sessions with medical staff; and 'deficiency' letters.

In contrast to the above findings, a reliable association was found between general rather than specialised coding and lower (better) PICQ scores; see Table 3. There was no statistically significant association between a hospital's PICQ score and its coding staff having other major responsibilities ($p > .05$).

Table 3: Contingency table showing association between obtained responses to the question 'Are the majority of your Coders allocated to specialist areas or to general coding across all units?' with PICQ scores of below-average compared with those above average

	GENERAL CODING	SPECIALIST CODING	TOTAL
PICQ < Average	9 (100%)	0 (0%)	9
PICQ ≥ Average	2 (40%)	3 (60%)	5
	11	3	14

Findings from the qualitative data

In contrast to the findings from the quantitative data, all participants indicated during the interview that the way in which the Coding Unit is organised and structured would have an impact on coding quality. Yet few common themes emerged to differentiate between hospitals with PICQ scores below average and those with above average scores. Recurring themes emerged concerning structural features reported as facilitating better coding quality:

- lack of proper structure creates barriers to quality of coding
- more accurate coding is facilitated by Coders' easy access to clinicians
- the physical setting must be properly structured to avoid work disruption
- coding Managers employed at large hospitals need to act as liaisons
- coders should be located close to their Coding Manager.

There was a mixture of opinion regarding Clinical Coders' workstation organisation. Many respondents believed that open-plan offices can be noisy and engender disruptions, but that physical isolation can produce a perception of a lower level of support thereby reducing coding quality, whereas others believed that co-location of Coders provides an opportunity for discussion of ideas and issues. Nevertheless, there was a unanimous view in favour of Coders being located within the HIS for easier access to medical records and that the structure of the Coding Unit must 'support' Coders through provision of a satisfactory work environment. Generally, though, the patterns of hospital error rates were not consistent with these reported views.

Organisational variable 4: education, training and support level

Findings from the quantitative data

All Coding Managers indicated that 100% of their Coders held recognised qualifications in clinical coding. 'Two by two' contingency tables (33 in all) were created to investigate various elements of continuing education, training and resource support and their influence, if any, on coding quality; none of these supports was found to be reliably associated with improved coding quality. However, the data did identify two elements with a tendency (as opposed to a statistical significance) for an association with superior quality: (a) hospitals providing their Coders with access to the ICD-10-AM browser to help them code; and (b) hospitals using HIS Coding staff meetings as educational opportunities.

No statistically significant association was found between improved PICQ quality scores and the existence of in-house programs to support new Coders (i.e. induction by units, review of the new Coder's work with coding peers, in-depth training by the Coding Manager, all coding checked and feedback provided, extensive training period covering all specialties, induction and/or orientation and/or graduate program, gradual increase in coding complexity level) or with financial support for Coders to attend courses, or the provision of 'other incidental costs' associated with professional support.

Findings from the qualitative data

Despite the non-significant results from the quantitative data, all 14 participants stated emphatically in the interviews that they considered education, training and resource support levels to have an effect on coding quality. The majority of respondents believed that continuous, up-to-date education was important and reinforced their views by expressing opinions such as the following:

- 'It is imperative to have a good training structure'.
- 'There is a reduction in quality when there is no education'.
- 'An increase in education produces better Coders'.
- 'Inadequate external training programs result in inconsistency in coding'.
- 'Education should be in place when there are revisions to ICD-10-AM coding books'.
- 'Quality improves when there are coding education programs involving clinicians.'

Furthermore, the Coding Managers suggested that while they expected new graduates to have a basic understanding of coding, there must be an organisational structure to support them. They also consistently asserted that greater emphasis should be placed on the adequacy of financial resources, by having adequate funding available to enable Coders to attend workshops.

Organisational variable 5: quality control activities

Findings from the quantitative data

All respondents indicated that their Coders received individual feedback from internal and external audits.

No statistically significant relationship was found between (improved) PICQ quality scores and having somebody employed whose job description included analysis of coded data quality. Respondents indicated that, variously, this job role belonged to the Coding Co-ordinator, all HIMs, the Clinical Analysis and Development Unit (which typically includes qualified HIMs), the Coding and Casemix Education Manager (or their Deputy), the Casemix/Information Analyst (typically a HIM), or the HIS Manager.

The majority of hospital Coding Managers indicated that their Coders undertook regular quality assurance activities, typically via: internal coding audits (a nominated percentage of monthly discharges); clinical unit meetings; education sessions at coding meetings; the use of PICQ; the use of the Australian Coding Benchmark Audit tool (ACBA) by an external auditor; and/or review of coded data via Diagnostic Related Groups 'DRG statements' that list all codes for every inpatient episode. However, there was no statistically significant association found between (improved) PICQ quality score and reported conduct of regular coding quality assurance activities.

There were similarly no statistical associations between an improved PICQ quality score and several common quality activities, including: the conduct of regular internal coding audits; the provision of individual feedback to Coders following internal and external audits; the regular receipt of PICQ extracts from DHS; having PICQ software available in the coding unit; the routine use of PICQ in addition to the regular DHS-generated coding quality reports; the reporting of PICQ and audit results to hospital units beyond the HIS; and the requirement for Coders to meet throughput targets. The hospitals whose Coding Managers indicated that their Coders were required to meet throughput targets demonstrated no consensus on the volume of throughput most commonly demanded: Coders were variously required to code between 15 and 42 records per day. Many Coding Managers stated that no specified coding quotas were set; rather, it was presented that all records must be coded by a specific day or time in the month thereby giving Coders a degree of flexibility in the management of their work.

Findings from the qualitative data

The majority of respondents believed that the use of specific coding quality measures, such as audits and PICQ, contributed to enhanced coding quality. They supported the use of quality tools to assist in highlighting and identifying coding errors that may otherwise be overlooked. Some believed that even though quality tools are important, it is the feedback provided during the discussion process that is more important and beneficial to their Coders. Additional themes that emerged regarding quality control activities included:

- Issues identified by quality tools should be reinforced during coding education.
- Tools are a standardised approach to measuring quality.
- Tools provide personal analysis and feedback on an individual Coder's performance.

The most important organisational factors affecting coding quality

All participants ranked education, training and the level of support as having the most important effect on coding quality. They ranked quality control activities as second; this was closely followed by the structural characteristics of the coding unit. Common themes that emerged in the qualitative data related to barriers Coding Managers believe may hinder coding quality, for example:

- inadequate resources
- illegible and incomplete clinical documentation
- tight deadlines
- lack of communication and consistency
- excessive volumes of coding throughput.

When the Coding Managers were asked to suggest ways of improving coding quality, several recurring themes emerged and the majority of the respondents recommended a greater emphasis on ongoing (more regular and consistent) professional development and education. Several indicated that improvement in clinical docu-

mentation would improve coding quality. Others suggested that an increase in human resources, specifically HIMs, would improve quality because there are 'not enough Coders available to code the amount of medical records'.

Other emergent themes included:

- the need to increase external interaction with other hospitals with a similar casemix
- increased clinical staff awareness of the importance of coding and its funding implications
- better access to, and enhancement of interactions with, clinicians for their input
- an increase in the use of quality measurement tools such as PICQ
- electronic tools should be used to assist coding
- a preference expressed for one central place (e.g. repository) from which to retrieve coding resources and updates
- completion of coding requires a timeframe less demanding than in current coding work environments
- improved coding education at tertiary (University) level
- improved physical environment for Coders.

Finally, while the Coding Managers demonstrated no overall consensus on the additional variables they considered important to understanding organisational factors affecting coding quality, their suggestions included:

- staff satisfaction (i.e. Coders who are more satisfied produce better quality coding)
- improved career opportunities for Coders
- greater availability of staff (i.e. Coders)
- lower volume of coding throughput
- more emphasis on casemix
- coders having a diversity or a variety of roles
- better education of Coders regarding the hospital funding system
- increase in clinicians' understanding of the importance of accurate clinical documentation.

Discussion

Hospital specialisation

No significant association was found between hospital specialisation and coding error rates, as assessed by PICQ. However, PICQ error rates did show that specialist hospitals had higher coding error rates (lower quality) than did general hospitals.

Geographical locality

There was no significant association found between the geographical locality (rural versus metropolitan) of a hospital and clinical coding error rates. This contrasts with Lorence and Ibrahim's (2003) finding of higher hospital coding accuracy rates in rural areas than in the larger metropolitan areas of Illinois, USA; the absence of a significant rural 'effect' in the current study could be explained by the fact that Lorence and Ibrahim used the HIMs' *perceptions* of error rates and these were not validated by objective measures. In contrast, the current study used an independent index of coding quality tool.

Structural characteristics

A main finding was a statistically significant association between hospital structural characteristics and error rates, specifically that Clinical Coders allocated to specialist coding areas produced higher PICQ scores (lower quality coding) than Coders assigned to undertake coding across all clinical units or specialties.

The following organisational variables showed no statistically significant association but did show an observed *tendency* for an association with better coding quality: having someone employed in an organisation whose job title is 'Coding Manager' or equivalent; having Coders physically located in a coding-dedicated HIS office; Coder access to the ICD-10-AM browser; the provision of HIS Coding staff meetings as an educational opportunity; running PICQ regularly and in addition to using the DHS generated reports; and reporting to beyond the HIS of both the DHS PICQ and audit results.

The results from the current study did not support the advantage of hospital specialisation; however, it is possible that an increase in the sample size might produce results consistent with Flood's (1994) finding relating to hospital-wide error rates, in that increased volumes of similar cases (specialisation) may lead to decreased coding error rates. We also might surmise that specialisation could produce lower quality outcomes due to the inherently complex nature of specialty coding.

When comparing previously published coding error rates ranging from 40% to 70% in some studies (cited by MacIntyre, Ackland & Chandraraj 1997) to those obtained from PICQ for the participating hospitals in this study, the current study rates are much lower (between 0 – 1%). The finding of such low coding errors is very encouraging, but because of the lack of a standard international approach to the measurement of the quality of coded health information, there is difficulty in making comparisons with rates reported in previous studies. Increased understanding of the use of casemix-based classifications, wider employment of HIMs, and voluntary efforts to improve coding accuracy, may explain some reported claimed improvement in coding accuracy (Hsia et al. 1992). The results from the ACWS have shown that Australian Coders are not well supported in beginner and continuing workplace education, resource materials, electronic products, and quality assessment techniques and tools (McKenzie & Walker 2003). In the bigger picture, Talbot (1995) and Kemp (1994) have outlined several enhancements initiated by the Australian government to improve the quality of coding. An example is the establishment of the NCCH, which has contributed to the development of coding standards, the organisation of education training programs, and other quality improvement initiatives including the development of PICQ. Other factors influencing the outcomes of this study may include the availability of a Clinical Coding Auditing Course and a Coding Refresher Course at La Trobe University and, for Victorian coders, the DHS ICD Coding Committee[5] which provides expert interpretations and responses to Coders' queries.

The findings from our research provide some support for the results and views reported in the ACWS (McKenzie & Walker 2003), and by Green and Benjamin (1986) and Callen et al. (1998). These authors highlighted the importance of coder education, employing qualified Coders, utilising feedback and offering continuous support to Coders, all factors consistent with the views expressed during interviews in the current study. The responses from our surveys and interviews revealed that all Coders were physically located within the HISs; this may partly explain the low coding error rates reported from the use of PICQ within the study's 14 participating hospitals.

While our survey and interview results were generally consistent with findings from previous studies, one finding was inconsistent with the results from Wendler and Slovensky's (1987) USA study; these researchers found that increased staff allocations resulted in a decrease in coding error rates. Our quantitative data did not show a correlation between a higher density of coding staff and better quality of coding; however, our findings from the qualitative data supported Wendler and Slovensky's results.

Qualitative results from the current study supported the view in the literature that poor quality documentation is a cause of coding error. Coding Managers consistently reported that incomplete and illegible medical record documentation creates barriers to coding quality.

Overall, it appears that Coding Managers in the current study had relatively similar views on factors affecting coding quality to those reported in the ACWS (McKenzie & Walker 2003). Our respondents reported that pertinent factors affecting coding quality in all participating hospitals are: issues relating to documentation; Coders having to perform multiple tasks; coding deadlines and demands; workplace distractions; and a lack of continuing education. Generally, though, the patterns of hospital error rates assessed by PICQ were not consistent with these reported views.

Statistically, only some results of the current study suggested that organisational factors, to a certain degree, may be important for coding quality; however, to identify the influence of particular organisational factors, we suggest a larger study of a combination of organisational and other factors, and involving more hospitals than in the current research.

5 The Victorian ICD Coding Committee was formed in 1979 as an official committee of the Victorian Health Authority, in association with the Victorian Medical Record Association (now the Health Information Management Association of Australia [Victorian Branch]). The Committee operates under the auspices of the Victorian Department of Human Services (DHS); it is chaired by a Health Information Manager from the DHS and comprises Health Information Managers who are qualified, experienced coders from across the state.

In conclusion

Study strengths

The study design had four main strengths. Firstly, the mixed method allowed us potentially to gain a more in-depth perspective and to confirm the validity of the focus of the survey questions by noting issues raised by respondents during interviews. A second strength was the use of an independent measure of data quality: PICQ is expressed in a standard format, therefore outcomes can be compared between facilities and across time. PICQ was used to validate the responses obtained from surveys and interviews to explore whether a correlation existed between assessed coding quality and the organisational variables studied, which was a major advance from many previous studies. The third major strength was the high participation rate, suggesting a non-biased group of participating hospitals. The fourth strength was that all respondents were appropriately qualified and experienced Coding Managers, thereby supporting the validity of factors perceived to be influencing coding quality.

Study limitations

Results of our inquiry should be interpreted in the light of the study methodology. Arguably, the greatest weakness was the small number of hospitals recruited into the study. A larger number of respondents would have been useful not only for external validity purposes but also to assist in observing significant relationships between potential organisational factors and error rates. The small range of errors may have restricted the opportunity to detect some associations that would emerge if there was a wider range of error scores. The time constraints of the study did not allow for controlling of the effects of the differing casemix of the sample hospitals and considering casemix variation as a variable affecting coding quality. The sample comprised leading, large public hospitals whose Clinical Coders would be expected to produce coding of a very high standard: the homogeneity of the sample members may have had some influence on the reported differences between the quantitative and qualitative findings.

Implications and recommendations

Given the limitations of the present study, it is not reasonable to generalise from the findings on the wider implications for health information clinical coding practice; however, in light of the data produced, it is appropriate to make some recommendations. While the current study did not find evidence to support the research question in terms of all the selected organisational factors, further investigation seems warranted given the importance of high quality coded health information. Future researchers might use larger samples to investigate several areas of organisational functioning to see if they affect hospital coding error rates. Further study could also be undertaken to replicate the main research finding, (i.e. that Coder allocation to 'general' coding produced fewer errors than did allocation to 'specialist' unit coding). As current findings are based on 14 hospitals, external validity needs further investigation in studies using a more representative hospital sample. Furthermore, structural and educational support variables of potential influence could be investigated to see if non-significant associations observed in this study can be confirmed as reliable associations in larger studies.

There has been little information published in scientific or professional journals about the reliability and validity of PICQ. The technical quality of PICQ begs further research, given its use by the Victorian state government as a clinical coding quality measure. Future research could break down the data into different PICQ error categories (rather than errors as an overall percentage from each hospital, as in the current study). It could also incorporate the 'audit through re-coding' method for measuring coding quality. Surjan (1999) has described the code-recode method, which relies upon a panel of expert Coders who undertake 'blind' re-coding, as being essentially valid.

The qualitative data from the interviews have indicated that Coding Managers perceive improvement in coding quality can be achieved by: (a) Coders engaging in a variety of role behaviours; (b) improved career opportunities for Coders; (c) higher Coder staff levels; (d) lower volumes of coding throughput; (e) less 'tight' time constraints for coding and associated work;

and (f) enhancement of Coder interactions with clinical staff. Notwithstanding these outcomes, we conclude that because of the small sample of participating hospitals and their relative homogeneity in terms of sector, size and/or casemix complexity and teaching functions, which presumably would require consistently high standards of clinical coding, replication of the study findings would be desirable before initiating changes in line with the current results.

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References

American Health Information Management Association (AHIMA). (2001). Developing a coding compliance policy document (AHIMA Practice Brief). *Journal of the American Health Information Management Association* 72(7): 88A-C.

Berthelsen, C.L. (2000). Evaluation of coding data quality of the HCUPO National Inpatient Sample. *Topics in Health Information Management* 21(2): 10-23.

Callen, J., Rust, J., Hines, B., Robertson, L. and Killen, J. (1998). Is coding in theatres a viable option? A review of the current theatre coding process at Royal Prince Alfred Hospital. *Journal of the Australian Confederation of Operating Room Nurses (ACORN)* 11(2): 34-38.

Demlo, L.K. and Campbell, P.M. (1981). Improving hospital discharge data: lessons from the National Hospital Discharge Survey. *Medical Care* 19(1): 1030-1040.

Denzin, N. (1978). *The research art*. Chicago: Aldine.

Fenig, S., Levav, I., Kohn, R. and Yelin, N. (1993). Telephone vs face-to-face interviewing in a community psychiatric survey. *American Journal of Public Health* 83 (6): 896-898.

Fletcher, R. (2002). The importance of addressing inaccurate Diagnosis Related Group assignment as a risk area. *Journal of Health Care Compliance* 4(5): 40-46.

Flick, U. (1992). Triangulation revisited: strategy of validation or alternative? *Journal for the Theory of Social Behaviour* 22: 175-197.

Flood, A.B. (1994). The impact of organizational and managerial factors on the quality of care in health care organizations. *Medical Care Review* 51(4): 381-428.

Green, E. and Benjamin, C. (1986). Impact of the medical record credential on data quality. *Journal of the American Medical Record Association* 67: 29-38.

Groom, A. (2000). Congratulations! You've passed the coding course. Paper presented at the International Federation of Health Records Organizations Congress, Melbourne, Victoria. October 2000. Re-printed in *ICD Coding Newsletter* (November 2000), Melbourne: Victorian ICD Coding Committee and Victorian Department of Human Services: 97-106.

Hasan, M., Meara, R.J. and Bhowmick, B.K. (1995). The quality of diagnostic coding in cerebrovascular disease. *International Journal for Quality in Health Care* 7(4): 407-410.

Hsia, D., Ahern, C., Ritchie, B., Moscoe, L. and Krushat, M. (1992). Medicare reimbursement accuracy under the Prospective Payment System, 1985-1988. *Journal of the American Medical Association* 268(7): 896-899.

Kemp, T. (1994). A profile of ICD-9-CM coding staff in NSW and ACT hospitals. *Health Information Management Journal* 24(3): 94-100.

Lorence, D.P. and Ibrahim, I.A. (2003). Benchmarking variation in coding accuracy across the United States. *Journal of Health Care Finance* 29(4): 29-43.

Lorence, D.P., Spink, A. and Jameson, R. (2002). Manager's reports on variation in coding accuracy across U.S. oncology centers. *The Journal of Oncology Management* 11(6): 20-26.

Lumsden, J. (1971). *Elementary statistical method.* Perth, Western Australia: University of Western Australia Press.

MacIntyre, R.C., Ackland, M.J. and Chandraraj, E.J. (1997). Accuracy of injury coding in Victorian hospital morbidity. *Australian and New Zealand Journal of Public Health* 21(7): 779-783.

McBurney, D.H. (1994). *Research methods*, 3rd edn. Pacific Grove, California: Brooks/Cole Publishing Company.

McKenzie, K. and Walker, S. (2003). *The Australian Coder Workforce 2002: a report of the National Clinical Coder Survey.* Lidcombe, New South Wales: National Centre for Classification in Health.

Mears, S.C., Bawa, M., Pietryak, P., Jones, L.C., Rajadhyaksha, A.D., Hungerford, D.S. and Mont, M.A. (2002). Coding of diagnoses, comorbidities, and complications of total hip arthroplasty. *Journal of Clinical Orthopaedics and Related Research* 1(402): 164-170.

Mehanni, M., Loughman, E., Allwright, S.P. and Prichard, J. (1995). The hospital in-patient enquiry scheme: a study of data accuracy and capture. *Irish Medical Journal* 88(1): 24-26.

Murphy-Muth, S.M. (1987). Medical records: Management in a changing environment. Rockville, MD. Aspen Publications.

Nunnally, J.C. (1970). *Introduction to psychological measurement.* New York: McGraw-Hill.

Obsorn, C.E. (1999). Benchmarking with national ICD-9-CM coded data. *Journal of the American Health Information Management Association* 70(3): 59-69.

Prophet, S. (2001). Developing a physician query process (AHIMA Practice Brief). *Journal of the American Health Information Management Association* 9: 881-M.

Siegel, S. (1956). *Non-parametric statistics for the behavioural sciences*. New York: McGrawHill.

Stevens, S., Unwin, E.C. and Codde, J.P. (1998). A review of hospital medical record audits: implications for funding and training. *Australian Health Review* 21(3): 78-91.

Surjan, G. (1999). Questions on validity of International Classification of Diseases-coded diagnoses. *International Journal of Medical Informatics* 54(2): 77-95.

Talbot, W. (1995). *An introduction to casemix development in Australia*. Canberra, Australian Capital Territory: Casemix Development Program, Department of Human Services and Health.

The National Centre for Classification in Health (NCCH). (2003). *Performance Indicators for Coding Quality (PICQ) 2002 user guide.* Sydney, Australia: NCCH.

Thompson, N.S. and Koch, D. (1999). Ongoing coding review: ways to ensure quality. *Journal of the American Health Information Management Association* 70(1): 45-49.

Waller, G. and Watts, S. (2002). Quality activities for morbidity and mortality coding. Paper presented at the Meeting of Heads of World Health Organization Collaboration Centers for the Classification of Diseases, Brisbane, Queensland (unpublished).

Waterstraat, F.L. (1990). Diagnostic coding quality and its impact on healthcare reimbursement: research perspectives. *Journal of the American Medical Record Association* 61(9): 52-59.

Wendler, M.W. and Slovensky, D. (1987). Effects of the Prospective Payment System on medical record coding. *Journal of the American Medical Record Association* 58(7): 13-17.

Williamson, D., Groom, A., Kearsey, I. and Perry, C. (1999). Quality concerns: what affects the quality of your coding? *Coding Matters* 5(4): 5-7. Available at: http://nis-web.fhs.usyd.edu.au/ncch_new/downloads/coding_matters/vol5no4.pdf (accessed 28 January 2008).

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