IN THIS ISSUE
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Health Information Management Journal

is a peer-reviewed journal with three issues per year.

The Journal is committed to supporting a broad range of professional activities, stimulating discussion, and lobbying current professional and political issues. It seeks to contribute to the body of knowledge in health information management and to enhance the profile of health information managers through the promotion of national and international communication on topics relevant to information management in health. These include: public and population level health information; health IT and informatics; privacy and confidentiality; health classification and clinical coding; health systems and resources management; epidemiology and health research, and related data management and analysis; casemix and related health business analysis; quality and clinical risk management; and comparative international health information systems.

The scope of the Journal covers empirical research, management perspectives, workforce planning, practical experience, product technical reviews and applicable newsworthy commentary.

Production schedule Issues 35(2) and (3)

<table>
<thead>
<tr>
<th>Issue 35(2)</th>
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<tbody>
<tr>
<td>Deadline for contributions</td>
<td>30 May 2006</td>
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<tr>
<td>Publication</td>
<td>Late September 2006</td>
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<tr>
<td>Themes</td>
<td>Health information service management: focus on resource management and disaster management</td>
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<tr>
<th>Issue 35(3)</th>
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<td>Deadline for contributions</td>
<td>30 August 2006</td>
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<tr>
<td>Publication</td>
<td>Late November 2006</td>
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<tr>
<td>Themes</td>
<td>Classifications and terminologies</td>
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Although each issue will have a distinct focus, it is intended that articles dealing with the following areas will be included on a regular basis: electronic health records; HIM careers: ‘alternative’ careers, ‘non-traditional’ workplaces; classification and terminology.

Contributors are also invited to submit at any time articles that illustrate use of data for understanding the occurrence and impact of diseases in the population, or the effects of population health activities or other (non-hospital) health care delivery.
Contents

President's report: Health informatics
Angela Randall 4

Editorial: The professional journal
Kerin Robinson 6

Invited editorial: Team-based approaches to health informatics research
Joanne Callen 8

Reviewed articles:
Data quality maintenance of the Patient Master Index (PMI):
a ‘snap-shot’ of public healthcare facility PMI data quality and linkage activities
Kelly Williams, Kerin Robinson and Alexandra Toth 10

Patterns of first-coded complications in acute episodes of lung cancer care
Gayle Cantsilieris, Terri Jackson and Annette Street 27

Coding and DRG relationships in stroke and transient ischaemic attack (TIA)
Shyamala Nadathur and Andrea Groom 41

Reports:
Electronic discharge summary and direct data entry for outpatient clinics
Alisha Lucas 48

Health information management in remote tropical islands
Leanne Holmes Gayle Cantsilieris, Terri Jackson and Annette Street 50

Professional profiles:
Angela Bayley, Senior Data Manager 56
Elvis Maio, Project Officer 57
President’s report:
Health informatics

Angela Randall

I am delighted to welcome our readers to the first issue of Health Information Management Journal for 2006, in its new dual paper-based and electronic formats. The National Board of HIMAA and the Editorial Board have collaborated to bring about the production of the Journal in its paper format at the request of HIMAA members. I hope you enjoy this issue and many more to come, and I take this opportunity to thank all those involved with its production for their dedication to our professional journal. This issue is dedicated to the field of health informatics and how that specialisation impacts on our role as health information professionals.

Nadathur and Groom discuss the issue of clinical coding and DRGs in relation to stroke and TIA, and the relationship of state-wide database collections. The article draws our attention not only to the importance of clinical coding and accurate assignment of those codes to diagnoses, but also to the positioning of the ICD-10-AM code in the field. Of equal importance is the accuracy of indexing the allocated code. This article emphasises the importance of the systems in use in our public and private hospitals, and the need for greater interoperability and connectivity between service providers to allow greater access to the wealth of research data that resides within our healthcare systems.

Williams, Robinson and Toth argue that systems are only as good as the data input, and that data quality, in particular the Patient Master Index, which is the cornerstone of all patient...
systems in our hospitals, require best practice and benchmarking to maintain accurate and concise patient information. This in turn will minimise the risk of record/patient duplication and hence minimise patient care risk. These practices require stringent guidelines and standards to ensure quality of data and patient information in our systems, and the reduction of duplicate files in the public health arena.

In their article ‘Patterns of complications in acute lung cancer care’, Cantsilieris, Jackson and Street examine abstracts of information from the Victorian Admitted Episodes Database (VAED), and reporting of first-recorded adverse events of inpatient care for lung cancer in Victoria. Again this article highlights the use of the ICD-10-AM clinical coding system and subsequent allocation of codes to the VAED utilising the ‘C’ complication code to identify the reporting of an adverse event. This article highlights the need for accurate assignment of codes to the database as well as accurate allocation of the event with the complication ‘C’ prefix. Through the use of the morbidity data collections, the authors conclude it is possible to screen larger numbers of patient episodes within an economical framework.

Alisha Lucas reports on the electronic discharge summary and direct data entry for outpatient clinics’ program, whilst we have an interesting report of the activities of our seasoned traveller Leanne Holmes. Leanne’s article describes health information management in remote tropical islands. In this issue we also bring some Health Information Manager (HIM) profiles for the interest of both our members and other readers.

I am happy to report on the HIMAA Strategic Planning Retreat, attended by members of the HIMAA National Board, Executive and other participants, which was held in Sydney in April. The primary goal was to achieve an increase in membership and provide better services to those members. A number of strategies were identified to help achieve this goal for the 2006-2009 period. These include development of:

- a business model
- website improvement; a communication strategy to incorporate the use of web based technology
- an education strategy for members, including credentialing, competency standards and accreditation
- a Health Information Management body of knowledge which fosters innovation and best practice, and a greater exposure of our profession to the community at large.

These strategies will be reviewed by working parties established from members of the retreat. In all, I believe the retreat was a great success, with many ideas flourishing for the betterment of our profession and our Association. I look forward to reporting on the activities of the working parties and the revitalisation of the organisation.

In closing, our strengths lie in our professionalism, our profile and our values. The HIMAA Journal supports those ideals through the publication of articles written by members, for members. Let’s hear about your activities and projects which highlight the breadth of our abilities as health information management professionals.

Angela Randall
National President, HIMAA
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Welcome to the new-look, hard copy Health Information Management Journal! Well, it is not such a new look because this journal had its beginnings over 35 years ago and was published in hard copy format until late 2000. Regardless of the format, since its inception the journal has been the key communication vehicle for the ideas, theories, innovations, and professional practice issues affecting Health Information Managers throughout Australasia. A peer-reviewed journal is one of the hallmarks of a profession and, throughout its lifetime, this journal has reflected and represented the growth and development of the profession and its knowledgebase.

‘The journal’ was established in February, 1971 as the bi-monthly National Newsletter of the Australian Federation of Medical Record Librarians (AFMRL), the antecedent of the Health Information Management Association of Australia (HIMAA). Ms Judith Young, the President of the association, wrote an introduction to the first issue that emphasised the need for the emerging profession to establish a united, national image and identity, with national ethics and standards, and a common voice with which to seek and receive international recognition. She asked all members of the profession to support the newsletter by submitting to the Editor articles, letters, ideas, and suggestions on any topic related to the field (Young 1971: p. 1, cited by Watson 2005).

In 1975, there was a change of name to Australian Medical Record and a shift to a small-size, journal format which continued until 1983. In the following ten years, to 1993, the journal adopted a larger size and a slight name change, Australian Medical Record Journal. In 1994, it morphed into a more contemporary ‘look’ as Health Information Management Journal (HIMJ). In 2000, the Board of Directors advised the Editorial Board of the need to cut costs because of severe financial pressures facing the Association; the journal was considered to be a critical plank of the profession and the best way to preserve it and to maintain publication of a number of issues each year was to cease hard copy production and publish electronically. The Editorial Board saw this as presenting an opportunity, for a profession that operates at the forefront of electronic health communications technology, to adopt an appropriate medium for communicating professional issues and developments.

The electronic journal has been wonderful for students, researchers, and international colleagues: the immediacy of this format has enhanced accessibility to these groups. Conversely, it has also had its critics: for some readers the effort involved in accessing the internet and using a complex password has been a deterrent to reading the journal. Others have found the electronic format created a real sense of reduced ‘visibility’ of the journal and the ‘disappearance’ of the key symbol of their membership of the professional association. Many Australian Health Information Managers, while enthusiastically developing and embracing high-level information and communications technologies (ICT) in their workplaces, prefer to read an ‘old-fashioned’ print journal. The hard copy journal seems to be more accessible, more user-friendly, and easier for readers to browse through, at leisure.

The Editorial Board will produce three, slightly larger hard copy issues per year and will continue to publish the ‘Contents’ page and the peer reviewed articles in an electronic format; this is necessary for the rapid and wide dissemination of important ideas and developments in Australasian health information management and its sub-disciplines. It is also important, for the reputation of the profession and the growth of the professional knowledgebase, that articles (especially those that are peer-reviewed) are read widely and cited by
Editorial

ally – Health Information Managers, Clinical Coders, Health Informaticians, and others - to share the stories of your plans, implementations, challenges, successes, and disasters. Reading about others’ experiences helps to inform one’s decision-making. We have revamped some of the categories; if you wish to write a case study, a commentary, a report, your professional profile, or a researched article, remember that others across the country and around the world will be interested in reading it. If you wish to submit photographs of your work or equipment, we will publish these in the ‘all-new’ Photo Gallery. Take a look at the ‘Guidelines for Authors’ elsewhere in this issue and on the HIMAA website, journal webpage. We welcome your views regarding the content. Enjoy reading your journal!

Kerin Robinson
Editor

References
This issue of the journal focuses our attention on the value of state and territory inpatient morbidity databases. These large data sets can be analysed to provide information which can be used to improve patient care delivery and outcomes, and the management of health services. State and territory inpatient statistics collections contain a wealth of information. Some would assert that this rich data source is under-utilised. Health information management professionals have expert knowledge regarding the collection and classification of this information and should be seen as integral members of research teams aiming to use this data source for their studies. Cantsiliseris, Jackson and Street (2006) show the results of using a multidisciplinary team in a study which analysed a state morbidity data collection to identify adverse events of lung cancer treatments. They found that the morbidity data could be used as a tool for inpatient screening of complications from lung cancer treatments, which could then be used to reduce the adverse affects of radiotherapy and chemotherapy. The Cantsiliseris et al. (2005) study is an excellent example of the usage of data from a state morbidity data collection. Health professionals who have the knowledge of how inpatient episodes of care are coded and entered into these databases should link with clinicians and epidemiologists to explore other opportunities to utilise these sources for patient care studies.

Another key concept which has been raised in this issue is the importance of communication between researchers. A number of studies have shown that health care services are best delivered in a team-based environment (Borrill et al. 2000; Sommers et al. 2000; Gosling, Westbrook & Braithwaite 2003) and this is also the case in research. Research which involves mining large inpatient databases requires coordination, discussion and understanding between clinicians, epidemiologists, and health informaticians to ensure reliability and validity of the findings. Working in multidisciplinary research teams ensures a more comprehensive analysis of all perspectives of a problem. However it is not always easy working across professional boundaries; the article in this issue by Nadathur & Groom (2005) highlights this concern, and concludes that experienced clinical coders should be utilised in morbidity data collection analysis studies. The accurate identification of inpatients is essential to ensure clinical and administrative information recorded for each patient is unique to that patient. In the electronic health record environment this principle is further emphasised because clinical information will be linked across multiple health environments. The paper by Williams, Robinson and Toth (2005) highlights the importance of comprehensive data quality activities to ensure the accuracy and currency of the patient master index (PMI). In their study a picture is provided of current PMI data quality activities in Victorian public acute care facilities and the need for best-practice guidelines is emphasised. The South Australian model is recommended as a template which could be used in other states and territories to ensure national consistency and uniformity.

The informative report by Alisha Lucas on electronic discharge summaries and the direct entry of outpatient clinic data highlights the complexity of moving towards electronic health records. There is a need to consider clinicians’ work processes and acknowledge that information technology implementation is a change process. In contrast Leanne Holmes gives an interesting report on predominantly manual health information systems in the Federated States of Micronesia and the Christmas and Cocos (Keeling) Islands. Both reports identify challenges in ensuring that...
health information is recorded accurately at the point of care (whether manually or electronically) to enable its availability for future patient care and for epidemiological studies. Our professional profiles for this issue allow a glimpse into two interesting and varied positions, stressing the range of employment available for health informaticians/health information managers.

I hope you will find this issue of the journal stimulating and informative. I encourage you to take note of our Editor’s invitation (Robinson 2005) and respond to articles and reports in this issue by writing directly to the Editor and also submitting papers of your own experiences and research in the area of management of health information. The articles underline the importance of team-based approaches to research and health care delivery. The feature article by Cantsiliseris, Jackson and Street (2005) accentuates the value of state and territory electronic health information data bases. ‘Decisions about groups of patients or populations should be based on a combination of three factors: evidence, values, and resources. At present many health care decisions are principally based on values and resources’ (Stefanelli 2002: p. 42). Appropriate analysis of information contained in morbidity databases, both national and international, can assist in providing the evidence to move health professionals and administrators from opinion based decision making to evidence-based decision making.

References


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Data quality maintenance of the Patient Master Index (PMI): a ‘snap-shot’ of public healthcare facility PMI data quality and linkage activities

Kelly Williams, Kerin Robinson and Alexandra Toth

Abstract
Patient (or person) master index (PMI) data quality activities in public, acute healthcare facilities in the state of Victoria, Australia were evaluated in terms of health information management-information technology best practice including data standards and practice guidelines. The findings indicate that, whilst data quality and linkage activities are undertaken, many are limited in scope or effectiveness. In view of published evidence that: (i) duplicate patient files pose significant risks by reducing information available for clinical decision-making; and (ii) quality and clinical risk management require, as a measurable outcome, continuous monitoring of duplicate files, improvements to PMI data quality practices are recommended.

Keywords (MeSH)
Medical Record Linkage; Patient Identification Systems; Medical Records Systems, computerized; Quality assurance, healthcare

Introduction
A research study was undertaken in 2004 to investigate the maintenance of the Patient (or Person) Master Index (PMI) in public sector, acute healthcare facilities in the state of Victoria, Australia.

The Patient Master Index (PMI)
Hospital and non-hospital healthcare facilities use a computerised PMI as a central register or index to identify each patient who has been treated (Huffman 1994; Kuehn & Grzybowski 2001). The PMI is called an index because it links a patient to a unique record number which is used to identify and locate any existing medical records for that patient (South Australian Department of Human Services [DHS] 2002); thus, the PMI minimises within-facility duplication of health and medical records (AHIMA – MPI Taskforce 1997b; Bowman 2002). Positive identification of an individual patient, using data supplied at the time of registration and compared immediately with the data held in the facility’s PMI, constitutes an important part of the process of linking the patient with their existing record (Bowman 2002; Standards Australia 2002). The PMI, as a longitudinal index, plays a critical role in supporting continuity of care by facilitating the location of, and access to, health information for individual patients over time (South Australian DHS 2002; Wheatley 2001).

The diversification of health care delivery in recent years has led to significant increases in the number of health care providers and the locations from which patients and clients access care (Teslow & Wilde 2001). This typically leads to the accumulation of patient health information in unrelated data repositories (Hewlett-Packard Development Company 2004; Standards Australia 2002). There is evidence of an increasing awareness of the power of health information derived from both the PMI and patient medical records to support health care delivery and high quality care, and that the value of health information can be greatly enhanced when it is used in conjunction with evolving information and
communication technologies (ICT) such as electronic medical records (Acheson 1971; Briggs 2000; Buck 1971; Hewlett-Packard Development Company 2004; Lewis & Mitchell 1998; Murphy 2001; Rifkin 2001; Victorian DHS 2003; Wagner 2002; Wagner 1981).

**The enterprise patient master index (EPMI)**

The Victorian Department of Human Services (DHS) is attempting to enhance ICT utilisation in the public hospital sector through its HealthSMART strategy, the long-term objectives of which include the introduction of a state-wide unique patient identifier, and electronic medical records (Victorian DHS 2003). In recent years, Victorian healthcare networks have begun increasingly to share data and technology resources across facilities, for example via an enterprise-wide patient master index (EPMI) (Toth 1999). An EPMI may either support a single unique record number for each individual patient to be used across all facilities in a network, or be used to maintain a cross-referencing system for all unique record numbers from each facility (Standards Australia 2002).

Sharing of health information, through technology, is also being explored at a national level in Australia, for example via the Commonwealth Department of Health and Ageing’s proposed national health information network, HealthConnect (formerly HealthOnline). The aim of HealthConnect is to facilitate the collection, storage and exchange of patient health information between authorised health care providers and facilities (Australian Government Department of Health and Ageing 2004).

**Data linkage and data quality**

If PMI data are of poor quality - for instance, if there are duplicates and inconsistencies such as incompleteness in the data format, and if data elements which uniquely identify patients are lacking - the ability to share information across facilities or with internal data repositories such as an ‘in-house’ pathology system is diminished (Arellano & Weber 1998; Damberg, Kerr & McGlynn 1998). Problems with data quality make the health record linkage process cumbersome, unreliable, and of little value to organisations, providers, and patients (Kerr, McGlynn & Damberg 1998; Standards Australia 2002).

The term ‘data quality’ refers to characteristics and attributes of the data, specifically: accuracy, accessibility, comprehensiveness, consistency, currency, definition, granularity, precision, relevancy, and timeliness (Teslow & Wilde 2001; Olson, Gallagher, & Fletcher 2001). It has been estimated that a PMI with poor data quality contributes to file duplication rates of approximately three to ten percent (Arellano & Weber 1998): this means that in a PMI containing 500,000 patient files, data for each of 15,000 to 50,000 patients may be in two or more records with different record numbers. It has been suggested elsewhere that duplicate file rates can be as high as 19 percent (AHIMA – MPI Taskforce 1997c).

**Aims and objectives**

The aims of this study were to create a ‘snap-shot’ of current practice in data quality and linkage activities, and of the technological capabilities associated with the PMI, and to evaluate these in the context of facility size and health information management (HIM)/information technology (IT) best practice.

The objectives of the research were:
- to identify the scope of responsibility for the PMI in Victorian public, acute healthcare facilities
- to elicit estimated sizes of PMIs, quantified by the number of patient files
- to investigate staff access to the PMI, and related training practices and procedural documentation for patient registration and associated PMI search strategies
- to examine how the capabilities of available technology are utilised in PMI management, particularly whether the technology assists in identifying duplicate patient files
- to ascertain the scope of attempted activities aimed at improving PMI data quality and, where such activities are not undertaken, to identify reasons why they are not
- to establish the extent of intra- and inter-facility PMI data linkage, estimate how successful data linkage activities are and identify factors that frustrate PMI data linkage attempts.
to provide suggestions, based on the study's results, for PMI data quality management and maintenance improvements in Victorian public healthcare facilities.

**Underlying assumptions**
For the purpose of the research, it was assumed that:
- All Victorian public, acute healthcare facilities maintain a PMI as a central data register of all patients who have accessed their services.
- These facilities use their PMI to index individual patients to a unique record number which, in turn, facilitates locating each patient’s medical record.
- The PMI is the logical central data repository from which linkage would or does occur (Abdelhak 2001; Huffman 1994).
- HIM professionals, who typically maintain the PMI, have the knowledge and skills to audit the accuracy and completeness of patient-identifiable data and health information, and to conduct routine data quality monitoring (Teslow & Wilde 2001; HIMAA- Education Committee 2001).

**The literature**
There is a wealth of literature emanating from the United States of America, Canada, New Zealand, the United Kingdom, and various Australian states, particularly South Australia, describing PMI data quality and record linkage techniques and their importance (Acheson 1971; AHIMA - e-HIM Taskforce 2003; AHIMA - MPI Taskforce 2004; AHIMA - MPI Taskforce 1997a, 1997b, 1997c; Arellano & Weber 1998; Carine & Parrent 1999; Drake & van Gemert 2003; Hewitt & O'Connor 2002; Holman et al. 1999; Lenson 1998; Manitoba Center for Health Policy 2003; McAlpin 2003; New Zealand Health Information Service 2003; Roos et al.1996; South Australian DHS 2000, 2002; Taylor 2003; Toth 1999; Wagner 1981; Walker 1999; Wheatley 2001). The American Health Information Management Association (AHIMA) Master Patient Index task force describes a PMI that has a notable standard of data quality as being one of the most important resources in a health care organisation because ‘it is the link tracking patient, person or member activity within an organization and across patient care settings’ (1997a: para.1). AHIMA (1997a) also recommends that responsibility for PMI maintenance should be centralised under the direction of Health Information Management (HIM) professionals.

**Guidelines and standards**
**Australian Standard AS 5017-2002**
This standard provides ‘a framework for improving the confidence of health service providers and clients alike that the data being associated with any given individual, and upon which clinical decisions are made, is appropriately associated’ (Standards Australia 2002: p. 5). According to Standards Australia, the ability to identify an individual, find their unique record number, and locate their medical record is ‘critical to the provision of speedy, safe, high quality, comprehensive and efficient health care’ (2002: p. 5).

**National Health Data Dictionary (NHDD)**
The NHDD contains health data definitions and has been designed to improve the comparability of data across the healthcare industry (AIHW 2004).

Many state-specific data standards, such those produced by the South Australian DHS, have been informed by AS 5017-2002 and the NHDD; both are voluntary codes of practice and the extent to which they are utilised by healthcare facilities is unknown.

**Risk management**
Healthcare facilities must have the capability to locate accurately the medical record of an individual patient, in order to provide clinicians with the history and other information to inform safe, knowledge-based decisions. Healthcare providers often have to undertake the burdensome task of requesting medical records from other providers to gain a somewhat fragmented medical history of their patients (Goldman & Tossell 2004). Wilson and Goldschmidt (1995: 509) stress that a patient's medical record “…is the core of the totality of
information relevant to patient care…”, that it is paramount in assisting health professionals make clinical decisions and that its accuracy and timeliness are the linchpins of serious risk avoidance. HIM professionals, in designing and managing the information systems that hold these vital records, must ensure that the PMI meets their facility’s obligations in clinical risk management (Callahan-Dennis 2001).

Accreditation

Victorian acute healthcare facilities are required to meet the accreditation requirements of the Australian Council on Healthcare Standards (ACHS), the International Organization for Standardization’s Quality Management System (ISO 9002), or the Quality Improvement Council’s Health and Community Services Standards (QIC), all of which promote the importance of quality management and improvement of information to support the functions of the healthcare facility (Victorian DHS 2004).

The ACHS EQuIP guide requires that facilities apply infrastructure standards to the main organisational functions in order to support the delivery of high quality, safe care. The standards most relevant to PMIs relate to ‘Information Management’ (Treacy 2003). The EQuIP guide describes the importance of information management, thus:

… The provision of quality care and the effective and efficient management of health care organisations are dependent on timely and accurate information. Organisations need to continuously improve their management of data and information, especially with respect to the creation of information from data, how information is used across the organisation, and whether information is available when needed (ACHS 2002: 87, section 4).

Gaps in the knowledge

Other than accreditation requirements, and statutory requirements surrounding mandated data collections (for example, the Victorian Admitted Episode Dataset [VAED]), there is little published evidence of the application of uniform data standards in Victorian hospitals. Furthermore, there is scant information available on the data quality of PMIs in these facilities, the techniques and rationale applied to data quality maintenance, or whether there is intra-facility consistency in practice.

PMI search algorithms

There are three types of automatic patient matching (Gudea 2005); all three use a combination of patient-identifying data elements within an algorithm to determine whether two separate files belong to one individual patient or client. These processes are usually unseen by the end-user:

- **Deterministic algorithm (‘exact match’)**: This performs an exact match based on a specific combination of data elements.
- **Rule-based algorithm (‘fuzzy logic’)**: This assigns weights to patient data elements. The weights are used to compare patient files for matching.
- **Probabilistic algorithm**: Formulae are used to analyse the PMI data to determine match weight probabilities for each data element.

The use of a unique patient identifier in all PMIs and EMPIs is suggested by AHIMA (1997b) to facilitate linkage activities and to match patients accurately with their existing medical record; in regards to patient record linkage methodologies, AHIMA explains that the majority of healthcare facility patient information systems use deterministic algorithms which often result in false matches. The Association considers probabilistic matching to be the most sophisticated technique available (AHIMA 2004) and that issues such as decentralised patient registration and a lack of data standards have a negative impact on PMI data quality and record linkage methodologies.

PMI linkage studies

Gudea (2005) states that because probabilistic matching has an accuracy rate of 90% or higher, it offers the greatest potential to maintain PMI integrity. This appears to be reflected in the choices of several high profile health data linkage projects such as the Oxford Record Linkage Study (ORLS) in 1963-1999 (Acheson 1971; Gill 1997); the Western Australian Linked Database Project,
which commenced in 1980 and was the first of its kind in Australia (Holman et al. 1999); the New Zealand Health Information Service (NZHIS) national, demographic register of all healthcare facility patients, which commenced in 1992 and covers approximately 98% of the population (NZHIS 2003); and the South Australian data standardisation initiatives and Oacis Programme, developed by that state’s Department of Human Services (DHS) (South Australian DHS 2000; 2002; 2003). The aims of the latter program include patient record linkage and a fully functional clinical information system across Adelaide’s eight metropolitan, public healthcare facilities. Its success relies heavily upon the input of high quality patient data into the EMPI, where linkage of records occurs. Drake and van Gemert comment that ‘… incorrect linking… of individual client records could have a significant risk management impact on service provision and hamper the system’s ability to deliver a seamless service’ (2003: para 5). It is in the interests of the Oacis Programme team to assist facilities with their data entry practices, to ensure that there is a common understanding and standardised practice in the collection, storage and transmission of patient data. A working party consisting primarily of Health Information Managers (HIMs) and representing the participating facilities created a series of publications on medical record documentation and data capture standards, and client identification standards for PMIs, with which all facilities are expected to comply (South Australian DHS 2000; 2002; 2003). Issues addressed included patient search principles, PMI training requirements, and minimum requirements for PMI data elements.

Quality maintenance activities
Data capture features are an important component of the PMI to support data quality at the point of data entry (Wilde & Teslow 2001). The AHIMA suggests that a comprehensive PMI maintenance program should include ongoing processes to identify and address existing data errors, and that HIMs should ensure that PMI policies and procedures are regularly reviewed and updated (AHIMA – MPI Taskforce 2004). Perry (1996) found a decade ago that Victorian HIMs supported the use of performance measures, including for PMI maintenance. The AHIMA practice briefs further advise the need for an adequate staffing complement, relative to PMI size, to maintain and ensure data quality (AHIMA – MPI Taskforce 2004).

Quality maintenance activities associated with the capacity to capture and share patient information include:

- implementation and maintenance of PMI data standards and unique patient identification standards.
- teaching persons who register patients on the PMI about data standards and patient search and registration techniques
- identification and rectification of duplicate patient records. This is known as record linkage (Standards Australia 2002).

Method

Sample selection
At the time of the study there were 122 public acute healthcare facilities in Victoria. A publicly available data file from DHS included the number of acute care separations (inpatient discharges) from these facilities for the most recent financial year (2002-2003). A decision was made to include in the study only those facilities with a minimum activity level of 2,000 acute care separations per annum. This criterion was based on the researchers’ prior knowledge that smaller inpatient facilities were likely to have neither the technology resources nor the staffing complement with appropriate knowledge and qualifications to complete the technical items in the questionnaire.

Sixty facilities (49.2% of the 122) met the inclusion criterion and made up the target population. These facilities were categorised according to the number of acute care separations in the 2002 - 2003 financial year:

- ≥2,000 but <12,000 ‘small’ facilities (n = 29; 48.3% of the 60);
- ≥12,000 but <24,000 ‘medium’ facilities (n = 12; 20.0% of the 60);
- ≥24,000 ‘large’ facilities (n = 19; 31.7% of the 60).

The categorisation into small, medium and large was based on the assumption that different-sized facilities potentially undertake different PMI data quality and linkage activities. This could be
due to: (i) the number of files and the proportion of PMI duplicates; and (ii) the available staffing and technological resources.

Approval for the research was granted by the La Trobe University Faculty of Health Sciences Human Ethics Committee.

Advance notice of the research survey was provided via the ‘University News’ column of Dataline, the newsletter of the Health Information Management Association of Australia (Victorian Branch): one of the researchers (KR) advised members that a PMI survey was to be conducted and that public healthcare facility HIMs might expect to receive a questionnaire in the mail in the coming months.

Study design
A cross-sectional survey was conducted during August, 2004 using a self-administered questionnaire. The questionnaire was mailed, with an introductory letter and reply-paid envelope, to the person responsible for the management and maintenance of the PMI in each of the 60 facilities targeted for the study. The timeframe for completion of the questionnaire was 14 days. The numbered questionnaire preserved respondent anonymity for results reporting but enabled telephone follow-up of non-respondents after two weeks; a one-week extension was granted where necessary.

The survey instrument
The self-administered questionnaire designed for this non-experimental research study included 22 items: ten closed questions; five open, narrative-type questions seeking opinions; and five mainly closed questions with provision for explanation or details. The penultimate question was open-ended and invited further comments; the final item was administrative and related to the notification of results.

Part 1 of the questionnaire (five questions) was designed to elicit details of the respondent’s position in the organisation and the size of their PMI; these questions related to the first two research objectives (scope of responsibility for the PMI; and PMI size, quantified by the number of patient files). Part 2 comprised five questions designed to elicit information to meet the third research objective and related to data quality management of the PMI through staff training and resources. Part 3 comprised eight questions, relating to the fourth and fifth research objectives, about data quality management of the PMI involving duplicate patient files. Part 4 comprised three questions, relating to the sixth research objective, designed to derive information on respondents’ activities at attempted PMI linkage with other internal systems and/or other healthcare facilities. The remainder of the questionnaire constituted the final two questions. The seventh research objective was achieved through analysis of the responses to all questions, including the penultimate (open, comment) question.

The questionnaire was amended prior to use to reflect the outcomes of a two-phase pilot trial.

Data analysis
The analysis of the responses was based upon a concurrent nested design; specifically, whilst the data were analysed via a predominantly quantitative approach, the analysis also included an embedded qualitative strand to assist in validation of the results. The responses to the closed items were coded, and computations calculated and displayed using Microsoft Excel. Responses to the open-ended questions were transcribed into Microsoft Excel for reference purposes. Anonymity of participants and facilities was preserved throughout.

Results
Response rate and study sample
A representative from each of 51 of the 60 eligible facilities responded, giving a response rate of 85%. These 51 respondent facilities formed the study population. The terms ‘respondent’ and ‘respondent facility’ have the same meaning in this study. The response rate was >80% in each of the small, medium, and large facility categories. Of the 51 respondent facilities, 25 (49%) were small, 10 (19.6%) were medium-sized, and 16 (31.4%) were large.

Responsibility for the PMI
All 51 respondents indicated that, as part of their position, they held responsibility for the maintenance and management of the PMI; 31 respondents (60.8%) shared this responsibility with another person. In all, 47 (92.1%) of those
with responsibility for the PMI were HIM professionals. Health Information Managers held this responsibility in all of the large facilities; only one information technology professional/system support person had this responsibility in a medium-size facility; and administrative staff had responsibility in three of the small facilities.

**PMI size**

Each respondent estimated the number of patient files contained in their respective facility’s PMI (Table 1). Some respondents may have been able to provide an accurate figure through query of their PMI system; however, there was no provision in the questionnaire to accommodate for differentiation between actual and estimated figures. Thirty-five respondent facilities (68.6%) had PMIs containing less than 500,000 patient files.

**Table 1: PMI size estimates, per facility size category and overall**

<table>
<thead>
<tr>
<th>NO. OF PATIENT FILES CONTAINED ON THE PMI *</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>TOTAL</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100,000</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>18</td>
<td>35.3</td>
</tr>
<tr>
<td>≥100,000 and ≤499,999</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>17</td>
<td>33.3</td>
</tr>
<tr>
<td>≥500,000 and ≤999,999</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>9</td>
<td>17.7</td>
</tr>
<tr>
<td>≥1,000,000</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td>13.7</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>10</td>
<td>16</td>
<td>51</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* Based on an estimate provided by respondents

**PMI training practices and procedural documentation**

The respondents in the 51 facilities were asked to give an estimate of the number of staff members in their facility who could use the PMI (register patients and update patient details). In 33 facilities, the estimate was 1–<50 staff, in nine facilities it was 50–<100 staff, and in five facilities 100 or more could use the PMI. Respondents in four large facilities failed to give an estimate and did not explain why they did not. Respondents who did give an estimate generally intimated difficulty in doing so due to the decentralised use of the PMI throughout various departments and because staff use of the PMI was not within the respondents’ control.

**Training new staff**

Table 2 shows that only six facilities (11.7%) provide all new staff, facility-wide, with a standardised PMI training program including training in registering patients and updating patient details on the PMI. It is seen that in 33 facilities (64.8%) there is no standard PMI training program.

**Table 2: PMI training practices for new staff, by facility size, and overall**

<table>
<thead>
<tr>
<th>DESCRIPTIONS OF PMI TRAINING PRACTICES FOR NEW STAFF</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>TOTAL</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A standard, facility-wide training program is provided for all new staff</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>11.7</td>
</tr>
<tr>
<td>A standard, facility-wide training program is provided for certain categories of new staff</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>12</td>
<td>23.5</td>
</tr>
<tr>
<td>All new staff receive training, but there is no standard training program – training is decentralised</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>19</td>
<td>37.3</td>
</tr>
<tr>
<td>Certain categories of staff receive training, but there is no standard training program</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>14</td>
<td>27.5</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>10</td>
<td>16</td>
<td>51</td>
<td>100.0</td>
</tr>
</tbody>
</table>
**Documentation of PMI search and registration procedures**

Forty-six (90.2%) of the respondent facilities have a PMI procedure manual. Nineteen of the 46 (41.3%) had updated or reviewed their procedure manual during the year of the study (2004). A further 15 facilities had updated their manual in the previous year (2003); four had updated two years ago (2002); one facility, three years ago (2001); and two facilities, four years ago or more (2000 and prior). Five facilities did not respond regarding the manual update.

**Capabilities of available PMI management technology**

The subjects identified, from the following list, the data capture features of their PMI software that support data quality at the point of data entry:

- ‘Use of mandatory data fields to promote data capture, e.g. Surname, Given name, Data of birth and Sex must be recorded for any new registration’
- ‘Data edits on specific fields, e.g. Data of birth cannot be greater than current date’
- ‘Use of drop-down menus (or similar) for accurate data entry choices, e.g. Lists for Suburb, Country of birth, …’
- ‘Other (features)’.

Approximately 73% of the respondent facilities reported using PMI software with three or more data capture features that support data quality at the point of data entry. Five facilities (9.8% of respondents) had one data capture feature; nine (17.7%) had two features; 33 (64.7%) had three; and four (7.8%) used at least four data capture features. Comments by some who nominated ‘Other’ included: ‘[Our PMI software offers] edits on a number creation to avoid inadvertent inclusion of characters’ and ‘[Our PMI software offers] warning messages on missing data fields and other data entry errors’.

Responses concerning the frequency of purposeful, routine data quality activities aimed at locating duplicate patient files in the PMI are summarised in Table 3.

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>TOTAL</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>11.8</td>
</tr>
<tr>
<td>Weekly</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3.9</td>
</tr>
<tr>
<td>Monthly</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>23.5</td>
</tr>
<tr>
<td>Half-yearly</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5.9</td>
</tr>
<tr>
<td>Yearly</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>13.7</td>
</tr>
<tr>
<td>Ad hoc or Never</td>
<td>9</td>
<td>4</td>
<td>8</td>
<td>21</td>
<td>41.2</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>10</td>
<td>16</td>
<td>51</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Further analysis undertaken to establish whether the size (number of files) of the PMI, as distinct from the size of the facility, correlates with the frequency of searching for duplicate records showed that facilities with larger-sized PMIs (those comprising 500,000 files and more) undertake more frequent daily data quality activities, as opposed to monthly or yearly activities, than do facilities with relatively small PMIs (<500,000 files). The latter facilities tend to undertake PMI data quality activities at more infrequent intervals, for example monthly and yearly, and have a higher incidence of undertaking PMI data quality activities on an ‘Ad hoc’ basis, or ‘Never’ (where ad hoc refers to non-routine activities undertaken to locate duplicate files on an ‘as needs’ basis).

**Methods of identifying duplicate files**

Eight of the 51 respondent facilities used more than one method to monitor duplicate patient files in their PMI. Table 4 shows that most facilities utilise a report generated by the PMI software to monitor duplicates. Only minorities of facilities use any of the other methods listed in Table 4.
Reviewed articles

Table 4: Methods of monitoring duplicate patient files on PMIs per facility size, and overall

<table>
<thead>
<tr>
<th>METHODS OF MONITORING DUPLICATE PATIENT FILES</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>TOTAL (METHODS USED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilise a report generated by the PMI software</td>
<td>20</td>
<td>6</td>
<td>10</td>
<td>36</td>
</tr>
<tr>
<td>Utilise a report generated by an internal report writer</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Utilise a manual register of duplicates that is maintained by clerical or other staff</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>No monitoring undertaken, or PMI incapable of running any sort of duplicate report *</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Other methods</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>11</td>
<td>21</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Respondents were able to select more than one option.

* This group of respondents generally indicated that their PMI system was incapable of running any sort of duplicate report.

Some of the respondents who did not monitor or who used other methods explained their selections thus:

- ‘Pathology (uses a different computer system with an interface to the main system) sends regular lists of duplicate numbers that they have detected’
- ‘Identified on a case by case basis when searching for a patient, that’s when we note if they have more than one UR number’
- ‘[We] also utilise benchmark duplicate KPI’s [key performance indicators] across the network’.

Duplicate files (per month)
The respondents’ estimates of the monthly number of duplicate patient files found in their PMI are shown in Table 5. They have been grouped for the purposes of data analysis. Nine facilities did not respond to this question. Four very ‘small’ facilities reported zero duplicates per month; it is noted that had the question asked for annual duplicates, a different response might have been received from these very low-activity facilities. Of the remaining 17 small facilities that responded, the range of monthly duplicates was 1-19, with a mean of 7.7 duplicates per month. When all the responses of small facilities are collapsed, the 21 respondents had a mean of 6.2 duplicates per month.

Ten medium size facilities responded and their range of duplicates was 1-30, per month, with a mean of 14 duplicates per month. Twelve of the ‘large’ facilities responded; the range across these facilities was 15-200, the upper and the mean was 51 duplicates per month. The upper level of the range (200 duplicates) was an outlier, as the next highest was 75 duplicates; when this outlier was excluded, the mean for the other large facilities was 38 duplicates per month.

Table 5: The estimated number and percentage of duplicate patient files found in PMIs

| NUMBER OF DUPLICATE PATIENT FILES, PER MONTH | SMALL FACILITY | MEDIUM FACILITY | LARGE FACILITY | TOTAL | PERCENTAGE (OF THE 42 RESPONDENTS)* | CUMULATIVE PERCENTAGE (OF THE 42 RESPONDENTS) *
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 duplicates</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>1 to 9</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>15</td>
<td>35.7</td>
<td>45.2</td>
</tr>
<tr>
<td>10 to 19</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>21.4</td>
<td>66.6</td>
</tr>
<tr>
<td>20 to 29</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>9.5</td>
<td>76.1</td>
</tr>
<tr>
<td>30 to 39</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>9.5</td>
<td>85.6</td>
</tr>
<tr>
<td>40 to 49</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4.8</td>
<td>90.4</td>
</tr>
<tr>
<td>50 to 99</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>7.1</td>
<td>97.6</td>
</tr>
<tr>
<td>≥ 100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>10</td>
<td>11</td>
<td>42*</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* 42 of the 51 respondents answered this question
Of the nine (17.6%) respondents who did not answer the question about the monthly number of duplicate files found, some provided comments instead and indicated difficulty in estimating a monthly rate of duplicate files because they use a duplicate patient file report on an ad-hoc (occasional; as needs) basis. One respondent from a large facility wrote ‘[duplicates occur in] 3.2% of patient registrations – based on an audit conducted in August 2003’ (nine months prior to this survey).

**Automatic matching**

Twenty-four (47%) of the respondent facilities had PMI software with the capability to match automatically, while 20 of the 24 actually utilise that capability. Just over half of the respondent facilities (n = 27, 52.9%) indicated either that their PMI software does not have the capability to match patient files automatically, or that they were not sure if it had this capability.

Fifty-eight percent of the respondent facilities use a deterministic algorithm, 17% use a rule-based algorithm, and 25% of respondents were not sure or did not know the type of matching algorithm used. The most sophisticated type of algorithm, ‘Probabilistic matching’, was not selected by any respondents.

**Attempted PMI data quality improvement activities**

Respondents were asked to identify the number and type of activities undertaken to improve PMI data quality and, where applicable, to identify reasons why such activities had not been undertaken. The most commonly selected data quality activity was ‘Purposeful search, identification and correction of duplicate patient files’ (n = 15): see Table 6.

### Table 6: Activities undertaken in the past two years to improve PMI data quality, by hospital size

<table>
<thead>
<tr>
<th>ACTIVITIES UNDERTAKEN IN PAST TWO YEARS</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>TOTAL OF THESE IMPROVEMENT ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purposeful search, identification and correction of duplicate patient files</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Implementation of new data capture tools, eg edits, mandatory fields</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Implementation of new search and registration processes</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Working towards implementation of Australian Standard Health Care Client Identification AS-5017</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Purposeful search and correction of missing and erroneous data items</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Facility-wide training of PMI users of patient search and registration practice</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No response</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Respondents nominated factors why no, or fewer than was desirable, PMI data quality improvement activities were undertaken in their facility. Table 7 shows that the most common reason was lack of staffing resources, followed by lack of IT resources. Most respondents (n = 30 or 58.8% of the respondents) indicated that their facility was not prevented them from undertaking any, or further, PMI data quality improvement activities.
Table 7: Factors preventing PMI data quality improvement activities from being undertaken, by facility size

<table>
<thead>
<tr>
<th>REASON *</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
<th>NUMBER AND PERCENTAGE OF RESPONDENT FACILITIES CHOOSING THIS OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of staffing resources</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Lack of IT resources and/or capabilities</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>The facility (governing body) does not perceive any benefits from improving PMI data quality*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Activities were completed just prior to the defined two-year period</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>No problems have been identified with the data quality of the PMI</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Not applicable / Not that I’m aware of</td>
<td>16</td>
<td>5</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>Other reasons not listed</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>13</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

* Note: Respondents could tick as many reasons as applicable to them

All PMI data quality aspects

The following is a selection of respondents’ comments on all data quality aspects of the PMI, including duplicate files:
- ‘[We are] waiting for a PAS (Patient administration system) replacement, as our older registration system doesn’t support good work practices which would improve data quality’
- ‘We routinely take errors in registrations back to the staff concerned so that they are aware of the consequences and clinical risks associated…’
- ‘[We are] technically unable to regularly run the potential duplicate report in-house. ’[We] do not have the clerical resources to merge all the records of duplicate unit record numbers.’

Intra- and inter-facility PMI data linkage and successes

An objective of the researchers was to gain insight to the intra- and inter-facility PMI data linkage practices and their success in terms of the resulting data quality. Table 8 shows the number of facilities that attempted each of the five data linkage activities. There were 82 attempts over the 51 facilities. Respondents rated their successes on a 5-point scale ranging from ‘Very successful’ to ‘Very unsuccessful’. Most attempted PMI linkage activities have occurred with intra-facility systems (n = 34) such as a pathology system. Eighty-two percent of the 51 facilities in the sample have attempted some PMI data linkage activities. Most attempts (81.7%) at data linkage were successful in terms of data quality.

Problems affecting PMI data linkage activities

Respondents were invited to select as many options as were applicable when indicating the greatest difficulty to overcome in PMI data linkage activities; see Table 9. The most common responses were:
- ‘[There is] a lack of information technology resources to support a linkage activity’ (n = 27, 53.0% of facilities); this was particularly a challenge for small facilities; and
- ‘[There is] a lack of staffing resources to support a data linkage activity’ (n = 20, 39.0% of facilities).

Additional reasons were provided by the following respondents.

Three large facility respondents:
- ‘PMI details are not updated at each episode.’
- ‘Limitations in PAS software require whole of surname search.’
- ‘Many unknown patients in the triage system in ED issued a new UR number, then cannot be merged while the inpatient episode is active.’

Two medium size facility respondents:
- ‘Poor data entry by staff in other areas.’
Reviewed articles

Table 8: Success rating of attempted PMI linkage activities

<table>
<thead>
<tr>
<th>PMI DATA LINKAGE ACTIVITY</th>
<th>NUMBER OF ATTEMPTS</th>
<th>VERY SUCCESSFUL</th>
<th>SUCCESSFUL</th>
<th>MEDIocre</th>
<th>UNSUCCESSFUL</th>
<th>VERY UNSUCCESSFUL</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a system within your facility</td>
<td>34</td>
<td>11 (32.4%)</td>
<td>16 (47.1%)</td>
<td>6 (17.6%)</td>
<td>1 (2.9%)</td>
<td>0</td>
</tr>
<tr>
<td>To a data repository within your facility</td>
<td>21</td>
<td>6 (28.6%)</td>
<td>12 (57.1%)</td>
<td>3 (14.3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To a separate PMI within your facility</td>
<td>12</td>
<td>2 (16.6%)</td>
<td>8 (66.6%)</td>
<td>2 (16.7%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To a PMI from a different facility within your network</td>
<td>7</td>
<td>3 (42.9%)</td>
<td>3 (42.9%)</td>
<td>1 (14.2%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To a PMI from a different facility within your alliance</td>
<td>5</td>
<td>0</td>
<td>4 (80.0%)</td>
<td>1 (20.0%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>1 (33.3%)</td>
<td>1 (33.3%)</td>
<td>1 (33.3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>23 (28.0%)</td>
<td>44 (53.7%)</td>
<td>14 (17.1%)</td>
<td>1 (1.2%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 9: The greatest challenges, in terms of PMI quality, in a PMI data linkage activity

<table>
<thead>
<tr>
<th>THE GREATEST CHALLENGES, IN TERMS OF DATA QUALITY, IN A PMI DATA LINKAGE ACTIVITY</th>
<th>SMALL FACILITY</th>
<th>MEDIUM FACILITY</th>
<th>LARGE FACILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>An excessive amount of duplicates existing in the PMI prior to linkage activity</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>A poor matching algorithm is used</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Incomplete and erroneous data in the PMI which would prevent probable linkages</td>
<td>4</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Differences in application of data standards from one PMI to the next</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>A lack of information technology resources to support a linkage activity</td>
<td>17</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>A lack of staffing resources to support a linkage activity</td>
<td>8</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>3 *</td>
<td>2 *</td>
<td>2 *</td>
</tr>
<tr>
<td>Total (challenges faced)</td>
<td>49</td>
<td>20</td>
<td>43</td>
</tr>
</tbody>
</table>
* These respondents provided other reasons.

• ‘Merge of the PMI resulted in many duplicates that are being systematically removed as clients present.’

Three small facility respondents.

• ‘There is always the potential for errors and breakdown to occur.’

• ‘Such an undertaking and not appreciated by management who dictate the above items (Pathology systems, data repository, etcetera). Subject to the decisions made by an IT alliance at a regional level. Generally, agreement is not easily obtained.’

• ‘Lack of recognition in various areas, of the need for accurate, complete data rather than rudimentary completion of fields.’

General comments

The following represent a cross-section of the comments on current and proposed future data linkage activities and feedback to the researchers, provided in the final open-ended question:

• ‘Our experience … has shown that merging PMIs has enormous workload implications. A great deal of planning needs to go into this.’

• ‘I have been surprised that many HIMs do not actively merge duplicates or look for them, and have let this process slide as they do not see it as “core business”. When staff resources are scarce this is the first thing that gets dropped. I see that in fact it should be a very important role of an HIS [department] as the problems that duplicates create is enormous both in clinical risk and the resources consumed.’
‘[We are] consistently endeavouring to improve the quality of data on the PMI. Standardisation on information on the PMI is becoming more important as data is used for other modes of communication, eg. SMS or email, outpatient appointment reminders.’

‘It is envisaged that we will develop a common health record over several campuses. Our computerised PMI will be the basis and essential tool with this merge. Should this occur, increased training and development would be required. We also utilise the computerised PMI for reference to destroyed, deceased and stored files.’

A number of respondents commented on the need for a state-wide, public hospital sector, unique patient identifier to facilitate PMI record linkage activities. In this context, several mentioned the Victorian Department of Human Services’ HealthSMART strategy as potentially offering the opportunity to address this issue.

Discussion

HIM role: technical and managerial

Almost all (92%) of those responsible for the PMI are HIM professionals. This statistic is consistent with the published literature; for example, AHIMA (1997a) recommends that responsibility for PMI maintenance should be centralised under the direction of HIM professionals, and that other healthcare facility employees responsible for PMI maintenance should be carefully trained and supported by appropriate documentation tools. Given the content of the HIMAA core competencies supporting University curricula for entry-level graduates, HIMs are well-positioned to understand the importance of the PMI and related data quality activities (HIMAA 2001).

There is not such consistency in relation to training of staff. It is noted that despite the overall responsibility by HIMs for the PMI, the majority of hospitals surveyed in this study reported PMI training practices that are decentralised, and there is not a standard PMI training tool for all staff in Victorian public hospitals. In the majority of the facilities surveyed, fewer than 50 staff members in each facility have the requisite capabilities for registering and updating patient details on the PMI. Therefore, HIMs appear to have responsibility for the PMI, but not for training staff who use it in a decentralised environment. This finding is also of interest in light of the AHIMA (1997a) recommendation that patient registration practices should remain centralised to ensure data quality.

A majority of facilities surveyed have PMI procedure manuals available to support users; this is consistent with recommendations of the AHIMA Taskforce (AHIMA – MPI Taskforce 2004). However, there is some room for improvement in the level of currency as approximately less than half had been updated or reviewed within the past year.

Automatic matching

Whilst 20 respondent facilities have, and use, PMI software with the capability to match patient files automatically, none indicated that the type of matching used was probabilistic. This contrasts with reported PMI features elsewhere (for example, see Acheson 1971; Gill 1997; Holman, Bass, Rouse & Hobbs 1999; New Zealand Health Information Service 2003; South Australian DHS 2000; 2002; 2003). However, the results in this study were consistent with the use of a deterministic ‘exact match’ algorithm. It is noteworthy that, whilst the AHIMA (1997b) states that probabilistic matching is far preferable (AHIMA 2004), the majority of healthcare facility patient information systems in the United States of America use deterministic algorithms which often result in false matches (AHIMA 2004).

PMI data quality improvement activities

The findings indicate that many Victorian public hospitals do not perform purposeful, routine data quality activities aimed at locating patient files; however it would appear that a considerable number of facilities do have PMI software with the capability to produce a report that identifies potential duplicates. Most of the facilities in the current study had undertaken only one activity aimed at improving PMI data quality within the previous two years. This suggests that data quality activities are not conducted as on-going or continuous processes. The fact that a lack of staffing and IT resources, were nominated by 33% and 18.6% of the respondents, respectively, as presenting barriers to undertaking PMI data
linkage activities is informative in identifying a need for future improvements. It is noted that the AHIMA practice briefs advise the need for an adequate staffing complement, relative to PMI size, to maintain and ensure data quality (AHIMA – MPI Taskforce 2004).

**Trends in intra- and inter-facility PMI data linkage**

Eighty-two attempted data linkage activities were reported, mostly internal to the individual facility. This finding supports the comments found in much of the reviewed literature that sharing health information internally across systems, and externally to the systems of other facilities, is becoming commonplace in the healthcare industry (Arellano & Weber 1998; Standards Australia 2002; Toth 1999; Victorian DHS 2003). Respondents also indicated that the majority of the attempted data linkage activities were successful in terms of the resulting data quality.

**Limitations of the research**

The study was limited to public sector, acute care facilities for several practical reasons: (i) to contain the scope and timeframe of the research within reasonable bounds; (ii) because private hospital data are not publicly available from the Victorian DHS; and (iii) there are time-consuming and onerous consent requirements for accessing private sector data. Acute separation data from the 2002-2003 financial year were used in sample selection because data for the 2003-2004 year had not been finalised by the DHS at the time the study commenced. The issues of privacy, confidentiality, and security of PMI and EPMI data were not addressed in this study.

**Conclusions and recommendations**

The results of this applied research are sufficient to inform the HIM profession and senior managers of Victorian public, acute healthcare facilities of a variability in PMI data quality maintenance and management. If the Victorian healthcare industry is to facilitate the sharing of health information in the future, then state-wide strategies are needed to address the identified lack of common practice. Furthermore, initiatives are required, to address the lack of resources faced by facilities awaiting strategies such as HealthSMART, to provide solutions to existing PMI-related problems.

A clear conclusion is that healthcare facilities in Victoria would benefit from the creation and implementation of state-specific data standards and PMI best practice guidelines similar to those of South Australia. These guidelines should be based on existing health information best practice publications such as Australian Standard AS 5017:2002 and the NHDD, and take into consideration the features and recommendations of other established projects. It would also be beneficial to establish a working party for this development, and to incorporate formal consultation with HIM professionals working in Victorian healthcare facilities, again along the lines of the South Australian model. Guidelines for the gamut of the PMI data quality activities noted in this research, such as standardised and centralised staff training programs, should be provided, with an expectation of mandatory participation. These publications should assist software vendors in providing adequate PMI software with probabilistic matching capability, extensive data capture features, and the capacity to produce sophisticated reports to support the monitoring of duplicate files.

The introduction of a unique patient identifier that could be utilised across public healthcare facilities in Victoria would facilitate record linkage activities. The authors are aware that this idea is encompassed in the HealthSMART strategy and, therefore, encourage the progress of this work.

Further research is needed to assess and compare this important aspect of health information management across other Australian states and territories, and in the private sector. It is evident that initiatives surrounding record linkage are being undertaken in other states, for example South Australia. More widespread research would enable a comparison of results to inform the Victorian facilities and, ultimately, to pave the way for more sophisticated, national linkages. It would also be valuable if, based on this and further research, HIMs were to establish threshold levels to assist in the monitoring of PMI data quality.
Acknowledgments
The authors thank the following persons: Fiona Carine, formerly of the Department of Human Services in South Australia, for her assistance in the initial exploration of this research idea; the staff of the Victorian public hospitals who responded to the survey questionnaire; and the Health Information Managers and other staff members of the Victorian Department of Human Services who provided the healthcare facility data files.

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AIHW – see Australian Institute of Health and Welfare.


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Patterns of first-coded complications in acute episodes of lung cancer care

Gayle Cantsilieris, Terri Jackson and Annette Street

Abstract
The objective of this research was to document the most common first-recorded adverse events of inpatient care for lung cancer in Victoria, Australia. The sample comprised record abstracts for 3642 admissions (overnight or longer) of adult patients with lung cancer, extracted from the Victorian Admitted Episodes Database for 2000-2001. The method involved analysis of diagnoses prefixed with ‘C’ (an indicator for diagnoses which arose only after hospitalisation), calculation of complication rates by intervention type, and analysis of complication type by intervention. Overall, 23% of episodes recorded at least one in-hospital complication, with highest rates for radiotherapy and surgical interventions. The highest surgical complication rates were for pneumonectomies, lobectomies, and lung resections. Nausea and vomiting were the most common first-recorded complications for both chemotherapy and radiotherapy. It was concluded that complications through the use of morbidity data may offer a timely and economical method for health care organisations to screen large numbers of patient episodes.

Keywords (MeSH):
Lung cancer; administrative data; complications; adverse effects; cancer therapy

Introduction
Lung cancer is a major public health burden and remains the leading cause of cancer related mortality in Australia (Australian Institute of Health & Welfare and Australasian Institute of Cancer Registries 2004). A range of therapies are used separately and in combination to improve the possibility of cure or increase the likelihood of remission. As lung cancer is often diagnosed late, much of the therapeutic intervention is palliative. Thus patients are faced with not only a life-limiting illness with a poor prognosis, but also the adverse effects of treatments which may provoke more fear and dread in sufferers than the disease itself. For this reason, there is a need to understand more about the prevalence of common adverse events and complications of treatment, in order to develop quality care interventions for these patients. This paper demonstrates an alternative approach to identifying adverse events through the use of morbidity data extracted from the Victorian Admitted Episodes Database for 2000-2001.
historical and cultural factors influencing the prevalence of tobacco smoking in the population (Giles & Thursfield 2002). Although a number of environmental and genetic factors are implicated in the development of lung cancer, a number of studies have established clear evidence that tobacco smoking is the main agent responsible for the majority of lung cancers (Parkin et al. 1994; Ridolfo & Stevenson 2001; Vineis et al. 2004).

Lung cancer is a debilitating disease and interventions such as surgery, radiotherapy and chemotherapy are themselves debilitating. In such vulnerable patients, even minor complications can be life threatening and compromise quality of life. It is important, therefore, to document common complications acquired during treatment and to focus efforts to improve patient safety and quality of care. Much of what we do know of adverse events in hospitalised patients, is as a result of studies based on record review (Leape et al. 1991; Wilson et al. 1995). Although considered the ‘gold standard’, record review is a method too expensive and time consuming to be easily used for monitoring complications and adverse events.

This study demonstrates the use of an alternative method, using coded administrative data routinely collected by hospitals and submitted to State health departments, as a tool to identify common adverse events found in lung cancer episodes of care. Coded data from administrative databases have previously been used to describe cancer incidence and prevalence, and in monitoring quality of care outcomes (Barzilai et al. 2004). As such, they provide an alternative method to record review that is timely and relatively low cost.

Data and methods
The study sample consisted of a subset of inpatient record abstracts drawn from the Victorian Admitted Episodes Database (VAED) for the period 1 July 2000 – 30 June 2001. These data represent admitted multi-day episodes of care of patients over 18 years of age with a principal diagnosis of lung cancer. The principal diagnosis is defined as: The diagnosis established after study to be chiefly responsible for occasioning the patient’s episode of care in hospital (National Centre for Classification in Health 2000a). Records for lung cancer patients admitted for treatment of other conditions are thus not included in this sample.

Same day cases were excluded on the basis of a previous study (Jackson et al. 2006) that found a significantly lower rate of complications in same day episodes (0.4%), compared to multi day episodes (11.5%). Complications of care for same day patients are typically diagnosed only after discharge from hospital, and thus analysis of incident cases would under-count these complications. As 20% of the cases in the sample were identified as same day, there was concern the lower rate of complications from such a large number of cases would bias the study findings. The final study sample size was n = 3642 records.

Males accounted for 61% of episodes and females 39%. The highest frequencies of episodes were for persons in the 70-74 year age group. These represented 22% of all episodes.

Incident complications were identified through the use of a prefix, which is attached to each diagnosis code by trained coders at the time of record abstraction. In Victoria, there are a number of State additions to the National Coding Standards (National Centre for Classification in Health 2000a). One important addition governs the mandatory assignment of prefixes to each diagnosis code (Victorian Department of Human Services 2000). The prefixes used are: P- Primary, A- Associated or M- Morphology (used with neoplasm coding) and C- Complication.

Through the use of these prefixes, any diagnosis can be distinguished as pre-existing (i.e. present at the time of admission: P, A or M) or classed as a new condition acquired while in hospital (C). The ‘C’ prefix denotes any new condition that was not present on admission and which required additional treatment or extended length of stay. This corresponds closely to the definition of ‘adverse event’ recommended by the Australian Council on Safety and Quality in Health Care: ‘An incident in which unintended harm resulted to a person receiving health care’ (Australian Council on Safety and Quality in Health Care 2005). In this paper we use the terms ‘adverse event’ and ‘complication’ interchangeably. While we are not able to distinguish causative ‘incidents’ from the data, the analysis...
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clearly shows that complications are related to patterns of patient care.

In addition to the ‘C’ prefix, a group of ICD-10-AM codes are designed explicitly to capture complications of care. These codes occur in the range [T80 – T88.9], or if the complication is considered medically important in its own right, may occur at the end of relevant ‘chapters’ (body-system divisions of ICD-10-AM) and are therefore referred to as ‘End of Chapter codes’.

Coding standards also specify that the injury codes must identify the cause of the event or injury and the place where the event or injury occurred. These are called ‘external cause codes’ and are sequenced after complication codes in the range [Y40-Y84.9] (National Centre for Classification in Health 2000b).

For this analysis, only the first recorded C-prefixed code on each abstract is analysed, although up to 24 fields may be used for recording complications of care and other additional diagnoses. Thus, incidence measures reported here relate only to episodes, and not to the incidence of individual complications. Analysis of multiple codes on records would require consideration of complex patterns of coding which arise from multiple codes which are required for coding external causes of injury.

**Grouping of procedures and intervention codes**

A frequency table was generated for the principal procedure field in each record. Each procedure or intervention was grouped into one of eight major categories: Medical, Minor surgical, Surgical, Chemotherapy, Radiotherapy, Scans and Imaging procedures, Allied Health, and Other miscellaneous procedures.

Operative procedures were grouped according to the type and intensity of the intervention: Pneumonectomy, Lobectomy, Lung resections, Other lung procedures, and Non-lung procedures. A full report of code assignment is available from the authors.

**Grouping of complication codes**

The first recorded ‘C’ prefixed diagnosis on each record was used to generate a frequency table identifying the number and type of complications found. Each complication code was then grouped into one of 15 major categories (shown in Table 4 below).

The categories were generally based on body system, apart from procedural/post procedural complications, metabolic imbalances, signs and symptoms, and those complications numerous and severe enough to be distinguished in their own right. These included infection/sepsis, cellulitis/decubitus ulcers, pneumonia, and drug complications.

**Results**

Table 1 summarises the major findings of the study, with Table 2 providing a breakdown of complication rate by intervention modality, and
Tables 3 and 4 showing details of complication categories by intervention modality and type.

### Table 1: Results summary

- The mean complication rate for the sample was 23%.
- Records with an intervention accounted for 83% of episodes, with surgical procedures accounting for 32% of all episodes, chemotherapy 19%, and allied health interventions 15%, radiotherapy 8%, scans and imaging 7%, and transfusions 3%.
- Seventeen per cent of episodes had no procedure or intervention recorded.
- Radiotherapy recorded the highest overall complication rate (36%), followed by surgical procedures (34%).
- Higher complication rates were associated with more invasive surgical procedures: pneumonectomies 62%, lobectomies 51%, and lung resections 51%.
- The most common complications for both radiotherapy and chemotherapy were nausea and vomiting. Oesophagitis and candidal stomatitis were also frequently found in radiotherapy episodes.

### Complication rates by treatment modalities

#### Radiotherapy

Table 2 shows radiotherapy episodes had the highest complication rate at 36%, with only 8% of the sample receiving this treatment modality.

#### Table 2: Treatment modality by percent of episodes and by rate of any complication

<table>
<thead>
<tr>
<th>INTERVENTION TYPE</th>
<th>% OF EPISODES</th>
<th>% ANY COMPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiotherapy</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>Surgical procedures</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>Allied health interventions</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Transfusions</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Scans and imaging</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>No procedure</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Total episodes</td>
<td>100</td>
<td>23</td>
</tr>
</tbody>
</table>

* Percentages rounded
Digestive system complications were recorded in 19% of radiotherapy episodes. Of these, oesophagitis and candidal stomatitis were the most frequent. Radiotherapy episodes had a significantly higher rate of oesophagitis or candidal stomatitis than other treatment episodes ($\chi^2 = 120.399; \ p < 0.000$).

Pneumonia was the most commonly recorded respiratory system complication associated with radiotherapy episodes, followed by respiratory distress/collapse. These accounted for 8% and 5% of radiotherapy complications respectively.

Surgical complications
Surgical interventions were the most frequent amongst these admitted patients (32% of episodes), and also showed one of the highest rates of complications, at 34% of surgery cases.

Of the surgical episodes with complications, 31% had a procedural or post procedural complication. Procedural/post-procedural adverse event codes specifically indicate ‘a condition or injury, which is related to a surgical/procedural intervention rather than the patient’s disease process’ (National Centre for Classification in Health 2000a: p. 217). The procedural/post-procedural complications were predominantly respiratory disorders (13% of all surgical episodes), subcutaneous emphysema (5%), haemorrhage and laceration (3%), and post-procedural infection (3%).

Other common complications in the surgical category included circulatory system disorders (19%), and respiratory system disorders (11%) (Table 4). Non-procedural complications (e.g. respiratory, infection/sepsis) are assigned a different code to those in the procedural/post-procedural category, to indicate that documentation did not exist to link the complication directly to the intervention, or when it clearly arose as a result of the patient’s disease process.

Complications by specific surgical procedure
Table 3 shows that the rate of complications is related to the invasiveness of the surgical procedure, and that procedural/post-procedural and circulatory complications are the most common first-recorded complications.

Pneumonectomy
Pneumonectomy is a major surgical procedure that entails the removal of a whole lung. The 62% complication rate reflects the invasive nature of the procedure.

Procedural/post-procedural adverse events accounted for 38% of all pneumonectomy complications. Two complication types predominated: haemorrhage or laceration (14% of all pneumonectomy complications), and subcutaneous emphysema (another 14%).

Forty-three percent of pneumonectomy complications were related to the circulatory system, and the largest sub-group of these were arrhythmias (24% of all pneumonectomy complications).

Lung resections
Lung resections are less invasive than pneumonectomies and involve surgically excising part of the lung. More than half of the resection episodes entailed an adverse event, and over 40% of these were procedural/post-procedural. The largest sub-groups were post-operative respiratory system disorders (15% of resection procedural complications) and acquired subcutaneous emphysema (7%). Other complications included anaemia and urinary retention (7% of complicated resection episodes, respectively), and pneumothorax and cardiac arrhythmias (6% of complicated resection episodes, respectively).

Lobectomies
Lobectomies are the least invasive of the lung procedures and involve removal of part of the lung. Adverse events were recorded in more than 50% of lobectomy episodes, and procedural/post-procedural respiratory sub-category disorders were again the most common, accounting for 14% of adverse events. Cardiac arrhythmias made up another 13% of lobectomy complications, and ‘other’ circulatory system disorders, a further 7%.

Biopsies
Forty-three per cent of biopsy complications were in the procedural/post-procedural category and, of these, respiratory disorders were the most common and accounted for 33% of complicated episodes. A further 7% of biopsy adverse events were pneumothorax.
Chemotherapy
The recorded complication rate for chemotherapy episodes was 12% (Table 2). This was the second lowest complication rate in comparison to other interventions, but may be underestimated for short episodes where symptoms develop only after discharge and would thus be unrecorded.

Table 4 shows 26% of chemotherapy episodes with a recorded complication were assigned to the signs and symptoms category. Within this category, the most common first-recorded complications were nausea and vomiting (12% of chemotherapy complications) and skin complications (5%).

Results also indicated circulatory system complications, metabolic complications, and psychological disorders were recorded in 14%, 11% and 7% of chemotherapy episodes with a complication, respectively.

Table 3: Surgical Principal Procedures

<table>
<thead>
<tr>
<th>COMPLICATION TYPES</th>
<th>SURGICAL PRINCIPAL PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural/Post procedural cc's</td>
<td>PNEUMONECTOMY</td>
</tr>
<tr>
<td>Prosthetic cc's</td>
<td>38.1%</td>
</tr>
<tr>
<td>Haemorrhage/Laceration CC's</td>
<td>14.3%</td>
</tr>
<tr>
<td>Post procedural respiratory cc's</td>
<td>4.8%</td>
</tr>
<tr>
<td>Post procedural circulatory cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Post procedural cc's to other sites</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other post procedural cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Post procedural infection</td>
<td>4.8%</td>
</tr>
<tr>
<td>Post procedural subcutaneous emphysema</td>
<td>14.3%</td>
</tr>
<tr>
<td>Circulatory system cc's</td>
<td>42.9%</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>4.8%</td>
</tr>
<tr>
<td>Angina</td>
<td>0.0%</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>23.8%</td>
</tr>
<tr>
<td>Cardiac failure</td>
<td>0.0%</td>
</tr>
<tr>
<td>Embolism</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other circulatory cc's</td>
<td>14.3%</td>
</tr>
<tr>
<td>Respiratory system cc's</td>
<td>4.8%</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>0.0%</td>
</tr>
<tr>
<td>Respiratory distress/collapse</td>
<td>0.0%</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>4.8%</td>
</tr>
<tr>
<td>COAD/Emphysema</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other respiratory cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Signs &amp; Symptoms</td>
<td>4.8%</td>
</tr>
<tr>
<td>Urinary system cc's</td>
<td>4.8%</td>
</tr>
<tr>
<td>Retention</td>
<td>0.0%</td>
</tr>
<tr>
<td>UTI</td>
<td>4.8%</td>
</tr>
<tr>
<td>Other urinary system cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Metabolic cc's</td>
<td>4.8%</td>
</tr>
<tr>
<td>Digestive system cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Blood cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Anaemia</td>
<td>0.0%</td>
</tr>
<tr>
<td>Thrombocytopenia/Coagulation defect</td>
<td>0.0%</td>
</tr>
<tr>
<td>Psychological cc's</td>
<td>0.0%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0.0%</td>
</tr>
<tr>
<td>Falls &amp; Injuries</td>
<td>0.0%</td>
</tr>
<tr>
<td>All other complications</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percent of episodes with any complication</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Percent of episodes with any complication: 61.8%
Allied Health interventions

Allied health interventions were associated with a complication rate of 25% (Table 2), although most complications would be related to interaction between patient condition and the medical care provided in the episode, rather than to the allied health intervention itself. In these episodes, no curative or therapeutic interventions such as surgery, chemotherapy or radiotherapy were undertaken. Coding standards mandate a hierarchical sequencing of procedure codes, with coding of allied health interventions only after more invasive modalities have been coded. Had there been surgery or radiotherapy in this group of episodes, they would have been coded as the principal procedure before the allied health intervention code.

The data in Table 4 show 16% of allied health episodes with complications had a digestive system disorder as the first C-prefixed complication, followed by the circulatory system (15%) and the respiratory system (13%). Eleven percent of complications in patients receiving only allied health interventions were in the signs and symptoms category.

Table 4: Patterns of complication type by treatment modality (principal procedure)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>RADIO- THERAPY</th>
<th>SURGERY</th>
<th>CHEMOTHERAPY</th>
<th>SCANS &amp; IMAGING</th>
<th>ALLIED HEALTH</th>
<th>TRANSFUSIONS</th>
<th>OTHER PROCEDURE</th>
<th>NO RECORDERED COMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural/Post procedural</td>
<td>1.0</td>
<td>30.9</td>
<td>2.5</td>
<td>---</td>
<td>3.7</td>
<td>1.6</td>
<td>50.0</td>
<td>15.8</td>
</tr>
<tr>
<td>Circulatory system</td>
<td>9.5</td>
<td>19.4</td>
<td>13.8</td>
<td>20.6</td>
<td>14.9</td>
<td>15.8</td>
<td>---</td>
<td>11.3</td>
</tr>
<tr>
<td>Digestive system</td>
<td>19.0</td>
<td>4.8</td>
<td>7.5</td>
<td>11.8</td>
<td>15.7</td>
<td>5.3</td>
<td>50.0</td>
<td>17.7</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>11.4</td>
<td>11.5</td>
<td>7.5</td>
<td>8.8</td>
<td>12.7</td>
<td>10.5</td>
<td>---</td>
<td>11.3</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>7.6</td>
<td>1.8</td>
<td>1.3</td>
<td>5.9</td>
<td>4.5</td>
<td>---</td>
<td>---</td>
<td>16.1</td>
</tr>
<tr>
<td>Signs &amp; Symptoms</td>
<td>25.7</td>
<td>9.2</td>
<td>26.3</td>
<td>17.6</td>
<td>11.2</td>
<td>15.8</td>
<td>---</td>
<td>9.7</td>
</tr>
<tr>
<td>Injuries &amp; Falls</td>
<td>2.9</td>
<td>1.5</td>
<td>1.3</td>
<td>5.9</td>
<td>5.2</td>
<td>---</td>
<td>---</td>
<td>3.2</td>
</tr>
<tr>
<td>Metabolic</td>
<td>4.8</td>
<td>5.4</td>
<td>11.3</td>
<td>8.8</td>
<td>4.5</td>
<td>5.3</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Urinary system</td>
<td>4.8</td>
<td>5.9</td>
<td>3.8</td>
<td>8.8</td>
<td>8.2</td>
<td>5.3</td>
<td>---</td>
<td>12.9</td>
</tr>
<tr>
<td>Blood</td>
<td>5.7</td>
<td>2.3</td>
<td>2.5</td>
<td>---</td>
<td>1.5</td>
<td>15.8</td>
<td>---</td>
<td>1.6</td>
</tr>
<tr>
<td>Psychological</td>
<td>1.0</td>
<td>2.3</td>
<td>7.5</td>
<td>---</td>
<td>2.2</td>
<td>10.5</td>
<td>---</td>
<td>1.6</td>
</tr>
<tr>
<td>Cellulitis/Decubitus ulcers</td>
<td>---</td>
<td>1.0</td>
<td>5.0</td>
<td>2.9</td>
<td>4.5</td>
<td>5.3</td>
<td>---</td>
<td>1.6</td>
</tr>
<tr>
<td>Infection/Sepsis</td>
<td>1.0</td>
<td>1.3</td>
<td>3.8</td>
<td>2.9</td>
<td>0.7</td>
<td>---</td>
<td>---</td>
<td>1.3</td>
</tr>
<tr>
<td>Adverse effects of drugs</td>
<td>1.0</td>
<td>0.8</td>
<td>---</td>
<td>---</td>
<td>3.0</td>
<td>5.3</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Other</td>
<td>4.8</td>
<td>2.0</td>
<td>6.3</td>
<td>5.9</td>
<td>7.5</td>
<td>5.3</td>
<td>---</td>
<td>11.3</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Total count</td>
<td>105</td>
<td>392</td>
<td>80</td>
<td>34</td>
<td>134</td>
<td>19</td>
<td>2</td>
<td>62</td>
</tr>
</tbody>
</table>

Scans and Imaging

Table 4 shows that 21% of first-recorded complications in these episodes involved the circulatory system, followed by 18% in the signs and symptoms category. Table 2 shows the relatively low overall complication rate in this category of 14%.

Transfusions

All transfusion procedures were for blood products. Only 19 episodes of the total 108 episodes for transfusions were recorded with a complication (17.6%). Of these, blood disorders, circulatory system complications, and disorders in the signs and symptoms category accounted for 16% of episodes for each category respectively.

Episodes without an intervention or procedure

In episodes where no procedure or intervention was recorded, the overall complication rate was a relatively low 10% (Table 2). In these episodes digestive system disorders, followed by hospital-acquired pneumonia and urinary system disorders, accounted for 18%, 16% and 13% of first-recorded complications respectively.
Discussion

Lung cancer represents an important area of morbidity and mortality, and continued efforts must be made to reduce the occurrence of preventable complications to improve quality of life for patients. Although a number of studies have attempted to ascertain the frequency of complications associated with lung cancer treatment, few have focussed on identifying adverse events of cancer treatment from administrative databases. Instead these have been used to evaluate outcomes of lung cancer surgery (Romano et al. 2002; Romano & Mark, 1992; Whittle et al. 1991).

Early research into the use of administrative data to screen for preventable complications of care relied on particular ICD-9-CM (International Classification and Diseases 9th revision, Clinical Modification) codes that specifically identified adverse events. Confounding the researcher’s work, however, was an inability to distinguish, clearly, complications from co-morbidities (Iezzoni et al. 1994). This limitation was especially apparent with identifying medical complications arising after the episode of care commenced, and determining whether such a condition actually arose as a result of the hospitalisation (Lawthers et al., 2000).

Few studies have been able to distinguish separately complications arising after the hospitalisation from co-morbidities. Two early studies (Naessens et al. 1991; Roos, Stranc, James & Li, 1997) used an indicator variable to distinguish whether the complication occurred after the patient’s admission or was in fact present on admission. The study outcomes, however, were not to assess rates of complications, but to assess relative risk.

In Victoria, the use of a prefix attached to the diagnosis code allows the researcher to distinguish additional diagnoses that occur after the patient's admission from coexisting conditions the patient had at the time of admission. Jackson et al. (2006) used the Victorian Admitted Episodes Database from 2000-2001 to compare rates of adverse events using the Victorian C-prefix compared with use of International Classification of Diseases and Related Health Interventions, 10th revision, Australian Modification (ICD-10-AM) diagnosis codes alone.

The overall rate of complications found in this study was 8.25%, similar to those reported from record review. Using ICD-10-AM codes alone, however, researchers found a rate of 4.85%.

O’Hara and Carson’s (1997) study attempted to identify complications from diagnosis codes alone, and found a similar complication rate of 5%. Part of this study was replicated using the Alfred Hospital’s morbidity data, and researchers demonstrated the value of using the data for monitoring a range of adverse events and as an indicator to estimate the frequency of adverse events (Carroll, Mclean & Walsh 2003).

In this study we aimed to explore the type of common complications recorded in routine medical record abstracts for various treatment modalities in lung cancer inpatient care, and to compare these with the clinical literature on such complications.

Radiotherapy

Radiotherapy is the most common treatment modality in lung cancer (Price 2003), used to control the spread of disease or to provide palliation. As is also true for chemotherapy, consideration must be given to the effects of the therapy on healthy tissue as adverse effects are dependent on factors such as the size of the area to be treated and the proximity to vital organs (DeLaney 2002).

The severity of nausea and vomiting in radiotherapy treatment are related to the total radiation; for example almost 100% of patients undergoing total body irradiation will experience these symptoms compared to 10 - 30% who only have radiation of the cranium (Schnell, 2003).

In the current study, nausea/vomiting and stomatitis/oesophagitis, were identified as the leading types of complications of radiotherapy episodes, consistent with the literature. Oesophagitis generally occurs two – three weeks after treatment begins, although toxicity to the oesophagus may occur sooner if concurrent chemotherapy is being administered (Knopp 1997; Price 2003) as this treatment sensitises the tissues to radiation (Yeh et al. 2004). Our study found radiotherapy episodes had a significantly higher rate of oesophagitis or candidal stomatitis than other treatment episodes ($\chi^2 = 120.399; p<0.000$).
Fatigue is also commonly reported in the literature, with nearly all patients experiencing this to some degree, regardless of the size of the treatment area (Armes, Krishnasamy & Higginson 2004; Sitton 1997). We found no recorded episodes of fatigue common to both radiotherapy and chemotherapy. This is likely to be due to the condition already being present when the episode commenced and hence not flagged as a ‘new’ complication, or becoming apparent only after discharge. The high rate of complications in radiotherapy can be explained if we consider that it has a major role in palliation (Haas 2003).

Pulmonary complications such as radiation pneumonitis can be difficult to diagnose clinically, masking the true incidence (Monson et al., 1998). Symptoms such as dyspnea with new or worsening cough or fever are indicators of radiation pneumonitis, with manifestation of symptoms occurring one to three months after completion of therapy (Knopp, 1997). In lung carcinoma patients the incidence varies, and this may be attributed to difficulty in obtaining a definitive clinical diagnosis as dyspnea and fever may develop from a variety of causes (Monson 1998). Our study found no record of radiation pneumonitis, as these late complications would not be recorded in acute episodes, unless the patient was hospitalised for a long enough period for them to become apparent before discharge.

**Lung cancer surgery**

For those patients undergoing lung cancer surgery, there is agreement in the literature that the majority of complications reported are respiratory and cardiovascular (Licker et al. 2002; Nagasaki, Flehinger & Martini 1982; Stephan et al. 2000; Uramoto et al. 2001); however, post operative complication rates overall show great variation. Nagasaki et al. (1982) found a complication rate of 19%, while Licker et al. (2002) reported a complication rate of 47%. These variations have been attributed to differences in defining the type of complication studied and differences in the functional status of the patient (Stephen 2000). Additionally the burden of co-existing diseases in each patient impacts on their ability to better tolerate invasive procedures; selection criteria therefore will also influence overall complication and survival rates (Pearson 1999).

Our study found an incident complication rate for lung surgery of 34%, well within the range found in other studies. Similarly, we found that the largest group of post-operative surgical complications were cardio-respiratory in nature. We also found that procedural and post-procedural complications represent nearly a third of surgical adverse events, many with cardiac or respiratory consequences.

As would be expected, we found that the rate of adverse events varies with the extent of surgery, more invasive procedures such as pneumonectomy incurring the highest complication rate. We did not investigate the burden of coexisting disease in these episodes.

**Chemotherapy**

Chemotherapy also is an important treatment modality for lung cancer, and research is continuing to explore new drug regimes (often combined with radiotherapy) in an effort to improve the outcome of those with the disease (DeLaney 2002; Rathore & Weitberg 2002). Chemotherapies target rapidly dividing cells and these include the bone marrow, gastrointestinal mucosa and hair follicles, decreasing the body's ability to replace cells that have died (Wilkes 1996). Interference with the normal production of these cells therefore may lead to severe complications from infection, haemorrhage, anaemia, and fatigue (Wilkes 1996). Our study found only one episode each for anaemia and neutropenia in the chemotherapy group. Given that three per cent of all episodes in the sample were for blood transfusions, it is likely that these complications were already present when the patient was admitted. Our focus on incident (rather than pre-existing) complications would not have identified those present on admission.

Adverse effects of treatment may also be seen on all organs susceptible to the particular drug being used, as chemotherapy does not distinguish between healthy cells and malignant cells (Walker 2003). These include cardiovascular complications, metabolic imbalances due to chemical destruction of the tumour cells (Yeh et al. 2004), and symptomatic type complications such as
nausea and vomiting. Our study found cardiovascular conditions, nausea/vomiting, and metabolic conditions to be the most frequent complications for these inpatient chemotherapy episodes, consistent with the expected pattern of chemotherapy complications.

Differences in the types of complications found in radiotherapy and chemotherapy episodes can be explained by factors governing the coding process. We extracted only the first ‘C-prefixed’ code on the record. However, it is likely that there is more than one complication code (or sequence of codes) on most records, and different patterns might emerge if all codes were considered.

A second explanation is that there is no coding standard governing the sequencing of complications, although clinical coders are directed to sequence the more significant ones higher in the string. However, given the wide range of symptomatic type complications common in chemotherapy, choosing the most significant may be problematic for coders.

Other intervention types
The relatively high rate of complications for episodes with allied health as the principal procedure may reflect the palliative nature of these admissions, with patients at a later stage of the disease. Diagnostic interventions such as scanning and imaging are likely to occur earlier in the disease process, and are associated with much lower rates of complications.

Methodological limitations and strengths of the research
Much of chemotherapy and radiotherapy is provided on a day-case or outpatient basis. Because of the short follow-up available for coding complications, these two groups were excluded from our study; therefore the frequency and type of complications commonly found in these episodes remain unknown.

In addition, our study only extracted the first complication code in the record. While the number of episodes reporting any complication is reliably identified by this method, the overall frequency of different complication types is not known and hence rates for particular complications may be under-reported.

Other issues that may affect the validity of the data include poor documentation in the medical record, incomplete abstraction from the medical record, or organisational factors that limit coding to those conditions that affect diagnosis related group (DRG) assignment. Considerable variation exists in coding depth by hospitals (Jackson et al. 2006) and this would impact on the number of complications that are recorded. Finally, we do not know severity or stage of disease in our sample, characteristics that may also influence the rate of complications in the various groups.

However, the strengths of this study and others using incidence-flagged data lie in their value as a screening tool. Currently, no method exists for hospitals to screen routinely for new complications acquired within the episode of care, and for which the care team should accept responsibility. Record review, considered the ‘gold standard’, is too time consuming and expensive and therefore not amenable to screening large numbers of records in a timely way to assist in quality assurance programmes. Additionally, the data reflect population-based characteristics and are therefore not subject to selection bias inherent in some prospective studies.

Conclusions
Identifying common complications in cancer therapies is essential to improving quality of care and reducing adverse effects of such therapies. Screening of morbidity data may offer a timely, economical method for health care organisations to review large numbers of records and use comparative rates of complications to target their quality assurance efforts.

Further improvements in coding standards to guide code assignment and sequencing will improve the validity of the data. Additional diagnoses, such as those analysed here, are a desirable component to enrich the database for research. The Victorian Department of Human Services has recently increased the number of diagnosis fields to 40 per abstract, and this increase in the number of available coding fields will also improve the quality of the data.

Ongoing monitoring of complications and adverse events is an essential component of high quality cancer care. Readily available and good quality data may provide the means to ensure
health care organisations are able to incorporate such improvement strategies into their frameworks to ensure the well being of patients already burdened with debilitating illness.

References


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Coding and DRG relationships in stroke and transient ischaemic attack (TIA)

Shyamala Nadathur and Andrea Groom

Abstract
The selection of cohorts from national and state databases in Australia usually relies on patient diagnoses according to International Classification of Disease (ICD) codes and/or Diagnosis Related Groups (DRGs). The aim of this study was to select a specific cohort consisting of stroke and transient ischaemic attack (TIA) episodes, thereby allowing the researcher to examine current process of care using State level hospital admissions datasets. Difficulties in accurately selecting the specified cohort were encountered, due to various interpretations of ICD codes and DRGs as well as the placement of codes to DRGs and different classifications used. These difficulties highlighted several issues regarding the relationships between ICD coding and DRGs in stroke and TIA and are the focus of this paper.

Keywords (MeSH):
Cerebrovascular accident; ischemic attack, transient; International Classification of Diseases; Diagnosis-Related Groups; hospital records; medical records

Introduction
Routinely collected State-wide and national datasets of hospital admissions are increasingly being used for epidemiological, quality of care, benchmarking and cost studies (Roos, Menec & Currie 2004; Scott, Youlden & Coory 2004). The selection of cohorts from these datasets usually relies on Diagnosis Related Groups (DRGs) (Kugler et al. 2000; Evers et al. 2002) and/or the patient diagnoses as classified according to International Classification of Disease (ICD) codes (Ellekjaer et al. 1999; Lee, Somerford & Yau 2003).

DRGs are a means of classifying a variety of diagnoses and procedures ICD codes into groups. One of the three main criteria of a DRG classification system is that the episodes in each DRG are clinically meaningful – that is, the diagnostic cluster should be clinically significant. Therefore, it is not unreasonable to expect that, for instance, a selection of ‘stroke’ and ‘transient ischaemic attack’ (TIA) DRGs, and hence the codes contained within them, would provide all of the relevant admissions from the dataset.

This paper reports the problems encountered in the selection of the cohort for an analysis of stroke and TIA process of care in acute hospitals using multiple year, state-level, hospital admissions datasets. The issues discussed here include discrepancies in how ICD codes are classified to stroke and TIA DRGs; working with several DRG classifications with different axes; and coder variance in the selection of ICD codes and DRGs for stroke and TIA. The latest version of the DRG was checked for amendments that correct some of the reported inconsistencies.

Method
The Victorian Admitted Episodes Dataset (VAED) for the financial years 1999/2000, 2000/2001 and 2001/2002 was the source of the cohort of stroke and TIA for the study. For the purpose of this study stroke syndrome is defined as ‘a symptom complex caused by a disorder of the blood vessels serving the brain, with impaired blood supply and ischaemia...called also stroke, cerebral vascular accident, and cerebrovascular accident’ (O’Toole, 1992: p. 1424). A transient
Ischaemic attack is defined as a temporary attack, often a precursor to a stroke (O’Toole 1992).

For this study, stroke and TIA ICD codes and DRGs were selected in consultation with clinicians and coders. As DRGs should represent clinically significant clusters, first the coders were asked to select the relevant ‘stroke’ and ‘TIA’ DRGs. Second, the ICD codes included within these DRGs were reviewed with clinicians for face validity. It was recognised that the first two steps did not provide a complete list and so step three was applied, whereby all relevant stroke and TIA ICD codes were selected in consultation with coders and clinicians. ICD-9-CM codes selected were also mapped to the equivalent ICD-10-AM code. A fourth step was required to determine the DRGs for the codes in step three.

Three DRG versions were used during the study timeframe, namely (v) 3.1 (Commonwealth Department of Health and Family Services 1996), 4.1 (Commonwealth Department of Health and Aged Care 1998) and 4.2 (Commonwealth Department of Health and Aged Care 2000). The AR-DRG v4.1 classifies stroke patients into four DRGs rather than the two found in v3.1 (namely DRG 37 and 38 ‘Cerebrovascular disorder except TIA’). Within version 4.1 the groups include B70A ‘Stroke with severe or complicating diagnosis/procedure’, B70B ‘Stroke with other complication or comorbidity’, B70C ‘Stroke without other complication or comorbidity’ and B70D ‘Stroke died or transferred < 5 days’. DRG 37 of v3.1 has been reclassified into B70A and B70B, and DRG 38 maps to B70C. TIA patients are classified to DRGs 67, 68 and 69 ‘TIA and precerebral occlusion’ in AN-DRG v3.1; and adjacent DRG B69 ‘TIA and precerebral occlusion’ in AR-DRG v4.1 and v4.2.


At the conclusion of the study, the latest version of the DRG (AR-DRG v5.0) was also checked for amendments that would correct some of the reported inconsistencies.

**Results**

The issues encountered when choosing stroke and TIA codes and the relevant DRGs are listed below.

**Codes not representing ‘stroke’ found in AR-DRG v4 and v5.0 stroke DRGs**

In the stroke DRGs there were ICD codes not describing stroke, such as ‘Encephalopathy’ (G93.4), ‘Other specified disorders of brain’ (G93.8) and ‘Disorders of brain, unspecified’ (G93.9). Table 1 (below) lists non-stroke codes in stroke DRGs.

<table>
<thead>
<tr>
<th>Code Description (ICD-10-AM)</th>
<th>AR-DRG V4.1</th>
<th>AR-DRG V4.2</th>
<th>AR-DRG V5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other systemic atrophy affecting CNS in neoplastic disease (G13.1)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Transient global amnesia (G45.4)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Encephalopathy unspecified (G93.4)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Other specified disorders of brain (G93.8)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Disorders of brain unspecified (G93.9)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Other specified disorders of the CNS (G96.8)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Diseases of the CNS NOS (G96.9)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Other disorders of the nervous system, not elsewhere classified (G98)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction (I66.x)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Cerebral aneurysm, non ruptured (I67.1)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Cerebral atherosclerosis (I67.2)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Other specified cerebrovascular diseases (I67.8)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Cerebrovascular disease, unspecified (I67.9)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
</tbody>
</table>
Codes representing 'stroke' in non-stroke AN-DRG v3.1 DRGs
In AN-DRG v3.1, the category ‘Occlusion and stenosis of pre-cerebral arteries’ (433.xx) was classified to non-stroke DRGs (i.e. DRG 67/68/69 which is TIA & Pre-cerebral occlusion). The above code category includes occlusion and stenosis both with and without infarction. This distinction is determined by the 5th digits of ‘0 without mention of cerebral infarction’ or ‘1 with cerebral infarction’.

Stroke ICD code not in AR-DRG v4 stroke DRG
The stroke code ‘Cerebral infarction due to cerebral venous thrombosis, non-pyogenic’ (I63.6) is in a non-stroke DRG in v4 of the grouper.

Other anomalous ICD code placement
The ICD-10-AM code I67.0, ‘Dissection of cerebral arteries, non-ruptured’, whilst not considered to be a ‘stroke’, currently groups to ‘Coronary atherosclerosis’ (i.e. DRG F66).

Code concepts different between ICD-9-CM and ICD-10-AM
Aetiology/manifestation convention (also known as dagger/asterisk codes) did not exist as such in ICD-9-CM. This convention was modified to remove duplication and include, where possible, 5th digit codes in aetiology rubrics, i.e. both concepts were included in one code, rather than two. The aetiology/manifestation convention was re-introduced in ICD-10-AM. Cerebral artery syndromes (G46.0/1/2) and stroke and lacunar syndromes (G46.3/4/5/6) are examples of such ICD-10-AM additions.

Another complication was that different axes between versions existed, such as the specification of the artery in a cerebral infarction due to occlusion and stenosis of pre-cerebral arteries in ICD-9-CM, but the specification in ICD-10-AM was the cause; see the example of thrombosis or embolism below.

Coding conventions not always reflected in grouper
It was found that several codes that were invalid as principal diagnosis according to coding convention grouped to valid DRGs. Examples are aetiology/manifestation combinations and sequela codes. See Table 2.

Coder groups selected different ICD code ranges
Different coders identified different ICD code ranges for ‘stroke’. Table 3 displays the different ICD code ranges selected by coder groups.

Discussion
At first, DRGs were used in selecting ‘stroke’ and ‘TIA’ as DRGs are a patient classification scheme that is said to provide a clinically meaningful way of relating the number and types of patients treated in a hospital to the resources required by the hospital. AN-DRG v3.1 37/38 (‘Cerebrov-
Table 2: Examples of where coding conventions are not reflected in grouper

<table>
<thead>
<tr>
<th>CODE DESCRIPTION (ICD-10-AM, ICD-9-CM)</th>
<th>DRG V3.1</th>
<th>V4.1</th>
<th>V4.2</th>
<th>V5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other systemic atrophy affecting CNS in neoplastic disease (G13.1)</td>
<td>B70 Stroke</td>
<td>B70 TIA and precerebral occlusion</td>
<td>B70 TIA and precerebral occlusion</td>
<td>B70 TIA and precerebral occlusion</td>
</tr>
<tr>
<td>Middle cerebral artery syndrome (G46.0)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Anterior cerebral artery syndrome (G46.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior cerebral artery syndrome (G46.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain stem stroke syndrome (G46.3)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Cerebellar stroke syndrome (G46.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure motor lacunar syndrome (G46.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pure sensory lacunar syndrome (G46.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other lacunar syndromes (G46.7)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Other vascular syndromes of brain in cerebrovascular diseases (G46.8)</td>
<td>B70 Stroke</td>
<td>B81 Other disorders of nervous system</td>
<td>B81 Other disorders of nervous system</td>
<td>B81 Other disorders of nervous system</td>
</tr>
<tr>
<td>Other specified disorders of nervous system in diseases classified elsewhere (G99.8)</td>
<td>B70 Stroke</td>
<td>B81 Other disorders of nervous system</td>
<td>B81 Other disorders of nervous system</td>
<td>B81 Other disorders of nervous system</td>
</tr>
<tr>
<td>Cerebral amyloid angiopathy (I68.0)</td>
<td>DRG I66 Other connective tissue disorders</td>
<td>DRG I66 Other connective tissue disorders</td>
<td>DRG I66 Inflammatory musculoskeletal disorders</td>
<td>DRG I66 Other connective tissue disorders</td>
</tr>
<tr>
<td>Cerebral arteritis in infectious and parasitic diseases classified elsewhere (I68.1)</td>
<td>B76 Seizure</td>
<td>B76 Seizure</td>
<td>B76 Seizure</td>
<td>B76 Seizure</td>
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<tr>
<td>Cerebral arteritis in other diseases classified elsewhere (I68.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other cerebrovascular disorders in diseases classified elsewhere (I68.8)</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
<td>B70 Stroke</td>
</tr>
<tr>
<td>Late effects of cerebrovascular disease (438)</td>
<td>56 Dementia and global disturbances of cerebral function</td>
<td>B63 Dementia &amp; other chronic disturbances of cerebral function</td>
<td>B63 Dementia &amp; other chronic disturbances of cerebral function</td>
<td>B63 Dementia &amp; other chronic disturbances of cerebral function</td>
</tr>
</tbody>
</table>

Table 3: Selection of ICD code ranges by coder groups

<table>
<thead>
<tr>
<th>CODE DESCRIPTION (ICD-10-AM, ICD-9-CM)</th>
<th>CODER GROUPS A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subarachnoid haemorrhage (I60.x)</td>
<td>Not selected</td>
<td>Not selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Subarachnoid haemorrhage (430)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Other non-traumatic intracranial haemorrhage (I61.x)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Intracerebral haemorrhage (431)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Subdural haemorrhage (acute)(non-traumatic) (I62.0)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Subdural haemorrhage (432.1)Non-traumatic extradural haemorrhage (I62.1)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Non-traumatic extradural haemorrhage (432.0)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Intracranial haemorrhage (non-traumatic), unspecified (I62.9)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Unspecified intracranial haemorrhage (432.9)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Stroke, not specified as haemorrhage or infarction (I64)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Acute, but ill-defined, cerebrovascular disease (436)</td>
<td>Not selected</td>
<td>Selected</td>
<td>Selected</td>
</tr>
<tr>
<td>Sequelea of cerebrovascular disease (I69.x)</td>
<td>Selected</td>
<td>Selected</td>
<td>Not selected</td>
</tr>
<tr>
<td>Late effects of cerebrovascular disease (438)</td>
<td>Selected</td>
<td>Selected</td>
<td>Not selected</td>
</tr>
</tbody>
</table>

ascal disorder except TIA') were selected as ‘stroke’ DRGs but, whilst most of the codes in these DRGs were in fact strokes, there were other codes which were not strokes. A reviewed article published last year also reports using the DRGs 37/38 as a surrogate for ‘stroke’ (Royle, Callen & Craig 2004). Although it is noted that the present study’s definition of ‘stroke’ is broader than that used by the above study, it is a misconception to believe that these two DRGs would encompass only ‘stroke’ cases. It is of course reasonable that ICD codes describing cerebrovascular disorders other than stroke are found in DRGs 37/38 due to the title ‘Cerebrovascular disorder except TIA'. After the renaming of the adjacent DRGs to ‘stroke’ in v4.1, there is an expectation that there would be a matched revision of its content, that is, ‘non-stroke’ codes would not be found in a DRG named ‘stroke’. However, it was observed that there still remained several ‘non-stroke’ codes in stroke DRGs in v4.1 and v4.2 (see Table 1) and
this trend continues in v5, the recent version of
the grouper.

Despite ICD distinguishing between precerebral occlusions with and without cerebral infarction, all precerebral occlusion codes grouped to AN-DRG v3.1 67/68/69 ‘TIA and precerebral occlusion’. There would appear to be a ‘match’ between DRG and code title, however, clinically those with a cerebral infarction are in fact more similar to ‘stroke’ patients than to those without a cerebral infarction. The classification of the ‘with infarction’ codes was rectified in AR-DRG v4.

Two other codes were identified which we believe are erroneously placed. First, a code believed to represent a stroke (namely ‘Cerebral infarction due to cerebral venous thrombosis, non-pyogenic’) is classified to a non-stroke DRG ‘Other disorders of the nervous system’ in v4. Other ‘infarction’ codes group to stroke DRGs. Secondly, ‘Dissection of cerebral arteries, non-ruptured’ groups to DRG F66 Coronary atherosclerosis in AR-DRG v4, that is, out of the nervous system classification. It appears that mapping between ICD editions have caused this anomaly. The ICD-10-AM code for ‘Dissection of cerebral arteries, non-ruptured’ (I67.0) was mapped back to ICD-9-CM code 459.9 (‘Unspecified circulatory disorder’) which was felt to be the best match for the purposes of historical mapping, but is by no means an equivalent code. The code 459.9 grouped to DRGs 255/256 Atherosclerosis in v3.1. The descriptor for these DRGs was changed to coronary atherosclerosis in v4 – DRGs F66A and F66B. Many of the anomalies that have arisen between versions 3 and 4 of the grouper have done so via the mapping process. It appears that mapping between ICD editions have caused this anomaly. The ICD-10-AM code for ‘Dissection of cerebral arteries, non-ruptured’ (I67.0) was mapped back to ICD-9-CM code 459.9 (‘Unspecified circulatory disorder’) which was felt to be the best match for the purposes of historical mapping, but is by no means an equivalent code. The code 459.9 grouped to DRGs 255/256 Atherosclerosis in v3.1. The descriptor for these DRGs was changed to coronary atherosclerosis in v4 – DRGs F66A and F66B. Many of the anomalies that have arisen between versions 3 and 4 of the grouper have done so via the mapping process. Commonwealth publications, such as Development of the Australian Refined Diagnosis Related Groups (AR-DRG) Classification, Version 4, Volume 1, Summary of changes for the AR-DRG classification Version 4.0 (DHFS, 1998) recognise the difficulty of mapping between the ICD-9-CM and ICD-10-AM coding systems.

Another issue identified in this study was that there were different concepts between classifications which create difficulties for researchers to accurately select the same cohort of patients across both coding and grouping classifications. Whilst mapping tables are available to assist researchers in understanding the changes between ICD-9-CM and ICD-10-AM, they do not contain an explanation of the reason for particular code choices. Explanatory notes accompanying the mapping tables assist in the general understanding of the process, that is, creating logical maps where the correct DRG outcome was not achieved through historical mapping, however, the mapping process itself can lead to poor code selection in the next ICD edition. It was found that where an ICD-9-CM code existed on one axis and the ICD-10-AM classification did not provide an equivalent code because the axis had changed, term mapping, rather than code mapping or reliance on mapping tables, provided a more correct cohort selection.

Whilst the grouper is not designed to perform as a coding verification system, the authors believe that reflecting basic coding conventions would reinforce good coding practice. Aetiology/manifestation combinations must have the codes assigned in that order, therefore a manifestation or asterisk code should never be sequenced as principal diagnosis, but yet there is provision for these codes as principal diagnosis to group to a valid DRG. Similarly a sequelae code should never be sequenced as a principal diagnosis code – nonetheless it was found that the ICD-10-AM code for ‘Sequelae of cerebrovascular disease’ (I69.x) and the equivalent ICD-9-CM code 438 ‘Late effects of cerebrovascular disease’ group to valid DRGs (see Table 2). Some coding verification is already seen in the grouper in the use of ‘error’ DRGs and edits such as ‘unacceptable principal diagnosis’, but expansion is needed to also capture all manifestation and sequelae codes.

The term ‘Coders’ used here includes those trained as Health Information Managers, those with nosology qualifications or those with ‘clinical coder’ qualifications, such as that provided by the Health Information Management Association of Australia. However, regardless of their initial qualifications, the selection of different code ranges by different coders may demonstrate the differences in clinical knowledge, training, experience in current and older ICD classifications, understanding of casemix classifications or simply the interpretation of the question raised by the researcher. These are all important issues for both researchers and coders to be aware of – ensuring
that the coder can provide the relevant codes with confidence and ensuring that the researcher has understood the use of the codes supplied.

In this project, the coders were requested to select the codes that describe ‘TIA’ and ‘stroke’. In response, one coder selected all possible options including ‘old stroke’, as well as providing scenarios of when particular codes would be assigned. From the researcher’s point of view, the coders choice just meant ‘TIA’ and ‘stroke’ and all codes selected were therefore included in subsequent data analyses. This caused the inclusion of many cases which were not current strokes in the current-stroke-episode cohort selection and hence producing erroneous results.

Similarly, assumptions were made by some coders that v3.1 DRGs such as 37 and 38 (i.e. ‘Cerebrovascular disorder except TIA’) only contained stroke codes. The subsequent comparison of codes contained in the above DRGs with complete stroke ICD code lists demonstrated that there were problems in DRG-based (i.e. 37 and 38) cohort selection.

In October 2003 during the early stages of the research, the anomalies, as they were discovered, were reported to the Department of Health and Ageing via the Victorian Department of Human Services. As a final step in this study, a review of the v5.0 grouping of many of the above mentioned codes was done. It was very satisfying to note that many of the anomalies had been corrected, presumably as a result of this notification.

As Roberts, Innes and Walker (1998) state, at the time of the release of the ICD-10-AM codes, considerable effort has always been devoted to coding diseases and procedures in hospitals. The accuracy of classification of diseases and procedures in turn determines the success of Casemix funding systems. Since the DRGs aim to represent patients who consume similar resources, are of a similar level of complexity and have a similar length of stay, it is important to have ongoing review of the placement of codes and concepts within the grouper.

Disease and procedure classification systems permits the systematic recording, analysis, interpretation and comparison of morbidity and procedural data collected from different hospitals, states and even countries. Increased accuracy of the classification system will also increase its usability in multiple areas including health policy development, planning and research.

Conclusion
This study provided several lessons and raised issues of which both researchers and coders need to be aware. Foremost, any selection of cohorts from hospital datasets using ICD codes and/or DRGs, needs to be clearly and carefully defined with feedback from an experienced coder to guide the process. Additionally, it is necessary to consult both coders and clinicians as both perspectives should clarify and confirm the selection. All parties need to be aware of ongoing changes between classifications, as well as the need to examine the inclusions and exclusions of DRGs rather than make assumptions of their contents. The issues raised in this study strongly support the need for an experienced coder, who understands coding conventions, history and background, as well as DRGs, to assist researchers with selection of ICD codes and/or DRGs.

This study helped the authors gain a greater understanding of coding and its relationship to DRGs and their evolution, which would allow a more specific and meaningful cohort selection for future studies. The process that was undertaken to arrive at the final cohort selection highlights the need for ongoing review of the placement of codes and concepts within the grouper.

Acknowledgments
The authors would like to thank the staff at Southern Health, the Victorian Department of Human Services and the National Centre for Classification in Health for their assistance. We are grateful for both the clinical input and critical review of the manuscript by Professor Barry McGrath, Head of Department of Vascular Sciences at Monash University. This study and the principal author are supported by a grant from Victorian Department of Human Services.

References


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Health Information Managers in the hospitals and community health centres in the Logan-Beaudesert Health Service District, Queensland, are moving from paper record systems to electronic medical record (EMR) data and information capture. On 14 January 2006, the second version of the electronic record system was released with new and improved functionality for clinical staff.

Since January 2006, electronic discharge summaries have been available for all specialties. The e-summaries have been created based on the information previously captured on the paper-based medical, intensive care, and nursing discharge summaries. Additional functionality has been added to decrease duplication and allow the clinical staff to ‘attach’ information to the summary.

The medical discharge summary is broken into a number of sections. The first section contains the patient’s demographic information and the second allows the clinician to select two care providers to whom the summary is to be sent. The system displays all allergy and alert information and the clinician can ‘attach’ specific details to the discharge summary. The main body of the summary forces clinicians to record diagnosis on discharge, presenting complaints/clinical features, treatment, other procedures, and complications. If the patient has had a procedure performed in theatre, the operation report contained within the theatre information system can be attached to the summary. Medications are currently typed into the summary; however, in April 2006 an electronic feed will be available for sending all medication records from the pharmacy system to the discharge summary. Clinicians can attach the result for any test performed during the admission. Prior to attachment, the result must be verified and doctors can click and verify a result where required. The last section of the summary outlines the discharge follow-up for the patient.

The medical discharge summary is managed via clinical work list functionality. The clinical staff members have the opportunity to complete the discharge summary during the patient’s admission. The summary remains a ‘work in progress’ until the doctor has flagged it as ‘complete’. Once flagged, the discharge summary is routed to a ward clerk work list: the ward clerk is responsible for auto-faxing to the care providers nominated on the summary, and for mailing a copy to the patient’s home address. If the clinician does not complete the summary prior to patient discharge, this fact is displayed on an outstanding discharge summary work list flagging the need for a summary to be completed. The Health Information Managers for each of the clinical business units regularly monitor the completion of summaries for their units and report non-compliance to the clinical directors. The monitoring process ensures all patients are provided with a discharge summary within 24 hours of discharge.

Developing system functionality was not the difficult part of this project. Clinicians are often very good at suggesting system functionality; however, they are not necessarily skilled at managing the associated changes to business process. The change management was carried out for discharge summaries over a period of six months, during which time discharge summary policies were reviewed and updated, staff were trained, and a processes of ongoing monitoring was set up. There was 0.4 EFT Project Officer assigned to this roll-out. Compliance is being monitored each week and some problems with completion have been identified. As an example, since initiation of the changes there have been...
some problems with clinicians completing and sending the summaries to external care providers prior to the patient actually being discharged from the hospital. Changes to business processes have been made to rectify this situation.

The Direct Data Entry project for outpatient clinics began in April 2005, and will continue for the next twelve months. With the second version release of the EMR, the surgical, orthopaedic, gynaecological, women’s health, and paediatric teams, with the assistance of the clinical informatics team, progressed from writing their clinic notes on paper to recording them electronically. The clinical staff worked with the project officer to develop three alternative mechanisms for electronic documentation. The options available for use include direct data entry templates, e-notes, and the dictation of a letter. The clinical directors assisted the process by flagging specific conditions that could be assessed and documented in a standard template, such as PR bleeding, amenorrhoea and varicose veins. This was modelled multiple times, on paper, prior to moving to an electronic solution. If a patient presents with a condition that does not have an associated template, the clinician has the option to enter an e-note which is a free text template that allows them to change the font to bold, increase font size, and insert pictures.

Business process analysis identified the fact that many clinicians document in the outpatient section of the medical record and dictate a letter with identical information. When queried about which they refer back to, most stated that they only ever search for their letter filed in correspondence. Many also felt the process of recording notes and dictating a letter constituted duplication of what was in the record. The decision was made to utilise the letter as the documentation for the clinic and, through the use of a standard dictating template, this has been achieved. The letter now covers enough information to reflect clearly the patient’s clinical appointment and the required information for the general practitioner. To assist the change to typing, voice recognition technology is being trialled by a number of the senior clinical staff. Voice recognition technology allows the clinical staff to dictate their notes directly into the record and is available for use with the templates, e-notes, or dictated letters.

The nursing staff in the outpatient department record their observation notes electronically. When the doctor selects the patient from the clinic work list, the nursing notes are displayed automatically so that he or she can peruse them prior to consultation with the patient. Records of patients listed on the work list are displayed in various colours to denote whether they have arrived, have not attended, or are still expected to arrive. At the end of each clinic, the doctor must document follow up for patients who did not attend. This is completed on a standard template and is designed to instruct the administrative staff as to whether the patient should be re-booked or referred back to the general practitioner.

The change management for this module was easier than first expected, with compliance very high. The development of templates, redesign of business processes, and training of staff have been achieved in nine months. For the remainder of 2006, the sole Project Officer will work with the outstanding units to move them from paper to direct data entry.

The electronic medical record system, ERIC, has been in operation within Logan-Beaudesert Health Service District since 2002. For more information on the system and its functionality, please contact the author.

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Health information management in remote tropical islands

Leanne Holmes

Introduction
Providing good quality health services and reporting of health related activities in remote island communities presents unique challenges, some of which are not apparent without personal experience in these regions. This article discusses the author’s recent experiences in the Federated States of Micronesia in the Pacific Ocean, as well as in Christmas and Cocos (Keeling) Islands, two offshore Australian Territories situated in the Indian Ocean.

Federated States of Micronesia
As Continental Airlines flight CO 956 prepares for landing on the lush green volcanic jungle island of Pohnpei, one of the many that comprise the archipelago of the Federated States of Micronesia, I wondered what awaited me. Contracted as part of the Basic Social Services project it was hard to imagine what health information management services would exist in this community. The terms of reference for my role stated that I was to assist and train the national health statistics officer and each state counterpart specifically in the collection and reporting of health information. This includes the collection and reporting of International Classification of Diseases (ICD) morbidity statistics and mortality data, as well as public health activities. It would also be necessary to review their existing processes for collecting health indicators, Key Performance Indicators (KPIs) and other outcome measures.

Historical and cultural background
The Federated States of Micronesia comprise over 600 islands representing four sovereign States, Yap, Chuuk, Kosrae and Pohnpei, which are governed by a national government. The Federated States of Micronesia has an estimated population of over 113,000 people, who inhabit more than 200 islands stretching over 7,000 square kilometres of the central western region of the Pacific Ocean. It is 2000 kilometres north of Cairns, and the only way to get there is by ‘island hopping’ north from Australia to Guam and then southeast to Micronesia.

This nation has been influenced by and at times occupied by a number of countries throughout its history. It was ruled by Spain, Germany and Japan prior to World War II, and subsequently by the US as part of the Trust Territories established by the United Nations, which provided support, funds and grants to the region. Since becoming an independent federation in 1986, and upon signing of the ‘Compact Agreement’, the Micronesians have been encouraged to take ownership of their own affairs. The influences of other countries continue today. For example, some Micronesians are passionate about driving American pick-up trucks. They drive on the right hand side of the road, pay for ‘gasoline’ by the gallon and their national currency is the US dollar. They can be obsessive about cable television, NBL basketball and baseball. Tuna and reef fishing is a huge business in this part of the world, so it is not surprising that, following Japanese tradition, they eat raw fish (sashimi) and sushi. In some island states the women wear
Spanish combs in their long dark hair. While English is the national language of these people today, most of them also speak and write in their own languages indigenous to their specific island group.

**Primary care**
Because the Federated States of Micronesia includes over 200 inhabited islands, perhaps the single obvious challenge to operating health services in this country is the limitation of access. The physical logistics of providing adequate healthcare worker expertise to each island and provision of medical supplies and staff training are considerable. Primary care is provided in dispensaries on many of the inhabited islands, sometimes in a room in someone’s modest tin-roofed house. If there are any health assistants present, they are generally trained only to issue basic first aid, but they are authorised to prescribe medications. They must contact the secondary healthcare facility for advice when necessary. It was surprising that health assistants receive only two years training and are able to prescribe medications, unlike the nurses at the state hospitals. No individual primary care health records are kept, but all visits are documented in a log book. At the end of each month the visits or encounters are tallied and usually radioed to the hospital at the main island.

I was fortunate to visit one such small island dispensary in Chuuk. With young children and women from the village creating a welcoming party, we were shown the rusted tin roof shack they called a dispensary. It was an ‘eye opener’, containing an equally rusted four-drawer filing cabinet and little other furniture. There was no electricity or running water, and the patient bed was no longer serviceable. The medications and medical supplies were displayed on a table since there was no refrigeration. The young newly trained health assistant proudly displayed his log book records of patients treated. Each time a patient visits a separate entry is made into the log book. There is no way of capturing a chronological history of patient illness.

Dispensaries closer to the larger towns and hospitals appeared to be better equipped and serviced. Only a handful of dispensaries attempted to keep individual health care records of all the patients in the community.

**Hospital care**
Each state has its own regional hospital, although its catchment area could extend over 200 nautical miles. These hospitals provide inpatient and outpatient care. Public health units are adjacent to the hospital and were established to provide screening and preventive medicine programs. No tertiary or specialised hospitals exist in the Federated States of Micronesia. A few private clinics do exist on some islands.

It was encouraging to see a range of modern medical record filing systems in place at each of the hospitals. Edna Huffman’s influence was evident (Huffman 1994); it was obvious that the people of Micronesia have received some health information training in the past. Each medical records room had colour coded medical record folders stored on fixed shelving, albeit the shelves were generally overcrowded and the facility was generally run down. It was inspiring to see a number of modern computers perched on work benches. Some staff demonstrated reasonable computer skills although most indicated a desire to learn more. Recent acquisition of computers from the World Health Organization has enabled each hospital to establish a computer laboratory for staff access, and this has further ignited their thirst for knowledge and training.

The medical records staff uses WINPAS, an Australian developed Patient Administration System to record admission, transfer and discharge activities. They also use it to enter ICD codes and to run basic patient activity and

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**Medical Records Offices at Chuuk**
bed occupancy reports. WINPAS was only used by medical records staff but was not used to its fullest capacity.

**Staff training**

Almost all the current coding staff had little if any coding training, with some participating in a one to two week coding course if they were lucky. The coding staff also had limited understanding of medical terminology but were eager to receive more training in both areas.

In order to assess the training requirements and develop a robust staff training program, I developed a staff training requirements survey for the staff to complete. It has provided interesting insights not only into what staff needs are but also into their work experience. Many staff had worked in medical records for a number of years and were nearing retirement age. Younger workers who might be working in this role at present do not see it as a career path. If they show talent they will move on, usually to a better paid job. Developing a sustainable coding and health information workforce for Micronesians is necessary if there is to be continuity and consistency of health data collection in the future.

The core areas where training needs are the most crucial lie in:
- ICD-10 morbidity and mortality coding
- understanding medical terminology
- gaining a solid working knowledge of how to collect, store, manipulate and present health data using MS Excel.

Senior administrative staff in the national health office also expressed a need to gain a better understanding of how to organise and analyse the monthly data they receive in an accurate and effective manner. It is fair to say they are buried in data, with little real ability to translate the data into meaningful information. Preparing statistics for mandatory reporting and submission to external agencies or national office was also highlighted as a training need.

Currently there is a limitation in submitting data across the health sector in a timely and effective manner. This is primarily due to the still weak but evolving telecommunications infrastructure in Micronesia. It was enlightening to see some or a number of health care workers embracing new technologies such as email and the Internet, but the infrastructure needs to be more robust and reliable before there will be a higher uptake of the technology. Internet connections drop out regularly, particularly during a tropical downpour (which is all too frequent in some island states). Some medical record staff do not have email access, or they share an email account across the department. For such a small population, there remains minimal communication amongst medical record staff across all hospitals due to poor telecommunication services.

**Challenges in collecting health information data**

Ensuring health data are complete and accurate is one of the single biggest challenges facing Micronesian health staff. Receiving the monthly activity statistics from each dispensary on each island in a timely manner is a huge challenge. This is particularly problematic with birth and death certification. It is not uncommon to have an unknown cause of death recorded on a death certificate from a remote island, simply because no health worker was available at the time to certify the death. Some deaths are simply not recorded if the deceased was buried by the families immediately after death. In recent years it has been reported that there has been a significant improvement in the rate of death certification, from 47% to 60%, although this is very difficult to accurately quantify. Birth registration presents a similar challenge. In accordance with some Micronesian customs, the naming of the baby might take months, or in some cases the father’s name is not verified, and as a result birth certification can be slow, sometimes taking many months. Capturing birth weight and length of pregnancy details is not always possible if women do not choose to receive maternity care at a health facility; the traditional village midwife still plays an integral part in Micronesian culture. Baby weight is often not recorded unless the baby attends a ‘Well Baby Clinic’, usually some weeks after birth.

Micronesia continues to have a close diplomatic and economic relationship with the United States of America. As a consequence many of the public health programs are funded through various government agencies and donor organisations such as Centre for Disease Control (CDC) Communicable Diseases, HIV/AIDS, Mental
Health and Immunization programs. National reporting for screening and health promotional activities of each public health program is mandatory. The challenge to monitor and evaluate these public health programs effectively requires accurate and complete data collection processes. It has been identified that many of the public health teams also require training in accurate and complete data collection.

Morbidity coding has been undertaken in Micronesia for many years. While there has been a constant turnover of coding staff, historical data continues to be stored at the national office. Health workers who have been fortunate enough to acquire coding expertise do not always achieve recognition for attaining this special skill set. There continues to be a lack of continuity in coding expertise at the state and national levels. Coding staff were still using WHO ICD-10 First Edition (1991) rather than the more recent edition published in 2004.

National Office of Health, Education and Social Affairs (HESA)

HESA has the central role of monitoring and evaluating health, education and social services across the country, based on the information derived from the states. Whilst a number of dedicated Micronesians have established the foundation for standardised data collection processes over the years, some systems are now outdated. The challenge here is to ensure that quality monitoring and evaluation processes are in place to keep abreast of the latest developments, for example, ICD-10 coding revisions and changes to WHO health indicator requirements. Better use of information technology updates to produce comprehensive planning and reporting tools should continue to be on the national Micronesian agenda. I am mindful of the need to promote long term strategies to ensure staff in the national office are equipped with the skill set necessary to accurately report on health outcomes and indicators. This is particularly crucial when health statistics are shared on a global scale to organisations such as World Health Organization, the United Nations and the United Nations International Children’s Emergency Fund (UNICEF). Improving health information systems in developing countries is a goal of the recently established Health Metrics Network. The Health Metrics Network (HMN) is a collaboration between parties by a common interest and expertise in generating, analysing and using health information at country and global level. It is ironic that ‘the countries with the biggest health problems are also those with the weakest health information systems’ (World Health Organization 2006).

Christmas and Cocos (Keeling) Islands

While we might expect that island communities outside Australia are still developing fundamental health information systems I was surprised that even within Australian waters the struggle to develop robust and long term sustainable data collection systems still exists. In 2004 I was employed as a consultant to the Indian Ocean Territories Health Service. Christmas and Cocos (Keeling) Islands are situated in the Indian Ocean over 2,600 kilometres northwest of Perth, and this geographical isolation again presents a challenge.

The two health facilities that comprise the Indian Ocean Territories Health Service come under the Commonwealth Territories jurisdiction. They are 900 kilometres apart and have unique Malay and Chinese cultural influences. As in Micronesia, this isolation poses the same remote island community issues, staff training and retention problems and a lack of robust and up-to-date health information practice. As preparation for the EQUIP Accreditation program...
I was asked to identify areas for improvement and develop strategies to ensure the information management aspects of the health services met mandatory and minimum requirements.

Although the hospital at Christmas Island was very small (eight inpatient beds), the health service also provided a wide range of community, dental and general practice (GP) activities. It was also required to provide emergency services. If the emergency was outside the expertise of the two GPs, medical evacuation to Perth would be necessary.

Health information services were in existence; however the staff did require coaching on current work practices in line with Australian practice. Paper medical records existed alongside an electronic database. There was no consistent system regarding clinical information. Nurses always preferred to document in the paper record. Some of the doctors preferred to use ‘Medical Director’ software² for their entire clinical note taking, irrespective of whether they were treating a patient as an outpatient or an inpatient. Visiting specialists were common; they brought with them their own preferences for patient documentation.

It was surprising that Admission, Transfer and separation data and ICD coded data were not included within the national admitted patient’s minimum dataset. Commonwealth jurisdiction over the Indian Ocean Territories Health Service further complicated matters. As a consequence, staff were required to be innovative with what was available. Since there was no patient administration system (PAS), patients where flagged as ‘admitted’ on the ‘Medical Director’ (general practitioner software) system. Setting up a robust IT infrastructure was crucial to the long term security of this electronic patient record environment.

General archive and retention guidelines were adapted to suit the community. Patient’s records were filed according to whether they were on-island or off-island. Archiving records as people stepped on the plane to return to the Australian mainland was a regular occurrence.

A number of recommendations were made and some improvements have already been implemented. Some major challenges still remain:

- Ensuring completion of ICD coding: is this best achieved through outsourcing the coding activity or by training a local person?
- Development of a discharge summary template to formalise the discharge process in readiness for ICD coding.
- Ensuring that inpatient and morbidity activity is included in the Australian admitted inpatients minimum dataset: does responsibility for this lie with state or Commonwealth statutory authorities?
- Development of a policy on security, storage and archiving and disposal of medical records in an island community. When a patient leaves the island for good, what is to become of their records?

Commonwealth Government record retention rules fall under a different retention policy which is unrelated to health records.

**Patient confidentiality in remote island communities**

An issue which is common to all of these island communities is the lack of privacy and confidentiality of patient information. As Arundell states in her discussion of the Chatham islands, a remote island community off the coast of New Zealand, ‘Maintaining the confidentiality of patient information in such a close community is a daily challenge.’ (Arundell 2004). Reporting accurate TB and HIV results is still difficult in Micronesia because of the cultural stigma attached to these conditions. Clinical documentation in the medical record may well be vague to preserve patient confidentiality.

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privacy, but at what cost? Staff training on patient privacy is crucial in these communities.

Conclusion
There are continuing challenges ahead for these island communities. As a visitor and adviser my impact would be minimal and temporary if adequate long term sustainability strategies are not put in place.

My recommendations for providing successful long term quality health information services in remote island communities are:

- To empower the local people in decision making and responsibility. Encourage them to constantly learn new skills and to take charge in their own island community.
- To develop sustainable ‘train the trainer’ programs, so that expert persons are easily identified within the local workforce.
- To respect and work within the boundaries of different cultures. Try to understand what will work best for various cultures. Too often we want to introduce our western system rather than consider its likely success elsewhere.
- To seek the commitment from government bodies to ensure the communication infrastructure, which is so vital in health information services, is maintained at an optimal level. This may well mean ‘lobbying for the cause’.
- To maintain a relationship with the remote communities long after finishing your project. This might only be an annual email contact to see how they are doing. Make yourself available to these people long after you return home to show you are still interested in their progress.
- In some cases annual monitoring of the data collection process should be undertaken by consultancy staff until a full cycle is complete. Working in these communities can be very rewarding if there is the commitment and enthusiasm in the local people to take up the challenge and learn from those of us who want to teach. Capacity building and skills transfer to the local community is imperative for their own long term sustainability as an independent nation.

References


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It is strange how a chance encounter early in one’s career determines the direction one takes later in life.

When I was 16 years old and living in the United Kingdom, I enrolled in a medical secretarial course in order to be close to my best friend. I then started work in a London hospital where I encountered the Head of Medical Records on a daily basis. I often dreamt of having her job but had no idea how to achieve this goal, and did not even think to ask at the time.

After immigrating to Australia in 1989, I joined a pharmaceutical company as a secretary and gradually worked my way up to be a Regulatory Affairs Associate. This role involved submitting and maintaining drug approvals to the Therapeutic Goods Administration (TGA), and preparing and submitting clinical trial notifications to the TGA. It was during my time as a Regulatory Affairs Associate that I began to feel the need to gain a tertiary qualification, and so I started looking around for a suitable degree. I began a Bachelor of Health Sciences degree at the University of Western Sydney, but after a couple of years it became apparent that was not the course for me. Luckily I learned of the Health Information Management course, which to me sounded perfect. Equipped with this degree, it also meant I could at last achieve my ‘dream’ of being the Head of a Medical Record Department! Although I enjoyed my job in the pharmaceutical company I knew I would be happier doing something different, so I left the company and started the course in 2000 while caring for a six week old baby and a five year old child. It was not unusual to see me in the library with a stroller!

In September 2001 it was necessary for me to return to the workforce and I started looking at how I would be able to use my degree which was due to be awarded in 2002. During work placements it became apparent that as a mature-age student I would not enjoy working my way up through the Medical Record Department of a hospital. So much for the ‘dream’! I applied for a few jobs, one of which was as a data manager in the Clinical Haematology Department at Westmead Hospital. I have continued working in this area and am now a Senior Data Manager.

The job involves a number of activities:
- reviewing, in consultation with the haematologists, clinical trial proposals to evaluate feasibility and financial benefit to the department
- supervising and training other data managers and research nurses
- developing and implementing strategies to increase recruitment of participants
- interpreting clinical trial protocols and ensuring medical staff and participants are aware of the requirements of a specific trial
- preparing and submitting correspondence relating to clinical trials to the Area Heath Service’s Human Research Ethics Committee
- liaising with pharmaceutical companies, collaborative research groups and relevant hospital personnel in relation to clinical trials
- being present at national meetings on current issues relevant to clinical trials
- generally overseeing the organisation and running of clinical trials in the Clinical Haematology Department.

Another aspect of the job is overseeing the departmental database. This includes entering and retrieving data, and establishing access to the database across the hospital. Data entered include all inpatient admissions, including discharge summaries and information relating to patients undergoing bone marrow transplants. While working as a Data Manager I decided to undertake the Master in Health Science (Clinical
Professional profiles

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Elvis Maio,
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My introduction into the field of Health Information Management started in a way I imagine is common for many Health Information Managers; I worked part time in a small private hospital in Sydney’s eastern suburbs as a medical record clerk whilst completing my degree at The University of Sydney. Upon completion of the degree, I was given the opportunity to begin my career at the New South Wales Department of Health as a Data Coordinator for the Midwives Data Collection (MDC).

The MDC is a State-wide collection of paper forms and electronic submissions from all public and private hospitals that have a delivery suite. It is a mandatory collection initiated under the NSW Public Health Act 1991. The collection forms the basis of an annual report called the NSW Mother and Babies Report. There are an average of 85,000 births annually in NSW and the information contained within this collection is vital for the study of improvements to the care of mothers and babies at delivery. The MDC collects informa-
tion on birth defects, and feeds another repository called the Births Defects Registry. This registry collects information from the MDC to follow up on the babies with birth defects.

My current position as a project officer in the Data Collection and Quality area involves coordinating the MDC by liaising with midwives, other branches within the NSW Department of Health and other interested bodies to ensure the production of a robust collection covering all aspects of the data items. Due to updated data items collected by the MDC, the electronic repository is in need of an upgrade to reflect the previous and new data items collected. My role is to liaise with the stakeholders and other units to develop an appropriate electronic system. As the development of this system is undertaken, I am able to evaluate the efficiencies of the current collection and possibly improve the data in areas such as efficiency of collecting and processing the data to ultimately improve the quality and timely data received.

As a part of a multi disciplinary team, we work together on several projects. Two of my current projects are:

- MDC – implementation of the 2006 updated data items for the MDC electronic edit processing system and data repository.
- ICD-10-AM Fifth Edition – preparation of files for the specifications of each vendor. This involves liaison with the vendors – such as Cerner, iPM and CSC, and the Cancer Institute as well as other branches within NSW Health. The implementation of the new MDC involves liaison with all the stakeholders involved in order to deliver a system that is meaningful and useful for the purpose of the MDC. The mix of stakeholders includes clinicians, data managers, information technologists, and statisticians. In order to deliver a successful system, liaison with both the users of the information as well as the coordinators of the information is imperative.

To summarise, the range of subjects I studied while undertaking the HIM degree, combined with work experience and my part time job, equipped me to fulfil this demanding position. The skills needed in such a challenging position are vast, ranging across time management skills, computer skills in programs such as MS Access, Excel and others, attention to detail, and most importantly, documentation of each process undertaken.

Overall, by taking an integral part in the preparation of the ICD-10-AM Fifth Edition and the MDC projects, I have found my role as a project officer an enjoyable and fulfilling experience. To be involved with the ICD-10-AM Fifth Edition project was a source of major satisfaction to me. I had an interest in classification, and being part of the preparation for the rollout was a highlight of being in the position.

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**Professional Profiles**

Beginning with this issue, this section will become a regular feature of the Journal.

We are including these profiles as to showcase the breadth and complexity of Health Information Management careers and the exciting opportunities available for Health Information Management graduates. The editors encourage readers to submit their career profiles, with personal photographs if you would like them included.

– Editors
The Australian Institute of Health and Welfare released its report *Australian hospital statistics 2004–05* on 31 May 2006. It presents detailed information on hospitals in 2004–05, as well as trends over time. It is the twelfth such report that the Institute has produced. The report is a useful resource for health planners, administrators and researchers with an interest in the Australian hospital system.

Information compiled in Australian public and private hospitals on admitted patients, and on elective surgery waiting lists and emergency departments in public hospitals is analysed. The analyses encompass characteristics such as the age and sex of patients, diagnoses, procedures, lengths of stay and waiting times for elective surgery. In addition statistics are included in the report on hospital expenditure and revenue as well as bed numbers and a range of hospital performance indicators presented using the National Health Performance Framework.

For 2004-05, there were 7.0 million hospital admissions an increase of 2.6% over the previous financial year. The total number of days spent in hospital by patients was 23.8 million – an increase of 1.0%. There has been a continuing trend to a greater incidence of same day care. Same day hospital admissions have increased from about 42% of total admissions in 1995-96 to about 55% in 2004-05.

Public hospital emergency departments provided care on about 5.9 million occasions during 2004–05. Overall, 69% of all patients were seen on time in emergency departments. All patients assessed as requiring immediate care were seen immediately. Some 76% of those requiring care within 10 minutes were seen within the required time. Total recurrent public hospital expenditure in 2004–05 was estimated to be $21.7 billion with the average cost per stay in public hospitals estimated at $3,410.

The report is available on the AIHW’s Internet site at www.aihw.gov.au, or for purchase via Canprint.

**Publication name:**

*Australian hospital statistics 2004–05*

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The Editorial Board of Health Information Management Journal invites contributions in the following categories:

- **Peer reviewed articles.** This section is reserved for original articles which describe research outcomes, or processes, techniques or applications which enhance the practice of health information management. Included in this category are researched commentaries, literature reviews, new and developing topics and theoretical issues that have been researched through the literature. In general, they should not exceed 5,000 words in length; however, longer articles of up to 8,000 words using qualitative research methodology may be accepted in some circumstances. Non-reviewed articles can be submitted in the following categories:

  - **Professional Practice and Innovation.** Authors are invited to submit to this section articles which present interesting and innovative programs in all areas relevant to the profession. Length: 1500–5000 words.
  - **Reports.** The Journal welcomes reports on any topic, activity or concept of interest to health information management practitioners, or which pertain to health information management; for example information technology, health classification, data analysis, management and privacy issues, as well as standards and recent policy directions. Reports may present the personal view, experience or opinion of the author. Length: 1500–5000 words.
  - **Conference Reports.** The Journal invites those who have attended any conference of particular interest to the Journal’s readership to submit a short overview and critique of the conference proceedings.
  - **Reviews.** These are reviews of software, hardware, books and other media of interest and relevance to health information managers and related professionals are encouraged. Length: 200–500 words.
  - **Case Studies.** A case study can be a ‘how to do it’ paper, or a personal view or a description of an event or experience (such as moving a department to a new location). An informal case study can include check lists, tables, timelines, and other useful information that could be applied to similar experiences and projects. Length: 1000 words.
  - **Sounding Board.** These articles initiate or contribute to the debate on new and evolving issues. Length: 1000 words.
  - **Letters to the Editor.** Letters on any topic of relevance and interest to professionals interested in health information management and informatics are welcome. Letters should not exceed 300 words in length. Professional decorum should be observed; letters are published at the Editor’s discretion.
  - **Professional Profiles.** This section demonstrates the depth and breadth of professional work roles of individual Health Information Managers, including recent graduates, through personal accounts of workplace experiences. Length: 750 words.

**Style:** Authors should aim to use simple, direct and correct English, and spelling should conform with the third edition of the Macquarie Dictionary. *Health Information Management Journal* conforms with the Harvard (Author-Date) referencing style. For details, please refer to the *Style Manual for Authors, Editors and Printers. Revised by Snooks & Co. (6th edition), 2002. Milton, QLD: John Wiley & Sons.* The following website is also a valuable resource: go to [http://www.lib.latrobe.edu.au/help/style-guides.php](http://www.lib.latrobe.edu.au/help/style-guides.php) then click on ‘Harvard (Author-Date) System (La Trobe University)’.

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- Manuscripts are to be submitted electronically, saved in Word format, and with no headers and footers. Do not submit papers in PDF format.
- Only digital photographs are accepted. If they are essential, photographs accompanying manuscripts should be clearly identified and captioned. In addition, the subject’s permission to publish may be required.
- Formatting of the document should be kept to a minimum.
- A formal covering letter should be included with the manuscript.
- Ensure that in addition to the main text, the manuscript includes the following on separate pages: Title; abstract followed by four MeSH keywords (see [http://www.nlm.nih.gov/mesh/MBrowser.html](http://www.nlm.nih.gov/mesh/MBrowser.html)); author details (including academic qualifications, affiliations, postal and email addresses and identity of corresponding author if appropriate), and acknowledgments.


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Master of Health Information Management

- 1 year full-time or 2 years part-time
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Health information systems are essential for clinical decision-making and for the planning and administration of health care facilities. The Master of Health Information Management is a professional entry qualification designed to prepare specialists in the design and management of health information systems. This course provides graduates with a theoretical and practical understanding of the role of information and communication technologies in health care and the skills required for the successful integration of such technologies into the health system.

Master of Health Science
(Health Informatics)

- 1 year full-time or 2 years part-time
- 5 core and 3 elective units
- flexible, block mode and some distance delivery

The field of health informatics is one of the fastest growing areas within the health sector. Health informatics is concerned with the development, dissemination and use of information and communication technologies in health care. Exciting career opportunities are emerging for health professionals with knowledge and skills in information technology, management and health care systems.

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