1 The concept of a national health information model

1.1 Introduction

The rapid development of information technology and communications industries over the past two decades has enhanced our capacity to capture, process and store an ever-increasing volume of data. However, this proliferation of data has not been matched by a similar increase in our capacity to manage this resource efficiently, or to access and exploit the full extent of its value to generate information. In many fields, and in agencies using data from a variety of sources, the size and complexity of the available information resources have become overwhelming.

Australia has a history of achievement in the management and development of national health information, starting in 1989 with the publication of the first edition of the National Health Data Dictionary (then called the National Minimum Dataset—Institutional Health Care). The Dictionary, as well as the development and implementation of the National Health Information Agreement in 1993, the adoption of a number of agreed National Minimum Datasets, and the completion of a series of national information development projects are examples of the effort and achievement made through national collaboration and consensus.

One important element of this effort, Australia's National Health Information Model (hereafter referred to as the NHIM), provides a means of structuring and organising information within the health sector. Released in November of 1995, Version 1 of the NHIM was the first attempt to produce a consistent national model for health information in Australia.

This chapter relates the history and aims of Version 1, assesses its achievements against these aims, and discusses the significant issues that lead towards this new working version of the Model. Chapter 2 discusses the actual development of Version 2. Chapter 3 looks at the future, towards the development of Version 3. Chapter 4 explains the current structure of Version 2.

1.2 The objectives of NHIM Version 1

The Version 1 modelling project sought a national health information model to provide:

- a framework for the organisation of information, the development of data, and the design of new information systems
- a framework for the stable and consistent storage and expression of data
- a means of identifying gaps and deficiencies in current information holdings, systems and strategies
- a vehicle for coordinating investment in information management and system strategies.

The project included two important initiatives:

- the recognition of an established rigorous technique and a professional discipline for the management of national health information in Australia
- the use of the discipline to produce the NHIM.

As stated in the Preface to the NHIM Version 1 publication, it was intended that the NHIM would become 'an important part of the process for developing new data items for the National Health Data Dictionary. However, the NHIM has uses beyond the Dictionary, and will be an important component of the national health information infrastructure'.

In 1995, it was endorsed by the National Health Information Management Group (NHIMG) as a 'high-level framework and a technique for future information development and management'. Information modelling techniques have since been applied to a number of projects in the NHIMG's work program.

1.3 The concept behind NHIM Version 1

Version 1 of the NHIM was produced through a collaborative effort, with team members and funding from the Australian Institute of Health and Welfare (the Institute), the (then) Commonwealth Department of Human Services and Health, the NSW Health Department, and (as it was then) Health and Community Services Victoria.

A series of workshops were attended by individuals selected for their broad experience, ranging from health professionals and practitioners to consumer representatives, administrators and managers.

The concept of a national 'information model' was based on some underlying assumptions:

- All information has a 'structure' that could be identified and depicted.
- The national health model should be depicted at the 'enterprise' level, which would allow subordinate models with more specific detail to be developed over time.
- The technique of 'information modelling' should be used to identify and depict this structure.
- The 'entity-relationship' technique and diagram should be used as the final representation of the NHIM.

1.3.1 Underlying information structures

All information resources or systems have an underlying structure, regardless of whether they have been formally developed as such. Everyday resources, such as dictionaries, telephone directories or cookbooks, have identifiable information structures. Understanding these structures can significantly improve our capacity to exploit the information they contain.

Information modelling is a widely accepted technique for analysing the structure of information resources and representing that structure diagrammatically. Information models are inherent in everyday life, but are often localised and unplanned in their approach and structure.

1.3.2 An enterprise information model

The NHIM, version 1 is an example of an enterprise or corporate information model. It is a high-level representation of the information available or potentially available to a health enterprise or organisation. In this instance, the enterprise is the collaborative partnership of the NHIMG and its sub-committee, the National Health Data Committee (NHDC).

Information modelling is very similar to the process known as data modelling. However, the term 'data modelling' is more commonly used for more detailed modelling exercises, particularly in relation to the design and development of application software packages or databases. At the national or enterprise level, information models are more generalised and provide a framework for the development of more detailed subordinate models.

Data modelling techniques can be applied to the development of a high-level enterprise-wide model (e.g. the National Health Information Model version 1) as well as to the development of very detailed models for specific systems (e.g. an operating theatre booking system). The symbols used within the model have consistent meaning. Accordingly, information modelling has the potential to benefit a wide cross-section of stakeholders in high-quality information management, from the users of information at a policy or planning level, those who use information for everyday decision making, to those developing information systems (database designers, developers, administrators and programmers).

1.3.3 Why an 'information' model?

It is important to understand that the NHIM is an *information* model, i.e. a model of the information resources of the health sector. There are other types of models used within organisations or sectors, including business process models, function models and logic models. Such models are likely to focus on the processes used in a system, i.e. how something happens. An information model concentrates only on the information that makes up a system.

An information model is independent of process. Some complex processes, which may be depicted by intricate process models, actually produce very simple information models. Conversely, some very simple processes can generate very complex information models if they generate or cover a number of different types of information (as opposed to a large volume of the same type of information).

Australia's health industry is both politically and organisationally diverse. It comprises separate political and administrative jurisdictions at State, Territory and Commonwealth levels, and a broad range of professional sectors or specialisations. It also incorporates a mix of funding and service provision between the public and private sectors. The delivery of health services in Australia is largely a State and Territory responsibility and individual States, Territories, areas, regions, centres or settings have considerable discretion in the identification and development of their own administrative and clinical policies and processes.

Over time, collaborative national initiatives have tackled the standardisation of selected policies, practices and processes for particular sectors (e.g. mental health) with several notable successes. The Australian Health Ministers' Advisory Council and the Commonwealth Department of Health and Aged Care, working in conjunction with relevant stakeholders, have been particularly active in this regard.

The large enterprise that is 'health', however, remains characterised by a considerable diversity of technical and policy approaches. The information systems and packages that support the processes and policies of healthcare delivery within Australia can vary considerably between jurisdictions. However, although the systems, and indeed much of the actual data collected, may vary, the basic information used and generated by each jurisdiction is relatively consistent across the nation and the underlying information structures are relatively stable.

Although the development of a process model for the entire Australian health sector in Australia would be neither practical nor cost-effective, the construction of an information model that analyses and depicts the fundamental structural elements of health information in Australia has proven to be practical, cost-effective and achievable.

1.3.4 Entity-relationship modelling

At its most basic level, information modelling is a process for determining what information is important, how it is to be organised and how it might best be defined. The result of this process can be diagrammatically presented as an information model.

Version 1 of the NHIM was produced using the information modelling technique known as entity-relationship or E-R modelling. The technique was originally proposed by Peter Chen in 1976 and is still commonly used today. It was selected for the NHIM because of its general acceptance, and because it is a simple-to-understand technique that is still very effective at providing an information framework.

1.4 An evaluation of Version 1

1.4.1 The outcomes

Notwithstanding the ambitious scope of Version 1, it made steady progress in achieving the first two objectives described in Section 1.2; however, it had limited use in achieving the last two.

Although it gained acceptance as a high-level framework for organising the content of the National Health Data Dictionary, Version 1 received little direct use in developing new data items for the Dictionary. It also had some use beyond the Dictionary, as a conceptual basis for enterprise-specific information models for a range of data development projects.

In 1995 the NHIM was endorsed by the NHIMG (a body comprising the Institute, Australian Bureau of Statistics, Commonwealth Department of Health and Aged Care, each State and Territory health department or agency and, since 1999, the Health Insurance Commission) as the fundamental framework for national health information development in Australia. The NHIM continues to be supported by this group.

Version 1 attracted interest and support as a framework for health information, and provided an excellent platform for the subsequent development of a number of context-specific models within the health sector and parallel initiatives within the community services sector. Specific examples of these activities are contained in Chapter 2.

The NHIM's most significant role to date has been its adoption as the underlying architecture for the National Health Data Dictionary (NHDD) and for the Knowledgebase, the electronic registry of data standards maintained by the Institute on behalf of the National Health and the National Community Services Information Management Groups. The Model, version 2 is now published as part of the NHDD publication (the earliest Version 2 was published in 1998 as a component part of the NHDD Version 7 and the latest version of the Model was first published in version 9) and an electronic version is available on the Knowledgebase.

Since the publication of Version 1, several significant issues arose:

- the need for a process and procedures for managing and updating the NHIM;
- questions about the appropriateness of the E-R diagramming technique in the form used in Version 1;

- the validity of relationships between entities in the NHIM;
- the treatment of Classification Systems as a generic entity in the NHIM; and
- the treatment of date and time in the NHIM.

Use of the NHIM was requested by the NHIMG in order to test and validate the entities. Challenges of the use of entity relationships in Version 1 were not only expected but also encouraged. This has produced only a small number of proposed changes, although these changes are viewed as being very significant and positive. An example is the identification of the entity NEED/ISSUE that was not present in Version 1.

The main problem this has presented for the Institute, as day-to-day managers of the NHIM, and for the NHIMG has been how to capture, debate and make decisions on the future form of the NHIM. Although Version 1 optimistically noted that procedures would be developed and published for changing and updating the NHIM, this has not occurred and is still a key issue.

Another major issue relates to the future use of the E-R diagramming technique for depiction of the NHIM. Users of the NHIM and the Institute's work in the field of information modelling have questioned the definition of both 'entities' and 'relationships'. As a result of these questions, Version 2 includes only entities. In this new version, the NHIM remains at the conceptual level, leaving the precise definition and usage of entity relationships to lower levels of model depiction. This issue is discussed in more detail in Chapter 2.

Some users have criticised the apparently abstract nature of some of the entities, e.g. PARTY ROLE, and have expressed a need for entities to be expressed in terms that are more readily identifiable with aspects of the healthcare environment. This requires the NHIM to maintain a careful balance between the everyday detail required to describe important generic entities and their relationships and the need to express the NHIM in terms with which its stakeholders and users can easily identify. This issue has not been resolved in Version 2, and Version 1 terminology remains. This issue deserves attention in future development of the NHIM.

The Version 1 entity CLASSIFICATION SYSTEMS contains subtypes for most of the higher level entities in the NHIM. For example, CLASSIFICATION SYSTEMS contains a subtype PERSON CHARACTERISTIC TYPE for the NHIM entity PERSON CHARACTERISTIC, but not for PERSON CHARACTERISTICS' component subtypes DEMOGRAPHIC CHARACTERISTIC, LABOUR CHARACTERISTIC, LIFESTYLE CHARACTERISTIC, SOCIAL CHARACTERISTIC or PERSON IDENTIFIER.

Most users of Version 1 concluded that it is inappropriate to retain CLASSIFICATION SYSTEMS in the NHIM on the same footing as entities such as PARTY, EVENT, STATE OF WELLBEING and so on. This is because classification systems are fundamentally different in nature from these other entities. Classification systems are a resource or technique for the coding of information, whereas all the other entities represent actual features of the health system. Users, however, wanted the importance of classification systems to health information to be communicated in some other way.

Users also encountered some confusion in interpreting the entity CLASSIFICATION SYSTEMS. For example, there is no single classification system or scheme for PERSON CHARACTERISTIC TYPE, although there clearly are a number of classification systems or schemes for its component subtypes DEMOGRAPHIC CHARACTERISTIC, LABOUR CHARACTERISTIC, LIFESTYLE CHARACTERISTIC, SOCIAL CHARACTERISTIC and PERSON IDENTIFIER.

Consideration was given to including a DATE and TIME entity in Version 1, but this was not done since it would add to the complexity of the diagram. Subsequent experience in the use of Version 1 confirms the appropriateness of this decision. The relationship between entities in the NHIM and DATE and TIME generally apply at a data element level, and is covered in the metadata specifications of data elements and supporting databases. This situation is analogous to the CLASSIFICATION SYSTEMS entity.

Version 1 specified a number of relationships between entities in the NHIM. There was considerable debate (that is still ongoing) about whether it is appropriate to specify relationships at all in such a high-level model, and whether the relationships shown in Version 1 should be revised, including the addition of further relationships. Much of this debate has been associated with concern about the appropriateness of the entities themselves.