# National Health Information Model

**Version 2**

The Australian Institute of Health and Welfare is Australia's national health and welfare statistics and information agency. The Institute's mission is to improve the health and well-being of Australians by informing community discussion and decision making through national leadership in developing and providing health and welfare statistics and information.

NATIONAL HEALTH INFORMATION MANAGEMENT GROUP

# National Health Information Model

## Version 2

**This paper is a contribution to the ongoing work in health information modelling and is subject to revision based on future developments in the field of health informatics. The State and Territory health departments are continually enhancing their own enterprise information models and work is currently occurring nationally in Electronic Health Records and HL7 messaging. This and other work in progress will inform the development of future versions of this document.**

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# Foreword

Australia's National Health Information Model (hereafter referred to as the NHIM) was first published by the Australian Institute of Health and Welfare (the Institute) in November 1995. Version 1 was seen as an important advance in national health information management. This working paper reviews the experience of the Institute in producing and working with a national information model and, based on that experience, presents a new working version of the NHIM.

Australia, like many nations, has been increasingly coming to terms with the need to gain increased value from information and to use contemporary developments in information management. Recent Australian initiatives such as *Health Online* and Health*Connect* (that contribute to the momentum behind electronic health record development projects, electronic data interchange and business-to-business data exchange) make established information concepts such as the NHIM and the National Health Data Dictionary even more important.

Since the release of Version 1 of the NHIM, considerable feedback has been received on its utility and general presentation. Also during this time, many other information models of particular aspects of the health and community services sectors have been developed. These have tested the logical assumptions in the original Model and challenged the conventions under which it was presented. Although dominant structural considerations remain essentially intact, a number of modifications have been accepted and are presented in this new working version of the NHIM.

Readers of this paper are encouraged to:

- test its applicability in their respective work areas
- contribute to the future development of the NHIM, through feedback on any aspect of content, application or form
- encourage others to evaluate, use and comment on the NHIM.

In May 2002, the National Health Information Management Group and the National Community Services Information Management Group met together for the first time, and agreed to work towards a common information model. This meeting was an important first step in moves towards integration of health and community services information. (The National Community Services Information Model (NCSIM) is described in the National Community Services Data Dictionary (NCSDD) Version 2.)

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March 2003

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# Acknowledgments

The construction and publication of Version 1 of Australia's National Health Information Model (NHIM) was a collaborative exercise over 2–3 months. Some 150 or so people attended one or more of 22 formal modelling workshops conducted at various centres and on various topics. The response to the initiative was overwhelming and demand for copies of the publication required two separate reprints.

Moving the NHIM from Version 1 to Version 2 took place under the expert guidance of the National Health Data Committee (NHDC) and the National Health Information Management Group. Proposals for further enhancement of the NHIM and the development of Version 2 were shaped by numerous developments in health information modelling both in Australia and internationally. This working paper details changes that have been made to the structure and presentation of the NHIM. These changes reflect both the collective experience of these developments and original research into information modelling theory undertaken by the information management staff of the Australian Institute of Health and Welfare (the Institute).

The following Institute staff contributed to the development of Version 2 of the NHIM over the past 3 years:

- Mr Nigel Mercer, who was project manager for Version 1 of the Model and who provided expert advice and assistance in preparing this working paper
- Mr Joe Christensen and Ms Bonnie Abraham, who proposed the change from an entity-relationship model to a high-level conceptual model
- Dr Laura Reece and Ms Trish Ryan, who applied the NHIM to a number of specific applications, including development of the National Community Services Information Model Version 1 and a number of subject-specific applications within the Institute;
- Peter White, who provided advice and support
- Mr Graham Horn, who assisted in gathering research material and in preparing this working paper
- Valuable contributions have been received from members of the National Health Data Committee, particularly from Ms Sam Green and Mr Graham Pegler.

Version 2 of the NHIM is the result of a welcome investment of funds by the Australian Health Ministers' Advisory Council and the Institute. The guidance and involvement of Australia's NHDC and the general direction of the National Health Information Management Group were critical to the success of the project.

These contributions and the general support and commitment of the parties to Australia's National Health Information Agreement enabled and sustained what we believe is a most important contribution to health information management in this country.

# Executive summary

Since Version 1 was published in 1995, the National Health Information Model (NHIM) has been adopted as the underlying architecture for the National Health Data Dictionary (NHDD) and the Knowledgebase. The Knowledgebase is the electronic registry of national health and welfare metadata standards maintained by the Australian Institute of Health and Welfare (the Institute) on behalf of the National Health Information Management Group (NHIMG) and the National Community Services Information Management Group (NCSIMG).

The development of Version 2 of the Model commencing in 1997 marked a change from the entity-relationship model presented in Version 1 to a high-level, relationship-free, multi-business framework. From 1998 the NHIMG approved the use of the Model version 2, in draft form, as the organising structure for the NHDD and Knowledgebase. This paper is a formalisation of that approval.

This change recognised the NHIM's general acceptance as a high-level framework and the need for multi-layering of the modelling process. That is, it reflects the importance of consistent identification of entities at the national level, and the greater importance of relationships or business rules at lower levels.

The NHIM is an 'information model'—it is independent of process. In other words, it is not concerned with 'how' something happens, but rather with the information structure underlying the diverse processes and policies of healthcare delivery in Australia. By understanding the structure of health information resources, we are better able to exploit the information these resources contain. It is a 'conceptual model' aimed at establishing an agreed high–level structure. It thereby enables broad entities to be identified and described and provides a framework to develop more detailed subordinate models.

In 1998, the NCSIMG adopted a National Community Services Information Model (NCSIM) as the organising framework for the initial edition of the National Community Services Data Dictionary (NCSDD). This Model was based on Version 2 of the NHIM.

As a national framework, the NHIM enables related data elements from the NHDD to be grouped under a single entity rather than organised alphabetically. Entities are the things about which we need to know or hold data on. They may be people, places, objects, events or concepts. The Knowledgebase uses this aspect of the NHIM as the conceptual gateway to locate, identify and download data elements.

The 12 major super-entities of the NHIM can be loosely organised into four categories—Parties and states, State changing events, Environmental factors and Classifying systems. The coverage and importance of particular entities can be assessed by the population of an entity with data elements. For example, if there are few or no data elements for some model entities, this may be helpful in identifying areas for further development or in reassessing the structure of the NHIM. Version 2 of the NHIM contains more entities than Version 1, largely because of the development of several sector–specific contextual models such as the NCSIM, the Disability and Aged Care Model, the Primary and Community Health Services National Information Model, the National Institutional-based Ambulatory Care Model and the Community Health Information Model.

There is increasing interest in the use of the NHIM as the main tool for standardising health and welfare information in Australia. This includes its potential use in developing electronic data, designing information systems and as a framework for the consistent collection, storage and transmission of data. The next 3 to 5 years are expected to prove a watershed for the NHIM, with significant national health information development projects (including

electronic health records) being actively pursued. There are a number of current developments that could see the NHIM applied as an overall model for context-specific models—the HL7 Reference Information Model and the Good Electronic Health Record (GEHR). It could also form the basis of other health information developments, such as *Health Online* and Health*Connect*, and of the work of the National Electronic Health Records Task Force. The Model will have to continue to prove its worth and utility in these projects, and will need to continue to learn from and develop with them in order to remain at the forefront of this work.

The development of Version 2 represents a significant period of consolidation and maturity for the NHIM. It reflects the Model's progression from an initial concept and design to a more robust architecture. The likelihood is that pressure for its enhancement and development will continue at a more rapid pace in the near future. Greater alignment between the projects under the Health and Community Services Information Management Groups will highlight the need for common information structures. The Model could act as a tool for building consensus, assisting business planning, providing logical frameworks and influencing application development across human service sectors.

Although models can improve information resource use and management in many ways, they are not substitutes for sound data development practice and management. Equally, there is no single best model for health or for any business activity. The best conceptual models continue to be challenged and supported by contextual level models, while accommodating the technical and semantic diversity that generates them.

# 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.

# 2 The development of Version 2

## 2.1 Introduction

### 2.1.1 Supporting material

Version 2 of the National Health Information Model (NHIM) is included in diagrammatic form, as an A3-size poster, at Appendix 1 of this working paper. Definitions of NHIM entities are provided in Appendix 2.

### 2.1.2 Status of this publication of Version 2

This stand-alone publication of the NHIM V2 is a working document of the National Health Information Management Group (NHIMG). The NHIMG has decided to publish the NHIM V2 only as a working document to ensure that progress made since 1997 can be incorporated into the model and the planned merging with the National Community Services Information Model (NCSIM) can be undertaken before formal publication of a new version.

Since the development of the NHIM V2 there has been considerable work undertaken by States and Territories in developing Enterprise Information Models (EIM) and Data Warehousing, which has progressed the understanding of generic health information requirements beyond that which was current at the time the NHIM V2 was completed. The State and Territory information models are at a greater level of specificity than the NHIM. A clear inheritance hierarchy should exist between the NHIM and these EIM. This hierarchy should be maintained in both directions so that the NHIM informs the development of the lower level models and in turn these models inform the next iteration of the NHIM. Late publication of the NHIMV2 would make it appear that the process of reviewing the NHIM in light of the lower level models did not take place when, in most cases, they were not available to inform the development of this version.

### 2.1.3 Changes from Version 1

The main differences between Version 2 and Version 1 are:

- change from an entity-relationship model to a high-level, relationship–free, multi-business framework
- deletion of the CLASSIFICATION SYSTEMS entity
- adoption of a formal process of ongoing management of the NHIM by the National Health Data Committee (NHDC) on behalf of the National Health Information Management Group (NHIMG)
- inclusion of some new entities, and changes to some existing entities; some definitions of entities have been expanded following consultation with a wide range of people working in Australia's health sector both nationally and at State and Territory level
- clarification of the treatment of DATE and TIME.

Version 2 has been in use (as an earlier draft form) since 1997 as the organising framework for the National Health Data Dictionary (NHDD) and the Knowledgebase. It was decided, however, to publish Version 2 as a working document at this time because of the importance of formally documenting and reviewing the transition to Version 2 that occurred in 2000.

Rather than being part of a specific development project, as was the case with Version 1, this latest draft version of the Model evolved through the deliberations of the NHDC and the NHIMG. This evolution took into account:

- developments in the field of 'information modelling'
- decisions made about the role of the model as a 'conceptual' information model, including the experience of Australian health information specialists in national and international standards development projects
- use of Version 1 of the NHIM in the Australian health and welfare sectors. This included its testing and development through its use as an architecture for the data elements in the NHDD and the resultant feedback from this use.
- decisions made about the use of entities and relationships for the future depiction of the NHIM.

The following sections review these aspects.

### 2.1.4 Use of established techniques and methods

In 1995 the NHIM publication of Version 1 stated that the project had used 'information engineering methods' and, in particular, 'information modelling' as the means of depicting the scope of information within the Australian health sector. The aim of using information engineering methods was to introduce a discipline to information development efforts, at least at a national level.

In selecting the entity–relationship diagramming technique to represent the NHIM, the project adopted one of the better known conventions in a field where a number of different conventions, techniques and methodologies persisted.

Between 1995 and 2000 it was reasonable to hope that the field of information modelling would have developed and 'crystallised' into a smaller number of more developed techniques. In reality, this was not the case with object oriented techniques, such as the Unified Modelling Language (UML), now being developed and offered, but with established information engineering techniques remaining relevant and hence persisting.

However, the important consideration is that an established, rigorous approach is still employed. Put simply, the difference is between using a 'model' with semantic interpretations that are consistently and inherently understood, and 'diagrams' which become pictures requiring interpretation by their viewer.

### 2.1.5 Issues with the entity-relationship approach

While the approach used to develop the NHIM has been criticised by some, it is the top-down method of developing the E-R model that has most likely drawn the assessment that it lacks formalism, not the E-R approach itself. After the development of the NHIM Version 1, the main area of discussion has been over the nature and applicability of the relationships.

In his original work, Peter Chen recognised that an entity could be strong or weak. A strong entity has no relational dependencies and, therefore, can exist in the absence of any relationships. A weak entity is dependent on the existence of another entity via an identifying relationship, however, these entities could be represented conceptually as a single entity.

Work by Codd and Date on the relational data model identified rules by which relationships may be expressed through foreign keys, resolving many-to-many (or weak) relationships by introducing 'intersection' entities. As the NHIM is not a fully attributed model, and is not intended to be, application of the relational model [applying normalisation techniques] cannot be fully applied. Relationships in this context may therefore be best omitted.

What this discussion tells us is that relationships can be problematic, and are often more important at lower levels of a set of models. This was recognised in Version 1:

> At the high level of the National Health Information Model, the relationships depicted are very general. However, with further development at lower levels of the NHIM, relationships become very specific and can accommodate complex representations of specific rules and associations. (p. 22)

## 2.1.6 Current and emerging modelling and data definition techniques and formats

The work of Peter Chen and others in the late 1970s and 1980s was drawn together by James Martin, Clive Finkelstein and others through a body of work known as Information Engineering (IE). IE introduced the depiction of 'business models' tied to systems design principles. More recent developments of 'object oriented' theory have seen information modelling evolve further, including through Unified Modelling Language, Object–role Modelling and Extensible Markup Language. These emerging techniques are briefly discussed below. Their potential significance to the future development of the NHIM and their use in major information development projects in Australia are indicated.

### 2.1.6.1 Unified Modelling Language (UML)

UML is a relatively recent development. It tries to bring together business concepts with information concepts in order to produce a standardisation of terminology and diagram notation for the representation of objects. UML is becoming widely used for both database and software modelling. UML Version 1.1 was adopted by the Object Management Group (www.omg.org) in November 1997 as a standard language for object-oriented analysis and design.

UML is described as a 'language for specifying, visualising, constructing, and documenting the artefacts of software systems, as well as for business modelling and other non-software systems'. (www.rational.com/uml/index.jsp)

Although UML focuses on systems and software development and is mainly an object-oriented technique, it may be of significant relevance to the future development and depiction of the NHIM. However, it would be wrong to think that established techniques, such as E-R, have become redundant:

> The *logical* view describes the design's object model when an object-oriented design method is used. To design an application that is very data-driven, you can use an alternative approach to develop some other form of logical view, such as an entity-relationship diagram. (The 4+1 View Model of Architecture, Philippe Kruchten, www.rational.com/products/whitepapers/350.jsp)

Critics of UML argue that object-oriented techniques are best used in the detailed design and implementation stages of systems development, and not in the conceptual representation, analysis or initial design stages.

UML has been used in the development of the HL7 Reference Information Model (RIM). In this conceptual model only the data component of objects has been modelled resulting in a model that is characteristically similar, although diagrammatically different, to an E-R Model. Conversion is therefore possible making the model applicable for lower level modelling using either Information Engineering or Object Oriented techniques.

#### 2.1.6.2 Object-role Modelling (ORM)

ORM originated in the mid-1970s as a semantic modelling method. One of the early versions was the Natural Language Information Analysis Method (NIAM). ORM has since been extensively revised by many researchers.

ORM aims to design database models at the conceptual level. It uses terms easily understood by users, rather than the language of information systems or data structures. ORM pictures the world simply in terms of *objects* (entities or values) that play *roles* (parts in relationships). For example, you (an instance of an entity) are now playing the role of reading, and this working paper (an instance of another entity) is playing the role of being read.

One significant distinction of the ORM technique is that it does not allow for attributes, a central part of the E-R technique and currently an important link between the NHIM and the NHDD. The ORM technique considers the difficulty of representing relationships and attributes, and dictates that all attributes should be depicted as entities and roles. For example, if in E-R terms *Date of birth* is an attribute of a person, then in ORM terminology the entity PERSON would 'have' (role) a DATE OF BIRTH (another entity).

Experience with mapping the NHDD (with its list of data elements or attributes) to the NHIM (entities) has presented the Australian Institute of Health and Welfare (the Institute) and its partners with some problems. A consideration of the ORM technique may help to solve these.

#### 2.1.6.3 Extensible Markup Language

The rapid and unpredictable explosion of the Internet, in particular the World Wide Web, has quickly generated a number of emerging 'standards' to allow documents and data to be produced, displayed and transmitted via the web. Although this field is relatively new and still evolving, XML has emerged as a standard format with significant potential.

XML, a project of the World Wide Web Consortium (W3C) (www.w3.org/), is described as the 'universal format for document and data on the web'. It is a specific version of SGML (ISO 8879—the Standard Generalized Markup Language (SGML)). XML Version 1.0 was accepted by W3C in early 1998. Significantly, XML is the messaging markup language used for Health Level 7 (HL7) version 3 messages which are used by a significant number of hospitals in Australia and the United States of America.

HTML, the markup language most frequently used on the World Wide Web, is another version of SGML. SGML is often referred to as the 'mother tongue', with XML and HTML being specific implementations of it. XML was designed to provide significantly more flexibility and power than traditional HTML in implementing SGML on the web.

The promise of XML, as it applies to health information, is that it can use pre-defined data structures within web-enabled applications and documents, either for displaying or transmitting data via the Internet. XML includes a number of techniques, including Document Type Definitions (DTDs) and XML Schemas, to specify text-based document content in terms of data structures.

XML is not the same—and does not provide the same functionality or power—as the schema of traditional database management systems. It is mainly a text markup language, although it obviously does have significant application as the basis for software development and data definition.

In terms of Australian health information, Model entities and NHDD data element definitions could form the basis of XML data definitions, providing a standardised approach for the web-based transmission of health information. This field of work is likely to be the subject of considerable interest and research over the next few years.

## 2.2 Use of information modelling in the Australian health and welfare sectors

### 2.2.1 NHIM and NCSIM

In 1997, the NHIMG endorsed the NHDC recommendation to adopt Version 2 as the organising framework for printed versions of the NHDD. However, it reserved judgment about the Model's role in specific information development projects, and asked that this be considered in more depth.

In 1998, the National Community Services Information Management Group (NCSIMG) adopted a National Community Services Information Model (NCSIM) Version 1 as the organising framework for the initial edition of the National Community Services Data Dictionary. NCSIM Version 1 was based on Version 2 of the NHIM with some adaptations for the community services sector.

As outlined in the following sections, the development and use of a range of other models has formed the basis of the development of Version 2.

### 2.2.2 Experience in the development and use of other models

The increase in the number of entities in Version 2 reflects the further refinement of the entities presented in Version 1, as well as contributions flowing from the subsequent development of several sector-specific contextual models (definitions of entities in the NHIM are set out in Appendix 2). Each of the following national modelling projects has either already influenced the development of the entities in the NHIM, or is likely to do so in the near future:

- the National Community Services Information Model (NCSIM)—a conceptual modelling project directed at establishing an information framework for Australia's community service, welfare and housing sectors
- the Disability and Aged Care Model—a contextual modelling project that developed data items associated with the disability, disability services and aged care fields
- the Primary and Community Health Services National Information Model—a contextual modelling project that covered services delivering assessment and care, early identification and intervention, and health intervention/promotion activities to people (clients) in facilities located in the community
- the National Institution-based Ambulatory Care Model—a contextual modelling project that covered service delivery interventions for ambulatory patients in outpatient clinics and emergency departments

- the Community Health Information Model—a community health data model developed through extensive consultation with clinicians as part of the Community Health Information Management Enterprise initiative.

The State/Territory health departments are at various stages of developing enterprise information models (EIM) that are being designed to help develop their information architecture and system development processes. The lead has been taken by the New South Wales Department of Health, that developed an EIM in 1996 and has made this publicly available. Several States/Territories have based their developments on this EIM. For example, Western Australian Department of Health has recently completed development of an EIM which was initially based on the NSW model. Some divergence between the NSW Health EIM and the WA Department of Health EIM has inevitably occurred during the development process  There are now significant opportunities for the harmonisation of models, both between the jurisdictions' EIM and between the NHIM and these EIM. This harmonisation should result in the establishment of an accepted generic base model which would obviate the continued development of development models.

The jurisdictional models are intended to provide an intermediate framework that standardises corporate (State) data and the business rules that pertain to this data. These business rules are depicted in the relationships between entities. The NHIM V1 was used as a conceptual framework for the NSW model, therefore, it can be mapped upwards to the NHIM, and the data elements map to the NHDD. The development of these EIM will have an important influence in designing Version 3 of the NHIM. The high-level conceptual model should be harmonised with a number of enterprise information models and their differing business rules (relationships). The harmonisation of this notional hierarchy would require on-going maintenance, as the structure grows in both breadth, with the addition of new jurisdictional EIM, and depth, with the creation of more detailed subject area models.

## 2.3 Decisions on relationships at a national level

### 2.3.1 Describing relationships

The E-R technique specifies in some detail how and under what conditions one entity can be related to another. If, however, an information model is to serve as a basis for national (or industry-level) consensus, it must be capable of accommodating:

- the political, administrative and cultural diversity of multiple jurisdictions and sectors
- the context models developed within a range of modelling conventions.

Accordingly, and consistent with views on conceptual modelling, Version 2 of the NHIM abandons the use of relationships between entities. This does not constitute a loss of faith in the E-R convention for use at lower levels of modelling. It does, however, reflect the importance of the consistent identification of entities at the national level, and the greater importance of relationships or business rules at lower levels.

The loss of relationships from the model emphasises the role of the model in classification or grouping of items and correspondingly, reduces its potential role in systems development.

The work of the Institute and its partners has led to the conclusion that relationships between Model entities cannot be effectively described at a broad, national level. They are more appropriately described at more specific levels, such as in the context of information or applications development for a specific aspect of the health sector. This is arguably the key finding of our practical experience in applying information modelling techniques in the national health information development environment over the past 7 years.

At the national level, the focus is on the broad categories of information required for national purposes. These are, in turn, supported by more detailed information that relates to specific information requirements required for specific purposes. It is only at these more detailed levels that these relationships can be specifically identified, particularly as these relationships will differ from one specific application to another. For example, it is self-evident that there must be some kind of relationship between the NHIM entities of EVENT and STATE OF HEALTH AND WELLBEING. In a high-level model such as Version 1 of the NHIM, this relationship can be described only in fairly generic terms, and in this particular instance is described as EVENT influences STATE OF HEALTH AND WELLBEING. Clearly, the precise relationships will vary widely from case to case depending upon the particular nature of the event and the state of wellbeing and, as such, are best described within a particular context. For example, STATE OF HEALTH AND WELLBEING may be an expressed or perceived state, and may relate to an individual or a population group with particular characteristics. The EVENT may range from a routine appointment with a service provider to a highly significant life (or death), legal or physical event. Furthermore, the EVENT to STATE OF HEALTH AND WELLBEING relationship does not stand alone from other entities. This is because both these entities will each have pertinent relationships to other entities in the NHIM. Attempts to abstract these multiple, specific relationships up to a broad, national level have been counter-productive, as there are too many relationships to document effectively within a general conceptual model such as the NHIM. Furthermore, it is perceived that this could exclude particular relationships that would apply in given contexts.

This has led to the identification of a number of 'layers' of models that will be required to further the development of national health information.

- *Conceptual modelling* is a process aimed at establishing an agreed high-level structure that will prove suitable for use as an enterprise-wide information framework and, following further development, capable of supporting applications development exercises. The conceptual modelling process identifies and defines entities only, with greater emphasis given to achieving consensus about entity 'supertypes' than to the need to identify necessarily a full range of subtypes. Data elements (attributes) would not normally be present in a conceptual model.
- *Contextual modelling* is the further development of a conceptual model to accommodate the business rules and specific attributes of a particular jurisdiction, sector or specialisation. Contextual models are developed within the technical boundaries of a particular modelling notation, whether E-R, UML, ORM or other convention. A single conceptual model may accommodate several unique contextual models without loss of integrity, each one varying from the other, based on the particular sector or specialisation covered, or on the particular modelling convention used. For example, an E-R contextual model may be developed from a conceptual model by the addition of the relationships between entities that characterise the business rules of a particular jurisdiction (or context) and the enumeration of attributes belonging to entities. The process may well also define a significant range of data elements to populate the entities. The same conceptual model would also support the development of a UML contextual model for the same jurisdiction.
- *Physical data modelling* is the extension and refinement of a contextual data model to form the basis for applications development or database design. A physical data model is an attribute-rich implementation of a single contextual model and represents the most detailed implementation of the original conceptual model.

These layers have been found to be usefully interrelated—each implementation of a model at the next lower level challenges the integrity of the respective higher level(s). Although one might reasonably expect the higher level conceptual and contextual models to be more stable over time than physical data models, the interactive nature of the approach is such that the models are subject to constant and ongoing review and, where necessary, amendment.

Enterprise models may thus be developed as conceptual or as contextual models. The NHIM is an initiative within the first of these layers, i.e. it is a conceptual model**.**

### 2.3.2 Revised aims for the project

The NHIM Version 1 publication attempted to record how health information could and should be structured rather than reflecting, necessarily, how health information **is** currently structured. Version 2 continues to model the 'concept' of a health sector, rather than any particular system that might operate within that sector.

The aims of the NHIM are now more limited than they were previously, reflecting the specific role and niche that the NHIM has filled. The next few years, particularly with the advent of a number of major national health information initiatives, will further test and refine the Model's future role.

The aims of Version 2 are to continue to support :

- a common information management language and vocabulary for national health information projects where a data or information modelling approach is appropriate;
- a suitable framework for the development of sector-specific data models on which systems development activity might be more effectively based;
- a conceptual base for the NHDD; and
- stakeholders in conceptualising their information and data requirements.

# 3 Evaluation of NHIM Version 2

## 3.1 Introduction

This chapter evaluates Version 2 of the National Health Information Model (NHIM) in relation to:

- its uses as a national framework, looking at the technical features;
- some of the international information modelling initiatives in which the NHIM may be useful or that may be useful in modifying the NHIM;
- the objectives that are the basis for the creation and publication of the NHIM; and
- the potential future roles for the NHIM.

## 3.2 Use as a national framework

### 3.2.1 The NHIM and the National Health Data Dictionary

Following its adoption as the organising framework for the Knowledgebase in 1997, Version 2 of the NHIM was accepted by the National Health Data Committee (NHDC) as the organising framework for the National Health Data Dictionary (NHDD) from Version 7 (published in 1998) onwards. This means that a range of related data elements can be grouped together under a single entity. For example, a set of data elements about service provision can be logically grouped together under an appropriate Model entity such as HEALTH AND WELFARE SERVICE EVENT, rather than being randomly distributed throughout the NHDD in alphabetic or other order.

The Model can, of course, be used at more sophisticated levels. It can be used to gauge the coverage of entities in the NHDD. For example, if there are few, or no, data elements for some Model entities (e.g. NEED/ISSUE), this can assist in identifying areas for further development, or in reassessing the structure of the NHIM. Similarly, the presence of a large number of data elements under a single entity may confirm the importance of that particular entity or may point to a need to enhance the structure of the NHIM. The Model also has the potential to be used to ensure that the concepts underlying data elements can be consistently mapped to entities, and that each data element is unique and does not overlap with other data elements. This is the direction that the NHDC is currently taking with the NHIM, with the aim of improving the underlying structure of the NHDD.

Although the NHIM has provided an organising framework for the NHDD, neither the NHIM nor other information modelling techniques have been used to any great extent to develop data elements. The Australia health system has tended to apply other approaches to the development of dictionary content. More work is needed to strengthen the relationship between NHDD elements and the NHIM.

Some proponents argue that some NHDD content cuts across Model entities, and duplicates relationships across Model entities. The proponents of modelling techniques argue that separate data dictionary items are required as a means of presenting reusable data value domains that then provide the basis for data elements. For example, a data element and data domain *Country* can support a data element called *Country of Birth*. However, the NHDC approach has been to emphasise presentation of relevant definitions rather than to adhere to any particular modelling practice. However, there is a subsequent diminishing of the direct applicability of the data dictionary elements for systems development.

Success using modelling techniques alone is not assured. Some context-specific modelling projects have fallen short of expectations because, although they were able to specify high-level models with entities and entity subtypes, they had limited success in getting below the levels of abstraction to the more critically important task of defining data elements. In a number of these projects, modelling *per se* was perhaps seen as providing all the answers. However, insufficient emphasis was given to articulating the business case and dealing with specific data requirements. While the use of information modelling techniques cannot be credited with the failure of these projects to deliver, the experience gained points strongly to the need for balance in applying information modelling techniques to the task of defining users' data requirements. Subsequent projects utilising data modelling will need to implement bottom-up as well as top-down techniques to avoid a recurrence of the abstraction issues experienced previously.

### 3.2.2 The NHIM and the Knowledgebase

The capabilities of modern communication and information technologies are such that an increasing amount of information is now accessible online within particular jurisdictional settings or via the Internet. The expansion in this resource base, whether online or not, has highlighted the need for enterprise-wide management of information about such resources ('metadata') and a general integration of that metadata.

Formal data registries and metadata registries have been developed in a number of agencies, several of which offer public domain Internet access to metadata resources. The pioneering installation among these online data registries is the Knowledgebase-Australia's health, community services and housing metadata registry. The Knowledgebase uses the NHIM as a conceptual gateway to a wide variety of Australian data standards, including:

- the NHDD and National Community Services Data Dictionary (NCSDD)
- national agreements to collect data, e.g. the National Minimum Data Set for Institutional Health Care
- performance indicator frameworks.

The Knowledgebase has recently been expanded to act as a register for additional health related metadata, namely:

- data elements under development by the NHDC that are candidates for future inclusion in the NHDD
- data elements administered by other agencies that are relevant to national information development activity.

Use of the NHIM as a gateway to the Knowledgebase enables a user to easily locate, identify and download data standards without knowing the name allocated to the particular resource by its originator. The Knowledgebase is accessible on the Institute's web site (www.aihw.gov.au).

### 3.2.3 Potential for broader use as a framework

The potential of the future role for the NHIM was recognised in the July 2000 report of the National Electronic Health Records Taskforce, *A Health Information Network for Australia*, which states:

> The National Health Information Model provides the conceptual basis for the NHDD. The Model provides the framework and the Dictionary provides the detailed definitions. It has broader potential for use in standardising the fundamental structural elements of health and welfare information in Australia, providing a framework for organising information, developing data and designing new information systems, and providing a framework for the stable and consistent storage and expression of data (p. 142).

Version 2 of the NHIM has attracted positive comments internationally. For example, in its publication of the Canadian Health Data Model, the Canadian Institute for Health Information states, in reference to the depiction of the NHIM within the Knowledgebase:

> The Australian National Data Model is better presented than the RIM (the Health Level 7 Reference Implementation Model), with a 'drill down' capability that gives a better sense of the levels of the NHIM and specific relationships to 'data agreements' that tie the elements of the NHIM to actual processes in use. It is an excellent template of what a National Health Data Model should look like and how a model can be used to encourage the various jurisdictions to actively use common definitions.

In 1998, the report *Establishing Health Care Quality as a National Priority* was published by the US President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry. This report states:

> Other industries, as well as the health care industries of other countries, have begun to address inconsistencies in the specifications and operational definitions of data concepts by establishing data registries. These registries serve to promote consistent use of data that need to be interchanged between organisations. Examples of such efforts include the National Health Information Knowledgebase of the Australian Institute of Health and Welfare and the Basic Semantic Repository Project of the International Organization for Standardization of Data Elements.

Subsequently, a number of United States government agencies including the Health Care Financing Administration and Department of Defence Health Affairs have established data registries based on the Institute's Knowledgebase and the high-level conceptual framework of Version 2 of the NHIM.

In June 2000, at the 50th Anniversary Symposium of the United States National Committee on Vital and Health Statistics, the relevance of Australia's national information development infrastructure (including the NHIM) was given prominent reference in relation to the need for a health information road map in the United States.

## 3.3 Technical features of the NHIM

The major task for the future development of the NHIM is to remain relevant to the emerging needs of the health information field, and to play an increasing role in the major national health information development initiatives discussed in Section 3.2.3 (above.)

### 3.3.1 Appropriateness of entities

One criticism of both the NHIM Version 1 and Version 2 is the use of abstract terms such as Party Role (a term that actually embodies an entity relationship), and a preference of users for terminology that can more easily be related to specific features of the health sector.

A comparison of the Version 2 entities with the content of NHDD Version 9 highlights a number of interesting features:

- For some supertypes and entities (e.g. EVENT/HEALTH AND WELFARE SERVICE EVENT, PARTY CHARACTERISTIC/PERSON CHARACTERISTIC) there are a significant number of NHDD definitions, whereas others have few or even no NHDD definitions.
- Assignment of some NHDD definitions to an appropriate entity in Version 2 is problematic (e.g. *Age* is described as a PERSON CHARACTERISTIC while *Gestational Age* is described as a PHYSICAL WELLBEING subtype of PARTY CHARACTERISTIC). Some NHDD definitions do not appear to fit appropriately with any existing entity (e.g. *Census Date* is listed as a PERFORMANCE INDICATOR).
- The existing structure of entities and subtypes also needs to be reassessed. Supertypes, entities and subtypes tend to be specified in variable detail. Some entities appear to be isolated and lack context. There is scope for integration and rationalisation of such entities and their subtypes. Some entities are redundant, some require clearer definition and delineation, and some new supertypes and entities may be required.
- For example, the widespread adoption of the mobile phone means that a phone number no longer necessarily has a location associated with it, and is really a system node identifier (even the device can change). Internet and e-mail addresses also need to be incorporated, again as locationless system node identifiers. Also, SETTINGS are really types of environments or environmental factors, and should be so grouped, rather than under LOCATIONS as currently listed.
- The elevation of the NHIM to the nationally applicable conceptual level means that the previous reason for non-inclusion of TIME sub-entities (i.e. TIME, DATE and DURATION) is no longer valid; these could be gathered under a TIME grouping.
- It is also hard to inherently differentiate among the various sub-entities currently listed under BUSINESS STATEMENT and BUSINESS PROGRAM; while CARE PLAN, NEED/ISSUE, and OUTCOME appear also to come under this combined grouping.
- The EVENT entity could be expanded to EVENT/PROCESS, and thus could also encompass EXPENDITURE.
- The OTHER ENABLING FACTOR grouping is superfluous.

These may be attributed, in part, to the incomplete coverage of the NHDD. However, they point towards the need for a thorough reassessment of the NHIM structure and enhancement and rationalisation of Model entities.

### 3.3.2 Appropriateness of relationships

It is important to clearly distinguish between high-level information models (with or without relationships specified) and information modelling (or engineering) techniques for specific purposes. There is an argument that the latter could be usefully applied to the current content of the NHDD in order to:

- clarify interrelationships between data elements and data element concepts

- describe the logical flow of relationships between data elements, e.g.
  - an *Admission* occurs at the commencement of an *Episode of Care*
  - a *Separation* occurs at the end of an *Episode of Care*.

Proponents of this approach argue that this enables modelling of the NHDD by creating logical groupings of entities and by showing how information is used in conjunction with other information. Note that this is a somewhat different approach from the current description of related data references used in the NHDD.

This approach also helps to:

- identify overlaps and redundancy in the existing NHDD content
- identify instances where more generic data elements might be identified.

The overall view of the NHDC is that these issues are important but can't be resolved by technical means (i.e. conventional information modelling techniques) alone. They need to take non-technical issues into account as well. The current prevailing NHDC view is not to go the full distance with E-R modelling but to commit to adoption of a process of vigilance to ensure that NHDD content covers relationships between data items.

Nevertheless, there may be merits in providing the most significant and generic relationships between the highest level entities. This could have the benefit of facilitating basic comprehension of the business environment involved and potentially strengthening the relationship between the NHIM and the NHDD data elements.

An issue involved with this approach is that it may be argued that the NHIM would not encompass other frameworks if they contain any relationships not shown in the revamped Model. In particular, there may be controversy about such relationships not being 'significant' and/or 'generic'. However, just as the entities in the NHIM are a generic representation of many specific objects that may be differently named, so too would the relationships be a generic representation of many specific business rules that may be differently expressed at lower levels of granularity.

### 3.3.3 Definitional integrity of NHIM entities

As part of the review of modelling activities over the past 5 years, it is evident that the definitions of entities in both the NHIM Version 1 and Version 2 have not been subjected to the same level of rigour as applies to the definitions of data elements in the NHDD. As a result, a number of individual entities are not clearly defined. In some instances, this results in overlaps with other entities, leading to ambiguity. It is apparent that some existing entities are redundant, some require clearer definition and delineation, and some new entities may be required.

Clearly, there is a need to clarify entity definitions.

# 3.4 International information modelling initiatives

## 3.4.1 Canadian Roadmap Initiative

A number of overseas initiatives in information modelling are directly relevant to Version 2 and its subsequent development.

The Canadian Institute for Health Information (CIHI) has developed a coordinated approach (www.cihi.ca). It developed a Health Information Framework as a high-level conceptual framework with four basic information domains covering people, the health system, the environment and processes. Below this level, there is also a Conceptual Data Model, containing only the highest level of entities, along with the main relationships between them. The slightly adapted CIHI Health Information Framework High Level Diagram is presented in Figure 3.1.

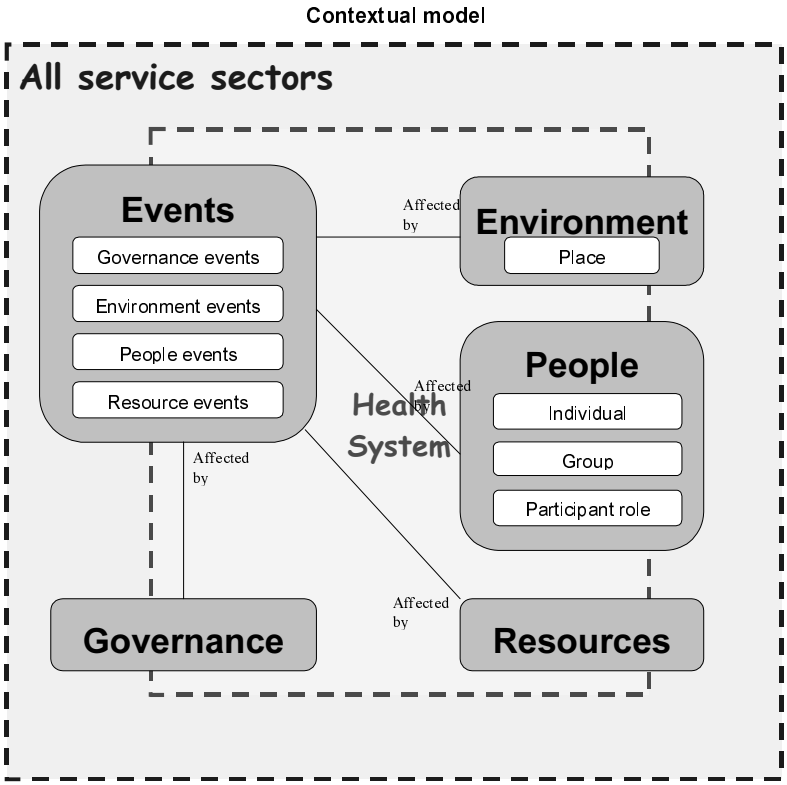


**Figure 3.1: Adapted CIHI Health Information Framework high-level diagram**

This high-level framework consists of broad entities that are clearly relevant to the health sector and with which all stakeholders can clearly identify. It allows a logical ordering of like things. For example, health expenditure and revenue, which are shown under a number of different entities in the NHIM Version 2, can be grouped together more coherently. These high-level entities or concepts are so generic that they arguably can be applied (with changes in terminology) to other sectors such as the community services and housing assistance sectors.

The advantage of doing this would be to provide a basis for promoting a level of consistency of data standards for the health, community services and housing assistance sectors. For example, there are differences in the way that expenditure and revenue are presented in the NHIM Version 2 and NCSIM Version 1. A framework such as that shown in Figure 3.1 could be used to ensure consistency at an appropriate level of abstraction, and as a solid basis for identifying any essential differences at a finer level of specification.

In addition CIHI has developed a Conceptual Data Model to provide a foundation structure for specific information development initiatives. Figure 3.2 has been adapted from the CIHI model.

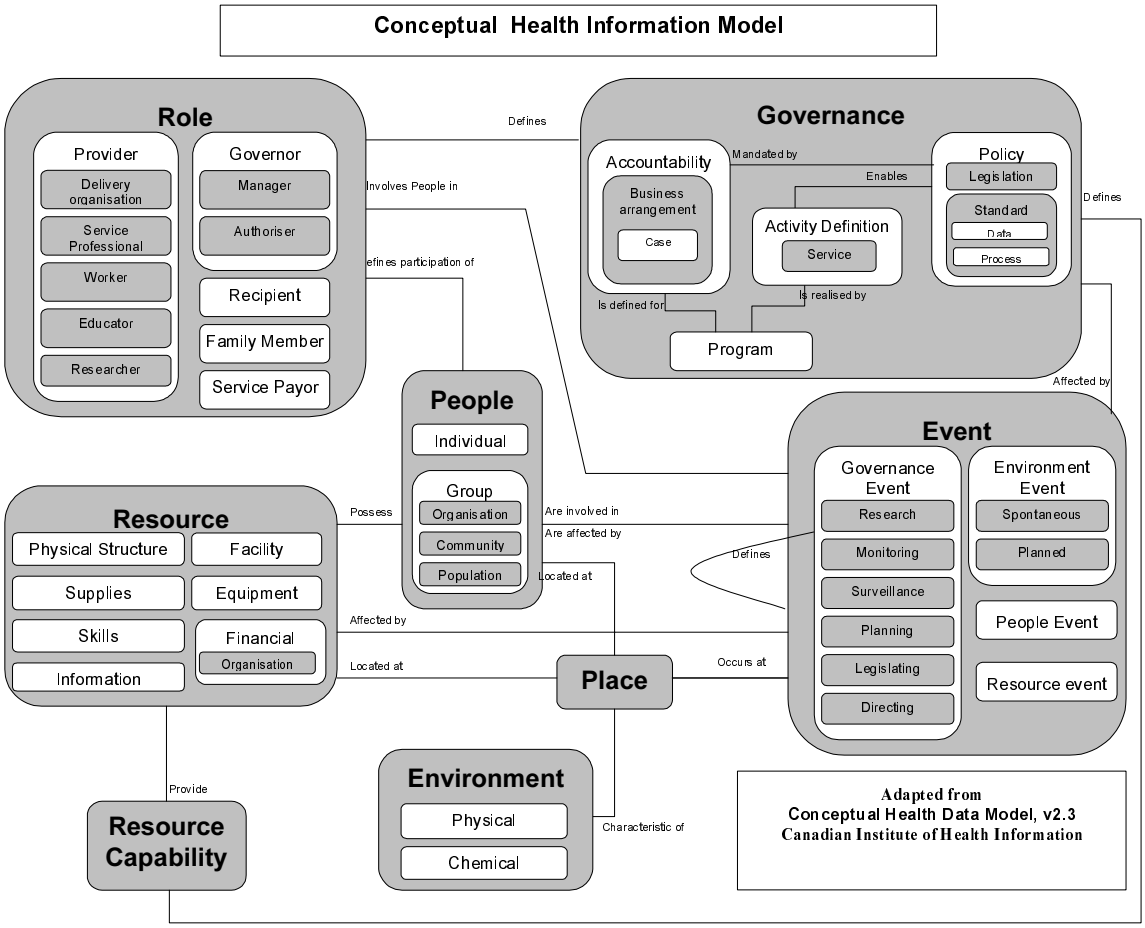


**Figure 3.2: CIHI conceptual health model (adapted)**

It is notable that the CIHI Conceptual Data Model describes two significant areas that are not separated out in Version 2—namely Governance and Status. Governance is seen as a concept that could be considered for inclusion in any future enhancement of Version 2. Status is an attribute of all the other entities, and it could also be considered for inclusion, although it may be similar in nature to Classification Systems and Date and Time discussed in Chapters 1 and 2.

It is notable that the CIHI Conceptual Data Model includes relationships between a number of the entities. There is no relationship, for example, between either Environment or Resource and Event, nor is there one between Facility or Place and Environment, yet it would be readily possible to argue for such links. Although a clear decision has been made

to make Version 2 a relationship-free model, the possibility of restoring at least some broad relationships in any revision should be left open as an option.

### 3.4.2 ISO developments

The International Organization for Standardization's Technical Committee ISO TC 215 (Health Informatics) developed a 'Health Information Architecture Framework' (now retitled 'Health Information Modelling Framework') based on John Zachman's 'Enterprise Architecture—a Framework'. As such it had the form of a two-dimensional structure with axes that TC 215 has labelled as 'Specificity' and 'Perspectives'.

More recently, ISO TC 215 has added a third dimension of 'Layers of Purpose' (www.health.nsw.gov.au/iasd/imcs/iso-215/meetings/london). In so doing, it has revisited the work of the European Committee for Standardisation Technical Committee CEN TC 251 Health Information Framework in 1994. The Draft Health Information Modelling Framework is set out in Figure 3.3.

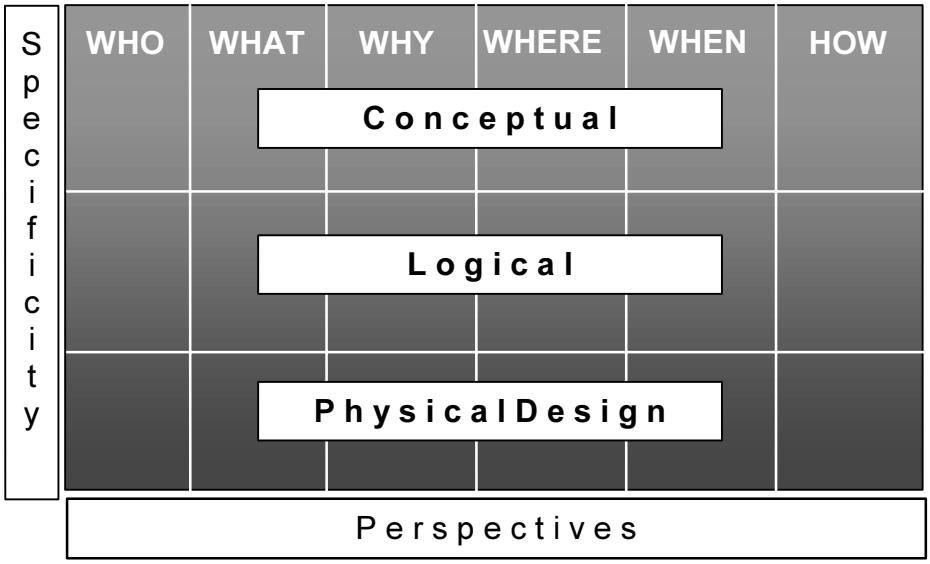


**Figure 3.3: Draft Health Information Modelling Framework**

Initially, ISO TC 215 attempted to develop a global conceptual health information model, i.e. a global version of something akin to the NHIM. TC 215 concluded that obtaining international consensus on a fairly detailed model was an unrealistic expectation. Further research and discussion pointed to the extensive range of information models and frameworks that exist for varying purposes. This is a strikingly similar finding to the findings in Australia discussed in Chapter 2 and supports the approach taken with NHIM Version 2 as a high-level, multi-business, conceptual framework that should coexist with Enterprise Information Models (EIMs) and context-specific models.

### 3.4.3 US NCVHS

The 50th Anniversary Symposium of the United States National Committee on Vital and Health Statistics (NCVHS) featured a discussion entitled 'Towards a National Health Information Infrastructure' (www.ncvhs.hhs.gov/ncnhs50tr.htm).

Papers presented on this topic identified three relevant basic entities: PERSON [= CLIENT], PROVIDER, and COMMUNITY, each of which is comparable with the CIHI Conceptual Data Model and (to a lesser extent) with the NHIM Version 2. The coverage of the needs of the three basic types of stakeholder provides a good starting point for electronic health records information modelling and standards development, and a handy review for the basis of health statistics standards.

## 3.5 Aims for Version 3

Although the NHIM Version 2 is an important update to the initial Model, there is still much potential work to be done. As outlined previously, the experience with Version 1 and Version 2 of the NHIM, and with the NCSIM (as well as the State/Territory experience in developing Enterprise Information Models (EIMs)) has shown a need to develop a Version 3 that more effectively supports user needs. In particular, it will be important to tackle the following:

- The Model should be retained as a high-level conceptual framework, but revamped to delete or rationalise some of the more amorphous entities, and adopt more user-friendly terminology. Review of Model entities using international information modelling initiatives such as the CIHI, United Kingdom National Health Service and other relevant overseas health information models as a guide is important.
- The harmonisation of the NHIM with contextual models, such as the State EIM, should be undertaken in order to advance the National standardisation of information models and enhance the applicability of the NHIM to systems development initiatives.
- Its redevelopment should provide a more mature and user-friendly framework. It is important to redevelop entities to provide a set that is more easily identifiable with the 'real-life' health sector. A set of distinct entities free of ambiguity should be developed to ensure coherence at the entity, sub-entity and attribute levels of the NHIM.
- It needs to be adapted to provide an appropriate framework for an expanded NHDD that supports data definitions needed for the development of the Health Information Network Australia.
- Its development should be suitable for both health and community services.
- New entities are needed to cover the broadened scope generated by business demands within the health sector and related arenas.
- The merits of providing the most significant and generic relationships between the highest level entities as a means of basic comprehension of the business environment should be reviewed.
- There are opportunities to make the NHIM more generic, and encompass the NCSIM, possibly developing into a human services information model.
- There is a need to attain a wider application of the NHIM as a high-level, conceptual, industry model. A modest aim would be to have a capacity within the industry to be able to map 'competing' models (NHIM, context–specific, HL7 RIM, GEHR, etc.) to a consistent reference point; a more ambitious aim would be for the NHIM to be the overall model.
- There needs to be an information-sharing process within the health sector for future modelling work. This might include a formalised process for periodic review of the NHIM, and sharing of expertise and experience in development of context-specific models and in the application of modelling techniques to data definition development. It would have the advantage of bringing together much individual energy.

## 3.6 Potential roles for the NHIM

As stated in *A Health Information Network for Australia*:

> the National Health Information Model has broader potential for use in standardising the fundamental structural elements of health and welfare information in Australia, providing a framework for organising information, developing data and designing information systems, and providing a framework for the stable and consistent storage and expression of data.

This endorses the potential of the NHIM to be the basis of health information development in this country. The following sections elaborate the main areas where this applies. The arenas discussed below are currently under development or in use in the Australian health environment.

### 3.6.1 *Health Online* and Health*Connect*

The development of national standards for health information management and information technology (IM/IT) that are compatible with international standards activity is included as a recommendation in *Health Online: A Health Information Action Plan for Australia*[1] (henceforth *Health Online*).

What has been missing has been the policy framework within which standards need to be developed. *Health Online* and, more recently, the National Electronic Health Records Taskforce Report, *A Health Information Network for Australia,* (henceforth known as Health*Connect*)[2] now provide both a strategic framework and a set of specific projects for the development of information activities in the health sector. The intent of the National Health Information Standards Plan for Australia is therefore to identify, at a national level, the standards work required for moving to electronic platforms in line with identified *Health Online* and Health*Connect* policies and projects.

The NHIM has the potential to provide a unifying framework that draws together the IM and IT components of Health*Connect* initiatives. This could have the advantage of eliminating or reducing the number of competing information models.

### 3.6.2 National Electronic Health Records Task Force

Given the endorsement of the potential of the NHIM, it is not unexpected that the NHDD is to form the basis for an expanded set of data definitions needed for the development of the network. For this reason, the requirements of the network need to be interpreted against the NHIM in greater depth, in conjunction with consideration of the specific data items required.

### 3.6.3 Framework for performance and other indicators

Information requirements of strategies in the following key areas have been catered for through an initial framework that identifies points of monitoring or surveillance and specifies indicators, namely:

- National Health Priority Areas—an indicator framework spanning a broad spectrum of population health and clinical intervention activities

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1 National Health Information Management Advisory Council (NHIMAC) 1999, *Health Online: A Health Information Action Plan for Australia*, Canberra: Commonwealth of Australia, p. 33. *Health Online* is available at www.health.gov.au/healthonline

2 National Electronic Health Records Taskforce Report 2000, *A Health Information Network for Australia*, Canberra: Commonwealth of Australia. The network has the 'working title' Health*Connect*.

- National Public Health Partnership—a conceptual framework emphasising interventions targeting determinants; this is providing an emerging framework for public health indicators
- National Health Performance Framework—indicators of efficiency and effectiveness developed by the former National Health Ministers' Benchmarking Working Group (now the National Health Performance Committee).

Stakeholders are being encouraged to use these context-specific frameworks as a guide to information development.

There is potential for these projects to help in the continuing development of the NHIM and for them, in turn, to be helped by the NHIM.

### 3.6.4 Good Electronic Health Record

The Good Electronic Health Record (GEHR)[3] (a major part of the work of the openEHR Foundation[4]) was conceived as 'a solution to the widespread use of health records in diverse contexts'. It is an open information architecture that formally expresses a set of requirements about patient health records, and is ultimately designed to be used by software developers as a starting point for application and system development. The GEHR suggests that it defines an 'information model'.

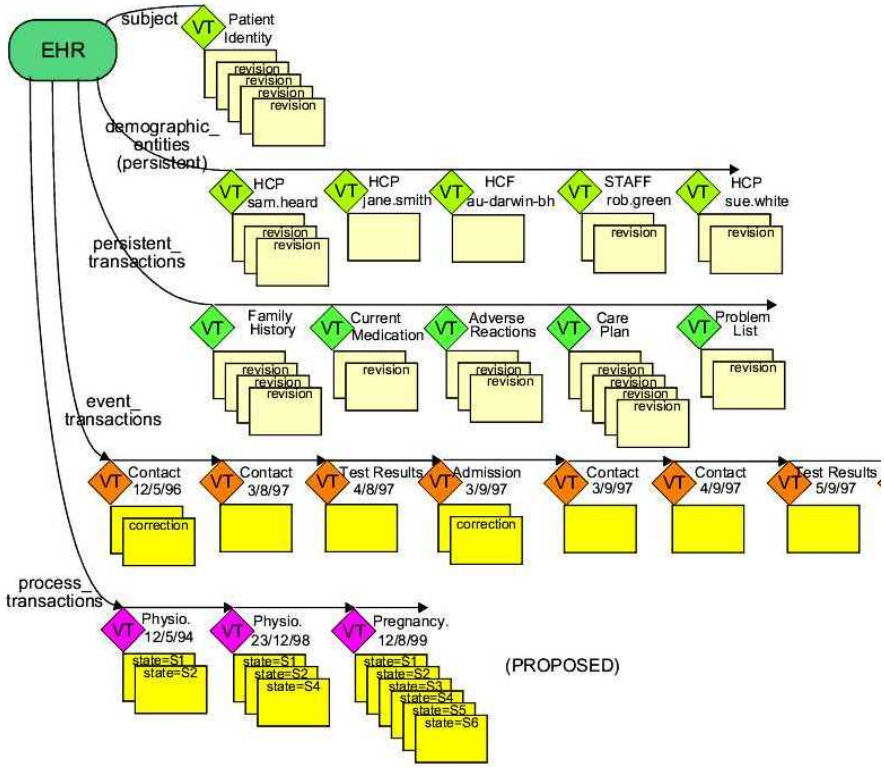


**Figure 3.4: Electronic health records (versioned view)**

3 The Good Electronic Health Record (GEHR) *(www.gehr.org)* is an evolving electronic health record architecture designed to be comprehensive, portable and medico-legally robust. It has been developed from the Good European Health Record Project requirements statement and object model.

4 The openEHR Foundation is an international online community, pooling efforts so that patients and clinicians everywhere can benefit from compatible and high-quality electronic healthcare records, developed and evaluated using a tried and tested common format.

The NHIM has the potential to provide a broad conceptual framework, not just for the NHDD, but for the wider health information arena, particularly the Electronic Health Records (EHR) initiative. Given the intention that the NHDD be the repository for key clinical and operational terms necessary to support EHRs, such an expanded role for the NHIM would appear to be highly relevant.

### 3.6.5 HL7 Reference Information Model

The AS 4700 series of Australian Standards for Health Level 7 (HL7) specify a messaging protocol that is used widely by hospitals and related health services in Australia. Currently at Version 2.3.1, the AS 4700 series is based on the international HL7 standard. Development of Version 3 of the international HL7 standard has begun, and for the first time will be based on a high-level model known as the HL7 Reference Information Model (RIM).

See Figure 3.5 for a view of the RIM in a format similar to that of the NHIM.

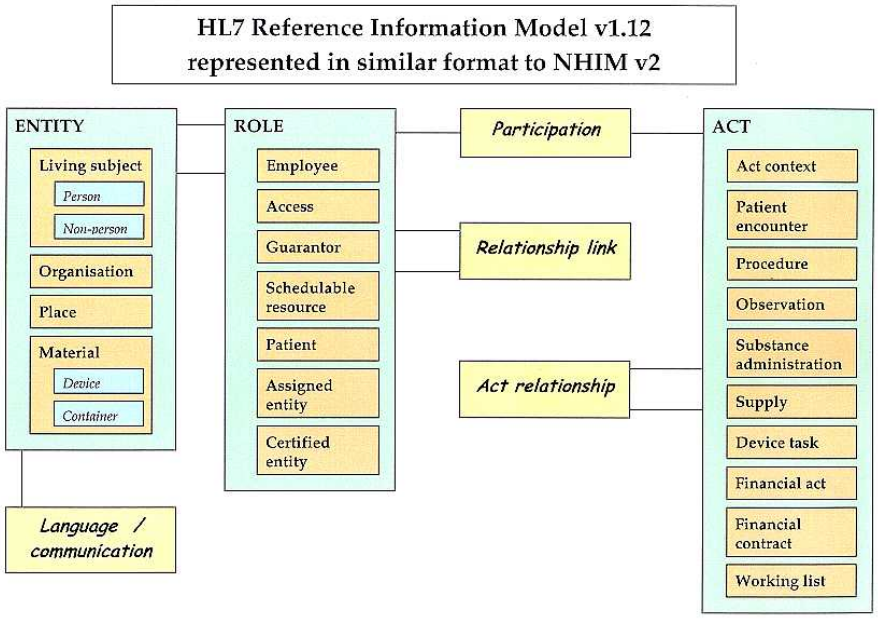


**Figure 3.5: Simplified HL7 Reference Information Model**

It is intended that the scope of HL7 be expanded beyond intra-hospital messaging to cover community health and so on. This suggests a growing commonality in the broad content of HL7 and NHDD. Nevertheless, the NHIM also has the potential to encompass the HL7 system and the RIM.

### 3.6.6 State health data models

Various State health departments have developed data models at various levels to cover their corporate roles, such as:

- the New South Wales Health Enterprise Information Model[5]

5 The NSW Health EIM can be viewed on-line at http://www.health.nsw.gov.au/iasd/eim/index.html

- the Queensland Health Information Model
- the Western Australian Department of Health Enterprise Information Model (WA DOH EIM)[6].

For example, the WA DOH EIM contains the following subject areas:

- Accounts
- Environmental Health and Licensing
- Human Resources
- Locations
- Parties
- Physical Resources
- Planning
- Population Health
- Resourcing and Billing
- Service Events

The Service Events subject area is presented in Figure 3.6.

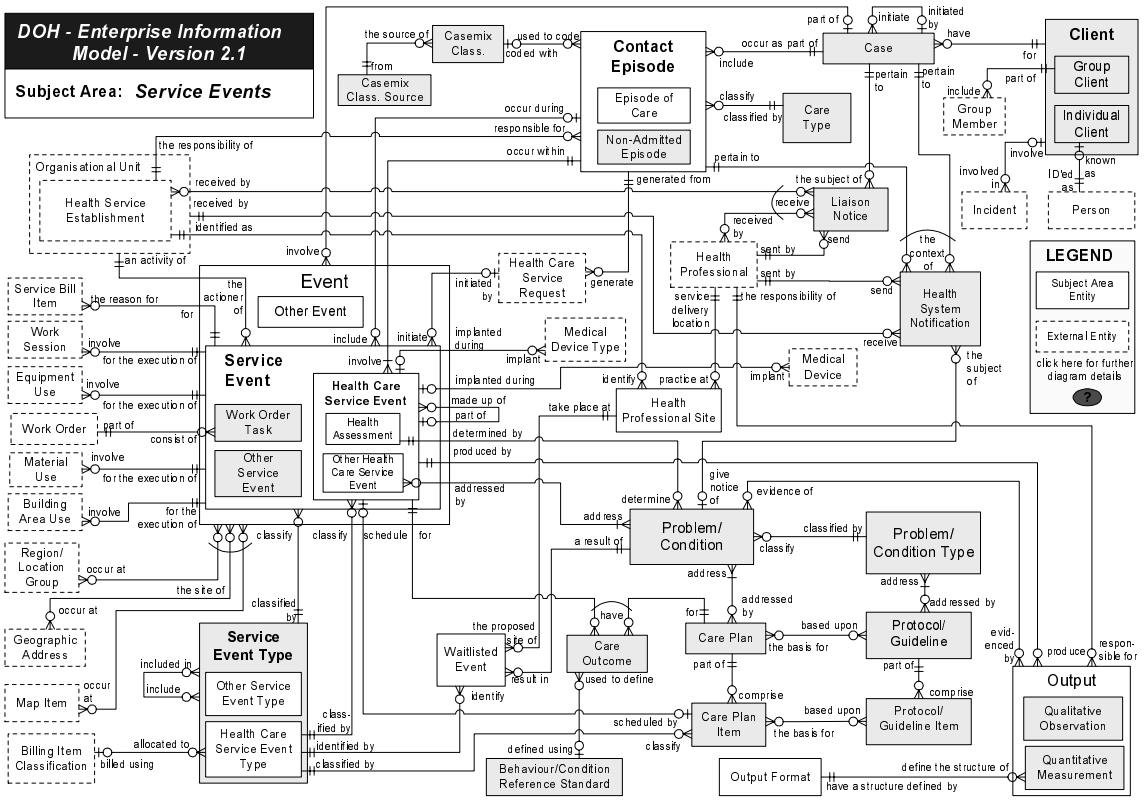


**Figure 3.6: Service Events subject area**

The WA Department of Health EIM is an entity-relationship model separated into subject areas purely for presentation purposes, so that a single subject area model can be viewed on one A3 page. While the EIM is generic within the WA DOH domain it is at a lower level of specialisation than the NHIM. It is specifically designed for supporting planning, purchasing and development of applications systems with a view to standardisation of the high-level data structures and definitions and, as such, has a slightly different focus to the NHIM. This difference in focus made the mapping of WA DOH EIM entities to NHIM entities problematic.

6 The WA DOH EIM can be viewed on-line at http://www.health.wa.gov.au/hic/eim/

### 3.6.7 Other jurisdictional data models

Various other jurisdictional data models have also been produced, usually on specific subject matter bases. Such models are also able to be encompassed by the NHIM entities and sub-entities, and exemplify the NHIM's use as a generic framework for the health area.

The General Practice Data Model was developed under a consultancy to capture the structure of information across this wide area of health service delivery. The consultancy stipulated that the model be aligned with the NHIM. Accordingly, the information specified under this structure will be suitable for alignment with the NHDD.

### 3.6.8 Summary

The various issues arising out of the above potential roles need consideration as part of the development of a Version 3. At this stage, the following principles appear worthwhile:

- There should be high-level entities (and there is nothing here to argue against several levels of sub-entities).
- Relationships have been controversial, though provision of the most significant and generic relationships between the highest level entities should be investigated.

## 3.7 Promoting the role of the NHIM

A recent review of the NHDD has recommended that more emphasis be given to online access to the NHDD and related data standards. Clearly, there is scope for the NHIM (albeit with enhancements as canvassed in this publication) to be adopted as the organising framework for this.

There is a need for more effective promotion of the role of the NHIM in relation to EIMs developed by State/Territory health agencies, and/or by other organisations involved in health information modelling activities.

Ongoing arrangements for information-sharing on health modelling activities should also assist in promotion.

### 3.7.1 Future management of the NHIM

Adoption of a set of guidelines or design principles should assist in effective continuing development of the NHIM. A formal consultation process to define and develop these principles has not yet been undertaken but, as an indication, they might include:

- annual or periodic review of the NHIM including consideration of:
  - submissions from NHIA signatories for changes to the NHIM based on their experience with contextual and physical data models
  - development of related conceptual frameworks such as the National Health Performance Framework
- adoption of a general set of information modelling principles including:
  - recognition that contextual (and physical) level data models are the appropriate level for describing detailed relationships between entities
  - recognition that the NHIM should help in the development of national data elements for inclusion in the NHDD, but not in isolation from clear identification of business needs

- formulation of a set of guidelines encouraging subject-specific national information development projects to:
  - use the existing Model as a starting point rather than create de novo models;
  - map their contextual models to the NHIM.

The development of guidelines or design principles for the future development of the NHIM should be managed by the NHDC in collaboration with the National Community Services Data Committee, on behalf of the National Health and the National Community Services Information Management Groups.

## 3.8 Summary

The techniques of information science, including data or information modelling, continue to evolve and develop. The tremendous growth of the Internet is continuing to make available techniques and standards that allow data and information to be collected, transmitted, stored, published and accessed more easily and effectively.

Behind all this activity is the reality of healthcare and health information, and the need to better organise and use this information. Technology is increasingly being used as an enabler, but it is only a means to an end.

In moving from Version 1 to Version 2, the NHIM has stayed with, but adapted, the entity-relationship technique for depicting the Model. At the same time the Australian health information modelling community is monitoring emerging techniques and opportunities to improve the NHIM and its representation.

The next 3 to 5 years are expected to prove a watershed for the NHIM, with significant national health information development projects, including electronic health records, being actively pursued. The Model will have to continue to prove its worth and utility in these projects and to learn from and develop with them in order to remain at the forefront of this work.

The development of Version 2 represents a significant period of consolidation and maturity for the NHIM, allowing it to progress from an initial concept and design to a better-proven and more robust architecture. The likelihood is that this pressure for enhancement and development will need to continue at a more rapid pace in the near future.

## 3.9 Copyright and disclaimer

# 4 Version 2 explained

This chapter documents the modelling conventions used in Version 2 of the NHIM, and explains its main components. It also explains some of the rationale behind specific changes to existing entities from Version 1 and the inclusion of new entities.

## 4.1 Presentation conventions for Version 2

### 4.1.1 Entities

Entities are the things about which we need to know information or hold data. Entities may be people, places, objects, events or concepts.

The 'rules' for entities, as used by the NHIM, are:

- An entity is represented by a soft box (i.e. rounded corners), with the name in capital letters.
- An entity name is located inside the box, justified towards the upper left-hand corner of the box.
- An entity name refers to a single instance, i.e. the entity would use the singular PERSON, not PEOPLE.
- An entity name must be supported by a definition.

Entity definitions provide much of the richness and utility of the NHIM and it is important for the reader to consider more than just the names allocated to particular entities. Although information modelling provides a concise representation of information, an entity name can be open to interpretation and possible conflict. In defining an entity, it is often useful to include practical examples of what is or is not covered by the particular entity.

### 4.1.2 Entity supertypes and subtypes

In constructing a model of a major system or sector, the practical information modeller treads a thin line between complexity and generalisation. Models with too many entities may be too complex for an audience to understand and genuinely appreciate the underlying information structures they represent. Conversely, models that treat structures at too high a level of generalisation may fail to capture the essential components of a dynamic information structure.

High-level entities may be usefully presented as a composite structure that includes a unique model within its logical boundaries. These composite entities are known as 'supertypes' and may present a subordinate or nested structure comprising several entities or 'subtypes'. The process of clustering entities together as subordinate structures of a single supertype is known as 'generalisation'. The refinement of an entity to incorporate a subordinate structure is known as 'specialisation'.

For example, in Version 2, the entity PARTY is subdivided into three mutually exclusive subtypes: PERSON, PARTY GROUP and ORGANISATION (see Figure 4.1).

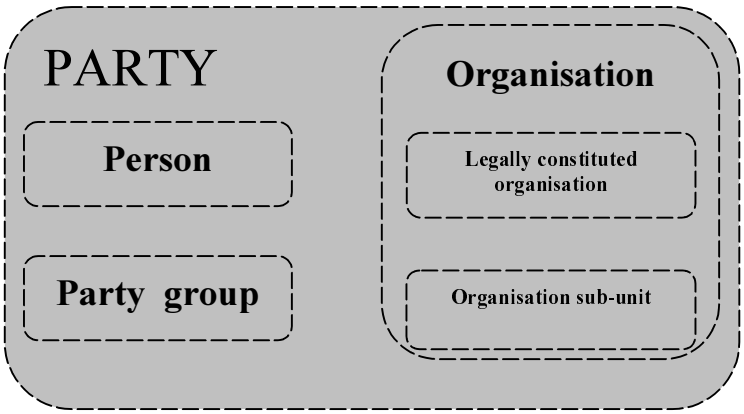


**Figure 4.1: The entity PARTY**

The smaller boxes in Figure 4.1 are entity subtypes, and the complete entity is an entity supertype. Note that the entity ORGANISATION is concurrently a subtype entity of PARTY and a supertype comprising two distinct subtypes (or specialisations). Nesting entities with supertype-subtype associations enables the modeller to present some complex structures with minimal visual complexity.

The 'rules' for entity subtypes and supertypes, as used by the NHIM, are as follows:

- Entities may be specialised into two or more entity subtypes.
- Entity subtypes should be mutually exclusive.
- Entity subtypes inherit the rules of their parent supertype.

Although the NHIM does not present attribute-level detail, it is useful for contextual modelling purposes to record that supertypes and subtypes may each have attributes.

### 4.1.3 Attributes

Attributes, often called data elements, describe an entity. They are the things that we want to know about an entity. As a conceptual model, the NHIM does not present attributes. Doing so would make the depiction of the NHIM complex and unreadable.

A valuable reference source for attributes that can populate the entities of the NHIM is Australia's National Health Data Dictionary (NHDD), presently in its eleventh edition. The NHDD presents a range of nationally agreed data definitions in a format that is specifically mapped to the entities in Version 2 of the NHIM.

### 4.1.4 Dotted boxes — further work required

One of the difficulties of developing a high-level model of health in Australia is that there is no high-level consensus on a number of areas depicted in the NHIM. Research is currently being undertaken to define some of these areas; for others there is ongoing debate.

One of the easy ways for the NHIM to accommodate this is to avoid the use of subtypes and use only high-level entities with very general names. The Model has adopted a new notation to represent entities and their subtypes that may 'need more work' or 'await national agreement'. These entities are represented on the NHIM as entities with 'dotted' box borders.

# 4.2 An overview of Version 2 of the NHIM

## 4.2.1 The macro-architecture

Although person-oriented, the NHIM has no prescribed centre; rather, it allows the reader to use any of the entity supertypes as the logical centre of the NHIM depending on the reader's interests at the time.

For some audiences, size and placement of the various entities and supertypes in the NHIM infer a degree of emphasis or importance and can affect acceptance and interpretation of the NHIM. This should not be the case and the NHIM Version 2 attempts to de-emphasise this as far as possible.

Notwithstanding this latter observation, the entity supertypes of the NHIM can, however, be loosely organised into four categories, as represented in Figure 4.2.

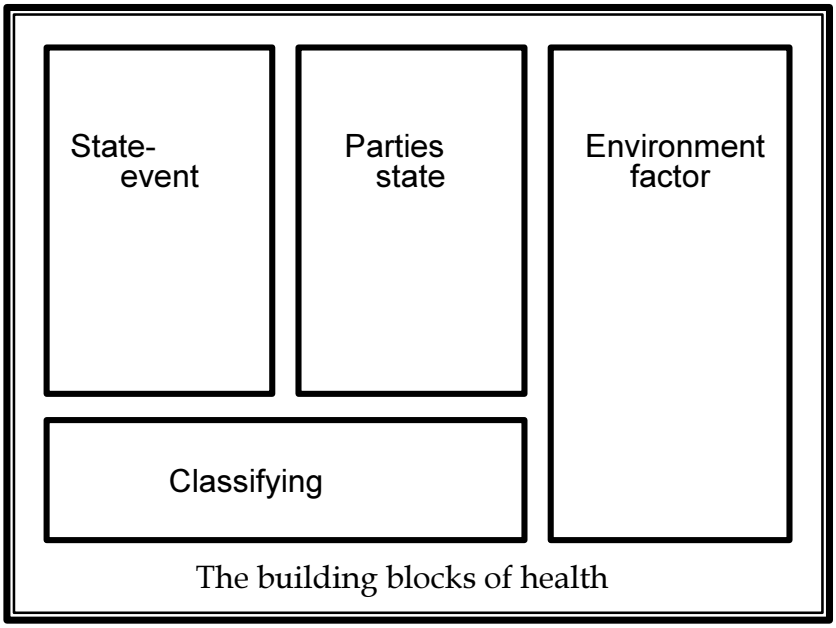


**Figure 4.2: National Health Information Model macro-architecture**

The macro-architecture categories of the NHIM are:

- *Parties and states*—the people or parties active in the health sector, the roles they play and their particular observable, recordable, definable or measurable characteristics
- *State-changing events*—things or 'events' that happen within the health sector and/or involve the parties of interest, and the distinguishing characteristics of those events. Events may vary from imprecise 'life events' such as the onset of puberty to complex service delivery events in institutional healthcare settings
- *Environmental factors*—the administrative, physical and social environments within which we live and within which the health sector operates
- *Classifying systems*—systems that might be used to classify, encode or assess health factors, states or events. Such systems may include value domains, coding systems and performance indicators.

## 4.2.2 The NHIM in action

If enterprise models are worth constructing, they must be put to good use in practice. A well-constructed robust model will be used in different ways. This diversity builds familiarity and stakeholder ownership, and ultimately challenges and reinforces the integrity of the model. Successful modelling initiatives result from the collaboration, commitment and sacrifice of many contributing parties and jurisdictions.

So how might the NHIM be used?

### 4.2.2.1 An aid to consensus

The health sector is full of complex language, terminology and jargon that often complicates effective communication, both with other sectors and within the health sector itself. Sector-specific language stands as a significant barrier to the rationalisation of data and information in most health jurisdictions and sectors. Some of the problem does indeed reflect the unique terminology of a specific sector and activity. All too often, the differences will be cosmetic or semantic (e.g. do we deal with 'patients' or with 'clients'?); they are, however, very real to their proponents. Irrespective of origin, semantic differences in terminology within the health sector present political and administrative difficulties to those charged with data development and/or standardisation exercises.

An enterprise model can diminish the adverse effects of semantic barriers in health. A model can support several separate expressions of logically similar constructs as subtypes or attributes of a single entity; PATIENT and CLIENT could reasonably be considered as unique subtypes of a ROLE for a PARTY in the health sector. Alternatively, sector-specific language and semantic variations on a particular theme might be covered by the use of aliases within a single attribute definition, a strategy that more appropriately accommodates our semantic example of *patient* and *client*. It is often useful to achieve consensus on logical structure in the first instance and an information model is an invaluable tool for assisting this process.

### 4.2.2.2 Business planning

An enterprise information model provides a novel perspective of a business. It can stimulate original thinking about the objectives and organisation of a business, and can be useful as an aid to planning. It can be used to structure thoughts and plans or to support the development of policy, thus enabling planners to analyse and assess the impact of a policy initiative on information.

Using an industry-wide conceptual model as the basis for constructing a jurisdiction-specific contextual model usefully challenges the integrity of the business rules that characterise the particular jurisdiction. Such a contextual model will clearly outline the business imperatives of the jurisdiction, and provides an ideal starting point for discussions with vendors of health systems and application developers.

### 4.2.2.3 Data development and management

An enterprise model can be used to highlight available data resources and those areas in which data development might be most productively undertaken. Appropriately populated with attributes and data definitions, and linked to an inventory of data collections, information models highlight areas of overlap in existing data and indicate where attention to data rationalisation might pay significant corporate dividends. The NHIM is routinely

used in this manner by Australia's National Health Data Committee, the data development arm of Australia's well-established national health information infrastructure.

Many agencies lack an easily accessible, properly indexed inventory of available data resources, a shortfall that can limit the use of those resources. The resultant problems can include duplication of data and data collection effort, the use of inappropriate substandard sources for data and, ultimately, poor decision making. Where catalogues, registers and inventories of data exist, they often rely on alphabetic indexes and key words for cross-reference capability, and hence are semantically vulnerable. These problems can be particularly apparent when data are sourced across jurisdictional or sectoral boundaries.

#### 4.2.2.4 Application development

It is self-evident that the health sector comprises a broad range of interdependent specialist sectors. Application and information systems development activities within health agencies often reflect the views, strengths and weaknesses of particular individuals from single sector environments. Without an overall information framework within which to work, data may not be consistently represented across an agency. This often leads to inefficient application/system design, increases the costs of data handling and management for the organisations involved and seriously limits agency-wide capacity for data exchange.

The acquisition of large health information systems often targets off-the-shelf systems or packages, rather than in-house development activity. It is important to remember that as well as buying an application system the buyer is importing an information model to the business environment, a model that will not necessarily reflect the wider industry and/or jurisdiction within which the agency operates. Agencies will often need to, and should be able to, influence a vendor's underlying information model but will often face the commercial reality of a developer with a mature product to sell and a reluctance (or even inability) to change.

Commitment to a national health information model, together with supporting products such as a national data dictionary, should enable agencies to indicate to vendors the preferred underlying information architecture for the system required without unreasonably affecting commercial considerations. Commercial realities are such that industry-wide commitment to an agreed model will be the key to this capability.

#### 4.2.2.5 An example of the NHIM in action

The NHIM can be used to describe many things, including how the health system might respond to particular circumstances. Consider the case of an individual person involved in a motor vehicle accident and how those circumstances might be mapped to the NHIM.

- The person we are following maps to the entity PARTY and the subtype PERSON.
- The person may be identified and characterised by a range of characteristics that map to the entity PARTY CHARACTERISTICS. These characteristics will include such things as the name of the person and state of wellbeing at a given point in time.
- The motor vehicle accident is an 'event'—a CRISIS EVENT within the entity supertype EVENT.
- The accident will have occurred at a particular place, and that place may be described in accordance with the factors relevant to the entity LOCATION. The place may be a specific ADDRESS (32 Smith Street) or it may be described as a SETTING (e.g. the metropolitan area or the country).

- The accident may have altered the person's STATE OF HEALTH AND WELLBEING resulting in the person being admitted to hospital (a HEALTH AND WELFARE SERVICE EVENT).
- The admission will have been authorised by an attending physician (another PARTY with identifiable PARTY CHARACTERISTICS, but this time a PARTY IN A ROLE of 'Service Provider'.

And so on.

Of course, in practice, each jurisdiction will have its own expectations of what data items might be necessary to document adequately each of these occurrences. The range of items is likely to extend well beyond the material included in the National Health Data Dictionary.

Although this process is, of itself, valuable, it gains significant additional value when the outputs from a number of similar exercises are compiled using the entities or entity supertypes from the NHIM, e.g. when specialists from a number of areas decide to consider how they describe PARTY CHARACTERISTICS that refer to their clients or patients. In this situation, the NHIM may be used to provide a framework for considering and classifying data.

## 4.3 Summary

Experience gained over the course of developing one version of a national health information model and a draft of a second has shown that not all models that are built are actually used in practice. If a model is to be used, it must be relevant to the sector to which it refers and sympathetic to the needs of data providers and users.

We believe that the NHIM passes scrutiny on both these criteria. Some of the functions it might perform include:

- *Providing a tool for building consensus*—an effective model overcoming the obstacles of sector-specific jargon and semantic differences
- *Assisting business planning*—models provide novel perspectives that can be used for policy analysis and to structure further development
- *Providing a logical framework*—models assist the data development process and provide a framework for the management of information resources
- *Influencing application development*—models illustrate fundamental information structures and can enhance communication with systems developers and vendors.

Although models can improve information resource use and management in many ways, they are not substitutes for sound data development practice and management. Equally, there is no single best model for health or indeed any business activity. The best conceptual models continue to be challenged and supported by contextual level models while accommodating the technical and semantic diversity that generates them.

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# Appendix 1: NHIM entity definitions

## The NHIM diagram

The National Health Information Model diagram for Version 2 is included as an A3 size poster with this working paper.

### Entity definitions, usage and rules

In Section 6.2 which follows, the NHIM entities are listed, with their associated definition, a statement of usage and the rules associated with it:

- ***Definition*** is a definition of an entity in the NHIM. The definitions have been developed by the NHIM Project Team, using available references where these were known to exist.

- ***Usage*** is a textual representation of the position of an entity in the NHIM.

  If an entity is a supertype (i.e. it has subtype entities), then a sentence is constructed with the format:

  SUPERTYPE ENTITY is either a SUBTYPE ENTITY A or a SUBTYPE ENTITY B

  If an entity is a subtype, then a sentence is constructed with the format:

  SUBTYPE ENTITY A is a type of SUPERTYPE ENTITY.

### The use of DATE and TIME in the NHIM

The National Health Information Model (NHIM) represents a point in time at which EVENTs occur. Date and Time should therefore be a major entity in the NHIM. Many of the entities in the NHIM have relationships with Date and Time, e.g. BIRTH EVENT (date of birth), HEALTH AND WELFARE SERVICE EVENT (event date and time), LOCATION ELEMENT (date commenced living at a residence).

To depict correctly Date and Time in the NHIM would require a large entity named DATE and TIME. On the NHIM diagram this is assumed to be implicit.

The Date and Time entity has therefore not been depicted in the NHIM. Users of the NHIM will need to make decisions for each entity as to whether Date and Time is important according to their specific needs. For example, one information system may need to record the Date and Time a person changed their residential address (perhaps to build up a profile over time), while another information system may need to record only the person's current residential address.

The decision whether or not to include Date and Time in a specific information system should be made very carefully. Since the currency and accuracy of recorded data will degrade over time, it is generally better to include a date/time stamp on information.

# Entities, definitions and business rules

In the NHIM diagram there are 12 major groupings presented on the Knowledgebase as supertypes. The super-entities Business Factors, Enabling Factors, Environmental Factors and Party Characteristics are not entities in their own right, but rather loose groupings of related entities. Super-entities may or may not have a subordinate or nested structure comprising several entities or subtypes within them.

Super-entities in the NHIM, by alphabetical order, are:

- BUSINESS FACTORS#
- CARE PLAN
- ENABLING FACTORS#
- ENVIRONMENTAL FACTORS#
- EVENT
- EXPENDITURE
- LOCATION
- NEED/ISSUE
- OUTCOME
- PARTY
- PARTY CHARACTERISTIC#
- PARTY ROLE

NOTE: Changes in entities from Version 1.

There are more than 140 entities of various levels in Version 2 of the NHIM in contrast to the 120 entities presented in Version 1. Of these entities, over 70 are unchanged or only slightly changed from Version 1. Seven were substantially changed and 63 are new.

# This is not an actual super-entity but has been created to look like one in order to group loosely related entities

| Name | Definition |
|---|---|
| Accessibility factor | An instance of a factor that influences, determines or affects access to services, providers and information.<br>For example, privacy of records, location of persons and providers, distance from medical services etc. |
| Accommodation characteristic | The living arrangements of a PERSON.<br>For example, the type of dwelling, age of dwelling, number of bedrooms, modification of dwelling to account for restricted movement etc.<br>In the National Health Information Model, ACCOMMODATION CHARACTERISTIC may relate to where a PERSON usually resides or it may be of interest at an instance in time—for example while a PERSON is in receipt of care. |
| Acute event | An acute ILLNESS EVENT (such as the incidence of disease) experienced by a PERSON. |
| Address element | The part of a LOCATION which is a component part of an address (e.g. 12 Main Street), but which is not a GEOGRAPHIC STANDARD (country, city, postcode) or a LOCATION GROUP (region). |
| Advocacy event | An EVENT associated with the act of communicating, defending and recommending a cause or position or acting as an agent. |
| Advocate role | A PERSON in their role as an advocate for another PARTY. |
| Aggregate health and wellbeing | A composite measure of the health and wellbeing of a PERSON. It generally involves measures/instruments that assess the multi-dimensional factors contributing to health and wellbeing.<br>For example, measures currently in use in Australia include SF-36 and SF-12 scores, quality of life measures, health expectancies etc. |
| Aggregate resource | An instance of aggregate or total resources.<br>For example, total nursing staff or the total budget allocated to a program or organisation.<br>Although the National Health Information Model recognises individual resource items (MATERIAL, FINANCIAL, HUMAN and INFORMATION RESOURCE items), the totals of these items are most commonly used in resource management |
| Assessment event | An EVENT associated with the gathering and analysing of information concerning a PARTY. |
| Attitude | The ATTITUDEs of a PERSON towards health, health care and the health and welfare systems. |
| Availability factor | An instance of a factor that influences, determines or affects availability of services for a PERSON or group.<br>For example, the availability of services such as employment assistance for a PERSON with a disability. |
| Belief | The BELIEFs of a PERSON about health, health care and the health and welfare systems. |
| Benchmark | A criterion against which something is measured.<br>Compare with STANDARD. |

| Name | Definition |
|---|---|
| Birth event | The EVENT of being born.<br>It describes EVENTs which happen to both the baby and the mother during the birth. |
| Built environment | The built (man-made) environment in which a PERSON or community lives.<br>For example, quality of housing, access to appropriate sanitation systems etc. |
| Business agreement | An agreement or contract between PARTYs which specifies the roles and responsibilities of each in relation to a HEALTH AND WELFARE PROGRAM.<br>For example, purchaser-provider agreements, employment contracts, service contracts and other funding agreements. |
| Business factors | This 'box' is a super-entity in the National Health Information Model. It is not an entity in its own right but rather, provides a simple grouping facility to access entities relating to business factors. The following entities have been grouped in this 'box':<br>- BUSINESS AGREEMENT<br>- BUSINESS PROGRAM<br>- BUSINESS STATEMENT<br>- PERFORMANCE GOAL |
| Business program | A program conducted by a business or organisation. |
| Business statement | A policy statement or business plan. |
| Capital expenditure | Expenditure on capital items incurred by an ORGANISATION. |
| Care plan | A sequenced list of treatments, other services, and resources that are prescribed to improve a PERSON's STATE OF HEALTH AND WELLBEING.<br>For example, a rehabilitation program for a back injury.<br>A CARE PLAN is a scheme which groups and specifies the roles of material or human resources, planned events, and parties in providing health and welfare services to an individual or group. A CARE PLAN may not always be formally notified or even documented.<br>This 'box' is a super-entity in the National Health Information Model. |
| Carer role | A PERSON in their role as a carer of another PERSON/s who are ill or disabled and unable to perform the tasks of daily living for themselves.<br>For example, a PERSON providing respite care. |
| Citizen role | A PERSON, about which information may be required, but who is not engaged in a specific role within the HEALTH AND WELFARE sector.<br>For example, the identification of an individual (often anonymously) who is participating in a population-based health or welfare survey. |

| Name | Definition |
|---|---|
| Community event | An EVENT which is initiated by or affects members of a community.<br>For example, meetings of support groups (e.g. SIDA), and actions or decisions by a community to undertake or not undertake a course of action on such subjects as curfews, right to life, use of alcohol and sex education. Extreme examples include protests, demonstrations and riots. |
| Community organisation | An ORGANISATION operating for the purpose of meeting community needs.<br>For example, a religious, recreational, sporting or volunteer organisation. |
| Component health and wellbeing | COMPONENT HEALTH AND WELLBEING is a single measure/assessment of the health and wellbeing of a PERSON. For example, diagnosis of illness, disease or injury, self-assessed health status, enough money to buy food, ability to look after oneself etc. |
| Crisis event | An acute LIFE EVENT (such as the incidence or prevalence of disease or injury) experienced by a PERSON. |
| Cultural characteristic | A characteristic of a PERSON which identifies their religious, political, linguistic and ethnic affiliations. |
| Cultural wellbeing | Those aspects of a PERSON's or community's wellbeing that can be ascribed to cultural factors. |
| Death event | The EVENT of death.<br>Attributes of this entity would normally include such data elements as date, time and cause of death.<br>The DEATH EVENT does not necessarily imply the end of all events relating to a PERSON, since events such as organ donation and transmission of disease may occur. |
| Demographic characteristic | A characteristic of a PERSON that contributes to the specification of the population or sub-population to which they belong.<br>For example, sex, country of birth, year of arrival in Australia, Indigenous status etc. |
| Economic wellbeing | Those aspects of a PERSON's or community's wellbeing that can be ascribed to economic factors.<br>For example, insufficient funds to support an acceptable standard of living. |
| Education characteristic | A characteristic of a PERSON that relates to their education.<br>For example, highest qualification held, age when left school etc. |
| Education event | The instance of a PARTY educating another PARTY about the availability, knowledge and access of health and welfare services.<br>For example, school-based drug and alcohol education programs. |
| Educational system | The public or private provision of education services.<br>For example, the availability of kindergarten, primary school, secondary school and tertiary education facilities in a locality or community. |

| Name | Definition |
|---|---|
| Employment agreement | An agreement or contract for employing a PERSON and being employed by a PARTY.<br>The EMPLOYMENT AGREEMENT normally involves two PARTYs, one in an employer role and the other in the employee role. |
| Enabling factors | This 'box' is a super-entity in the National Health Information Model. It is not an entity in its own right but rather, provides a simple grouping facility to access entities that relate to factors that enable events to occur. The following entities have been grouped in this 'box':<br>- RESOURCE<br>- OTHER ENABLING FACTOR |
| Environmental event | A change in the environment which has an effect on one or more PARTYs.<br>Although all events obviously occur within an 'environment', the concept of an ENVIRONMENTAL EVENT is an event that has the environment (physical, chemical, biological, social, economic, cultural) as its principal focus. Examples of ENVIRONMENTAL EVENTs include storms, floods, riots and war, spillage of hazardous chemicals, liquids or gases and economic recession. |
| Environmental factors | This 'box' is a super-entity in the National Health Information Model. It is not an entity in its own right but rather, provides a simple grouping facility to access entities relating to environmental factors. The following entities have been included in this box:<br>- PHYSICAL ENVIRONMENT<br>- SOCIAL ENVIRONMENT |
| Event | Something that happens to or with a PARTY.<br>This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- PERSON EVENT<br>- HEALTH AND WELFARE SERVICE EVENT<br>- LEGAL STATUS EVENT<br>- COMMUNITY EVENT<br>- ENVIRONMENTAL EVENT<br>- RESEARCH EVENT<br>- OTHER EVENT<br>This super-entity reflects the emphasis in the NHIM on events that happen, and that may trigger or influence other events. Since the model is also date/time stamped at different instances in time, the model can accommodate the development of people and their health and welfare status and wellbeing by tracking these events. |
| Exit/leave from service event | The instance of an exit or period of leave by a PERSON from a SERVICE DELIVERY SETTING. |

| Name | Definition |
|---|---|
| Expectation | The EXPECTATIONs of a PERSON about health, health care and the health and welfare systems.<br>For example, a hospital separation, leave from a hospital/nursing home for an agreed period of time etc. |
| Expected outcome | A desired level of attainment to be achieved through one or more HEALTH AND WELFARE SERVICE EVENTs.<br>An outcome in the National Health Information Model most commonly relates to a PERSON but may also be stated for a PARTY or ORGANISATION. |
| Expenditure | Expenditure on capital items (land, buildings) or recurrent expenditure (patient transport, cleaning services) incurred by an ORGANISATION.<br>This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- CAPITAL EXPENDITURE<br>- RECURRENT EXPENDITURE |
| Family member role | A PERSON in their role of family member.<br>For example, mother, father, guardian, child.<br>A family may or may not live within the same household. |
| Financial resource | The existence of funds and budgets to undertake activities.<br>Although this entity has no subtypes in the National Health Information Model, it is a major component of health and welfare systems, and one which can and should be separately modelled. |
| Functional wellbeing | The ability of a person to perform the usual tasks of daily living and to carry out social roles. |
| Funding agreement | An agreement between PARTYs for the provision and use of funds for a purpose. |
| Geographic standard | Those parts of a location that are defined or classified in law or have some official standing. For example, country, State/Territory, postcode. |
| Goal/objective | A statement of what is to be achieved in a shorter time frame, as compared with a longer term VISION/MISSION. |
| Health and welfare policy/plan | A statement or document which may include a VISION/MISSION, GOAL/OBJECTIVE, directions for development, PRIORITYs for action, actions to be taken, EXPECTED OUTCOMEs and PERFORMANCE INDICATORs in relation to HEALTH AND WELFARE PROGRAMs for particular PARTYs, particular LOCATIONs and particular periods in time.<br>HEALTH AND WELFARE POLICY/PLAN is an entity subtype which reflects instances of policies and plans which are made up of components (HEALTH AND WELFARE POLICY/PLAN ELEMENTs).<br>Other business statements will exist which are not created for or by the health and welfare sectors but which still impact on a PARTY's STATE OF HEALTH AND WELLBEING. |

| Name | Definition |
|---|---|
| Health and welfare policy/plan element | A component part of a HEALTH AND WELFARE POLICY/PLAN. |
| Health and welfare program | A business program specifically created for or by the health and welfare sectors.<br>HEALTH AND WELFARE PROGRAM is an entity subtype which reflects instances of programs which are made up of components (HEALTH AND WELFARE PROGRAM ELEMENTs).<br>Other business programs will exist that are not created for or by the health and welfare sectors but which still impact on a PARTY's STATE OF HEALTH AND WELLBEING. |
| Health and welfare program element | A component part of a HEALTH AND WELFARE PROGRAM. |
| Health and welfare service event | An instance of an EVENT which is part of the delivery or receipt of health and welfare services or care.<br>These EVENTs include delivery of community programs, consultations with service providers, diagnoses, treatment, operations, delivery of care and rehabilitation, delivery of palliative care, counselling services, and voluntary care. |
| Health status | An instance of the state of health of a PERSON, PARTY GROUP or population measured against accepted standards. |
| Human resource item | An instance of people with capacity, capability and availability as resources to provide health and welfare services.<br>This entity represents specialist service providers, nurses etc., but can also accommodate voluntary carers and those who have the potential to provide services, i.e. a spouse who could care for a partner who became ill. The idea of skills and expertise is also included in this entity, providing a measure of both capacity and capability.<br>Data elements within this entity reflect the view of the ORGANISATION or employer as compared with data elements that reflect the view of the PERSON in their role as a specialist service provider, nurse and so on. |
| Illness event | An acute or chronic LIFE EVENT experienced by a PERSON but not involving a HEALTH AND WELFARE SERVICE EVENT.<br>For example, the incidence or prevalence of disease. |
| Information resource item | An instance of information or knowledge that supports the health and welfare system.<br>This broad concept includes what we know about the human body from a medical and scientific perspective, what we know about drugs and interventions, what we know about other factors affecting wellbeing, and so on. Research is a process which generates or refines instances of this entity. |
| Injury event | An acute LIFE EVENT experienced by a PERSON involving the occurrence of an injury but not involving a HEALTH AND WELFARE SERVICE EVENT. |

| Name | Definition |
|---|---|
| Insurance/benefit characteristic | A characteristic of a PERSON that relates to their health insurance or social security status. |
| Judicial system | Provision, availability and access to legal services within a community. |
| Knowledge factor | An instance of a factor that influences, determines or affects a PERSON's, PARTY GROUP's or ORGANISATION's state of knowledge or cognisance, particularly of elements of wellbeing, health and welfare, and their services.<br>For example, factors that influence 'How much a person knows about the risk from smoking', 'How much a person knows about the availability of counselling services', 'How much a service provider knows about the latest technique for treating a particular illness'. |
| Labour characteristic | A characteristic of a PERSON that relates to their employment or labour force status.<br>For example, their occupation, industry of employment, hours worked etc. |
| Legal characteristic | A characteristic of a PERSON which relates to their legal status.<br>For example, ward of the State, held in custody etc. |
| Legal status event | An EVENT that changes a PARTY's legal status.<br>For example, reaching 18 years of age, marriage, or the decision by a Review Board or Tribunal to change an individual from an 'involuntary' to a 'voluntary' status under the Mental Health Act. |
| Legally constituted organisation | An organisation established under law.<br>LEGALLY CONSTITUTED ORGANISATIONs may be ORGANISATIONs in a one-to-one relationship with a statute, (e.g. the Australian Institute of Health and Welfare and the Australian Institute of Health and Welfare Act) or ORGANISATIONs that are examples of a class or ORGANISATIONs established under and regulated by a statute (e.g. hospitals, incorporated bodies). |
| Life event | An instance of an EVENT which occurs to or with a PERSON during their life.<br>The LIFE EVENT entity provides the means of identifying those things that happen during a person's life which affect their STATE OF HEALTH AND WELLBEING and occur between their BIRTH EVENT and their DEATH EVENT.<br>This entity does not include events identified elsewhere, e.g. HEALTH AND WELFARE SERVICE EVENTs, LEGAL STATUS EVENTs, COMMUNITY EVENTs, ENVIRONMENTAL EVENTs, RESEARCH EVENTs OR OTHER EVENTs, but does include such things as puberty, the onset of disease, the loss of employment etc.<br>While the actual date and time when some of these events occur may not need or be able to be known, this entity provides a means to consistently represent this information. |

| Name | Definition |
|---|---|
| Lifestyle characteristic | A behavioural attribute, trait or feature of a PERSON that describes an aspect of their lifestyle.<br>For example, cigarette smoking, participation in regular physical exercise, dietary habits or use of illicit drugs. |
| Location | This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- LOCATION GROUP<br>- LOCATION ELEMENT<br>- SETTING<br>A LOCATION is a site or position where something happens, or where a person, group or organisation is located, may be contacted or conduct their business, etc.<br>For example, an address or geographical region. |
| Location element | The elements of a LOCATION. This sub-entity provides for the combination of different location elements to form a known address or location. In this way this entity can accommodate more diverse locational constructs, such as electronic mail addresses, or 'the backyard', or 'the Sydney Football Stadium'. An actual address, such as a residential postal address, is normally made up of a number of components from this entity, including a detailed residential title (12 Main Street), plus city/town, postcode, State/Territory, and Country values (see also SETTING). |
| Location group | A notional grouping of other geographic location elements, including address elements to form a recognisable address. For example, areas, regions and districts (such as the Southern Highlands), where these are not defined as a GEOGRAPHIC STANDARD, and postal and house addresses. |
| Material resource | An instance of a material resource.<br>For example, drugs, buildings, plant, operating theatres, organs and blood products. |
| Mental wellbeing | The wellbeing of a PERSON, based on their mental state.<br>For example, test results, symptoms, diagnoses and self-perceived health status specific to the mental state of a PERSON. |
| Natural environment | The natural environment in which a PERSON or community lives.<br>For example, the air we breath, the quality of water, noise pollution etc. |
| Need/issue | The reason why a PARTY is seeking access to health and welfare services.<br>For example, the need for emergency accommodation.<br>This 'box' is a super-entity in the National Health Information Model. It is not intended to represent assessed need (ASSESSMENT EVENT) as determined by a service provider. Nor does it represent a STATE OF HEALTH AND WELLBEING once the assessment has been made. |

| Name | Definition |
|---|---|
| Non-acute event | A non-acute ILLNESS EVENT experienced by a PERSON.<br>For example, the prevalence of chronic disease such as diabetes or asthma. |
| Organisation | A business or administrative concern created for particular ends. |
| Organisation characteristic | A characteristic of an ORGANISATION (but unrelated to BUSINESS FACTORS).<br>For example, the nature of the business or reason for trading.<br>This entity has been included in Version 2 of the National Health Information Model to describe information about an ORGANISATION. |
| Organisation role | An instance of an ORGANISATION participating in a specific role in the health and welfare sector.<br>For example, an ORGANISATION as a funder of services, purchaser of services or other organisation role. |
| Organisation sub-unit | A constituent part of an ORGANISATION.<br>ORGANISATION SUB-UNITs are normally the smaller components of organisations such as departments, divisions, units and sections. ORGANISATION SUB-UNITs may exist in a hierarchical structure. |
| Organisational setting | An instance of where an EVENT occurs, described in terms of the ORGANISATION.<br>For example, a hospital, a government department etc. |
| Other agreement | A BUSINESS AGREEMENT other than a FUNDING AGREEMENT or EMPLOYMENT AGREEMENT.<br>For example, purchaser-provider agreements, service contracts etc. |
| Other crisis event | An acute LIFE EVENT experienced by a PERSON but not involving an ILLNESS, INJURY or HEALTH AND WELFARE SERVICE EVENT.<br>For example, emergency accommodation needs, crisis counselling. |
| Other enabling factor | Resources are a major 'enabling' factor in health and welfare. However, there are other important enabling factors, e.g. access, knowledge and availability, which are recognised by this entity. |
| Other event | An EVENT which is not a PERSON EVENT, HEALTH AND WELFARE SERVICE EVENT, COMMUNITY EVENT, LEGAL STATUS EVENT, RESEARCH EVENT or ENVIRONMENTAL EVENT. |
| Other health and welfare service event | A HEALTH AND WELFARE SERVICE EVENT other than a REQUEST FOR/ENTRY INTO SERVICE EVENT, SERVICE PROVISION EVENT, EXIT/LEAVE FROM SERVICE EVENT, ASSESSMENT EVENT, SCREENING EVENT, EDUCATION EVENT, ADVOCACY EVENT, PLANNING EVENT, SURVEILLANCE/MONITORING EVENT or PAYMENT/CONTRIBUTION EVENT. |

| Name | Definition |
|---|---|
| Other life event | A LIFE EVENT that a PERSON experiences other than a SELF HELP EVENT or CRISIS EVENT (such as illness, injury or other crisis). |
| Other organisation role | An instance of an ORGANISATION ROLE within the health and welfare sector which is not a SERVICE FUNDER ROLE or a SERVICE PURCHASER ROLE. |
| Other person characteristic | A characteristic of a PERSON other than a DEMOGRAPHIC CHARACTERISTIC, LABOUR CHARACTERISTIC, LIFESTYLE CHARACTERISTIC, EDUCATION CHARACTERISTIC, SOCIAL CHARACTERISTIC, CULTURAL CHARACTERISTIC, PARENTING CHARACTERISTIC, ACCOMMODATION CHARACTERISTIC, INSURANCE/BENEFIT CHARACTERISTIC or LEGAL CHARACTERISTIC. |
| Other person role | The role of a PERSON other than as a citizen, family member, carer, advocate, service provider or as a provider of resources. |
| Other policy/plan element | HEALTH AND WELFARE POLICY/PLAN ELEMENTs other than those identified by the subtypes (VISION/MISSION, GOAL/OBJECTIVE, PRIORITY, and PERFORMANCE INDICATOR). |
| Other role | A ROLE other than a PARTY RELATIONSHIP ROLE, PERSON ROLE, PARTY GROUP ROLE, ORGANISATION ROLE, RECIPIENT ROLE, SERVICE PROVIDER ROLE or RESEARCH ROLE.<br>An expanded list of subtypes relating to PERSONs and ORGANISATIONs can be found within the entities PERSON ROLE and ORGANISATION ROLE. |
| Other setting | An instance of where, in generic terms, something happens, which is not in an ORGANISATIONAL SETTING or a SERVICE DELIVERY SETTING.<br>For example, 'at home', 'on a sports field', 'at work' etc. |
| Other social environment | The social environment in which a PERSON or community lives other than the JUDICIAL SYSTEM, the EDUCATIONAL SYSTEM or a COMMUNITY ORGANISATION. |
| Outcome | A recorded change in the wellbeing of a PARTY which is expected or presumed to be, or to have been, caused by a HEALTH AND WELFARE SERVICE EVENT.<br>This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- STATED OUTCOME<br>- EXPECTED OUTCOME |
| Parenting characteristic | A characteristic of a PERSON that relates to their role as a parent.<br>For example, breastfeeding a baby or use of child care facilities. |

| Name | Definition |
|---|---|
| Party | Those PERSONs, PARTY GROUPs or ORGANISATIONs who are part of the health and welfare systems including those who are known to the system and those who are of interest to it. Essentially this includes all persons in Australia.<br>For example, a PARTY as a recipient of services, provider of services, purchaser of services or funder of services.<br>This 'box' is a super-entity in the National Health Information Model. |
| Party Characteristics | This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- ORGANISATION CHARACTERISTIC<br>- PARTY GROUP CHARACTERISTIC<br>- PERSON CHARACTERISTIC<br>- PERSON VIEW<br>- STATE OF HEALTH AND WELLBEING<br>PARTY CHARACTERISTICS is not a entity in its own right but rather, a loose grouping of like entities. |
| Party group | An instance of a number of PARTYs, normally PERSONs, considered as a collective unit.<br>For example, families, communities and tribes. The Australian population, or sub-populations within it, are represented in the National Health Information Model as a PARTY GROUP. |
| Party group characteristic | A characteristic of a PARTY GROUP (apart from those associated with a PERSON or those that are derived from aggregating PERSON data).<br>For example, the main language spoken or religious affiliation of a community.<br>This entity has been included in Version 2 of the National Health Information Model to describe information about a PARTY GROUP. |
| Party group role | An instance of a PARTY GROUP participating in a role within the health and welfare sectors. |
| Party relationship role | An instance of a relationship between PARTYs which is relevant to an EVENT.<br>Many of these relationships have been expanded in Version 2 of the National Health Information Model and are now found within the expanded entities PERSON ROLE, PARTY GROUP ROLE and ORGANISATION ROLE.<br>This entity does not include PARTYs in a RECIPIENT ROLE, SERVICE PROVIDER ROLE, RESEARCH ROLE or OTHER ROLE. |

| Name | Definition |
|---|---|
| Party role | An instance of a PARTY participating in a role in the health and welfare sectors.<br>The concept of PARTY ROLE in the National Health Information Model provides for different persons, groups and organisations to have different roles at different times. Some of these roles refer to service delivery, planning, resource allocation or agreements.<br>This 'box' is a super-entity in the National Health Information Model. It is comprised of the following entities:<br>- PARTY RELATIONSHIP ROLE<br>- PERSON ROLE<br>- PARTY GROUP ROLE<br>- ORGANISATION ROLE<br>- RECIPIENT ROLE<br>- SERVICE PROVIDER ROLE<br>- RESEARCH ROLE<br>- OTHER ROLE |
| Payment/contribution event | The instance of a PARTY making a payment or contribution as part of their involvement in a HEALTH AND WELFARE SERVICE EVENT.<br>For example, a Medicare payment or a private health fund payment. |
| Performance goal | A level of performance against which the performance of a PARTY ROLE will be judged. |
| Performance indicator | A PERFORMANCE INDICATOR is used to assess performance against goals and targets. PERFORMANCE INDICATOR is alternately referred to as Key Performance Indicator or KPI. |
| Person | An individual human being.<br>A PERSON is identified by the role he or she plays. See subtypes within the entity PERSON ROLE.<br>A PERSON will possess a range of characteristics and views. See subtypes within the entity PERSON CHARACTERISTIC and PERSON VIEW. |
| Person characteristic | Features which characterise a PERSON.<br>A PERSON CHARACTERISTIC is either a DEMOGRAPHIC CHARACTERISTIC, PHYSICAL CHARACTERISTIC, LABOUR CHARACTERISTIC, LIFESTYLE CHARACTERISTIC, EDUCATION CHARACTERISTIC, SOCIAL CHARACTERISTIC, PARENTING CHARACTERISTIC, ACCOMMODATION CHARACTERISTIC, INSURANCE/BENEFIT CHARACTERISTIC, LEGAL CHARACTERISTIC or OTHER PERSON CHARACTERISTIC.<br>This entity reflects the emphasis in the National Health Information Model on the PERSON. |

| Name | Definition |
|---|---|
| Person event | An EVENT that happens to a person which affects their STATE OF HEALTH AND WELLBEING from the time of their birth until their death. |
| Person role | A PERSON in a role as distinct from a PARTY GROUP in a role or an ORGANISATION in a role<br>For example, a PERSON in a role as a citizen, family member, carer, advocate, resource or other person role.<br>The expansion of the PERSON ROLE entity replaces PERSON IDENTIFIER as a subtype of PERSON CHARACTERISTIC from Version 1 of the National Health Information Model. |
| Person view | The attitudes, beliefs, expectations and values of an individual in relation to health, health care and the health and welfare systems. |
| Physical characteristic | A characteristic of a PERSON which relates to their physical features. |
| Physical environment | The physical environment in which a PERSON or community lives.<br>For example, the NATURAL ENVIRONMENT and BUILT ENVIRONMENT including air and water quality, noise pollution, quality of housing, sanitation etc. |
| Physical wellbeing | The wellbeing of a person based on their physical, chemical and biological state. |
| Planning event | The instance of a PARTY planning the provision of a HEALTH AND WELFARE SERVICE EVENT. |
| Priority | Something given special attention, normally involving special precedence over others. |
| Program activity | An identified action to be taken as part of a program or plan.<br>This is distinct from the National Health Information Model entity of EVENT, which is the actual instance or occurrence of these activities. |
| Program evaluation | A process to be conducted as part of a program or plan to determine the extent to which the program or plan achieved its GOAL/OBJECTIVE. |
| Program strategy | An intended course of action to be conducted as part of a program or plan. |
| Recipient role | An instance of a role that a PARTY as a recipient of services or care plays in EVENTs.<br>For example, a patient, client, consumer, customer etc. |
| Recurrent expenditure | Expenditure incurred by an ORGANISATION on a recurring basis for the provision of services, excluding CAPITAL EXPENDITURE, but including indirect expenditure. |
| Request for/entry into service event | An instance of a request for services or for entry into a SERVICE DELIVERY SETTING from one service provider to another. |
| Research event | An instance of a PARTY undertaking research of interest to the health and welfare sector. |
| Research role | An instance of a role a PARTY plays in research activities. |

| Name | Definition |
|---|---|
| Resource | The material necessary for an activity.<br>For example, buildings, reusable and consumable items, financial resources and people, and the information or knowledge required. |
| Resource role | An instance of a role a PERSON plays in the management, allocation and use of RESOURCEs.<br>For example, a manager, a cleaner, a computer programmer etc.<br>A PERSON in a RESOURCE ROLE excludes individuals providing health and welfare services. |
| Screening event | An instance of a PARTYs involvement in a SCREENING EVENT.<br>For example, mammographic screening, a pap smear etc. |
| Self help event | A PERSON actively seeking help, education or assistance or participating in activities of interest to the health and welfare sector.<br>For example, attending a quit smoking course, modification of one's diet etc. |
| Service delivery setting | An instance of where an EVENT occurs, described in terms of the SERVICE DELIVERY SETTING.<br>For example, a birthing centre, child care centre or hospital emergency department etc. |
| Service funder role | An instance of a role that an ORGANISATION, as a health and welfare service funder, plays in EVENTs. |
| Service provider role | An instance of a role that a PARTY, as a health and welfare service provider, plays in EVENTs.<br>This includes both PERSONs who are formally nominated as service providers (e.g. nurses and general practitioners) and PERSONs who provide voluntary or informal care. |
| Service provision event | An instance of the provision of a HEALTH AND WELFARE SERVICE EVENT by a service provider to a PERSON or PARTY GROUP.<br>For example, treatment, conduct of tests etc. |
| Service purchaser role | An instance of a role that an ORGANISATION, as a health and welfare service purchaser, plays in EVENTs. |
| Setting | A description of where something happens.<br>SETTING differs from LOCATION in the National Health Information Model, as an EVENT may occur at the LOCATION of 'Corner of Jones and Smith Streets, SomeCity, WA' , but it may be more relevant to describe an event as having occurred in 'a hospital' (the SETTING). |
| Social characteristic | A specific SOCIAL CHARACTERISTIC of a PERSON.<br>For example, marital status, language spoken in the home etc. |
| Social environment | The social environment in which a PERSON or community lives including the JUDICIAL SYSTEM, the EDUCATIONAL SYSTEM, COMMUNITY ORGANISATION or OTHER SOCIAL ENVIRONMENT. |

| Name | Definition |
|---|---|
| Social wellbeing | The wellbeing of a PERSON, based on their interaction with other people.<br>For example, a PERSONs experience with discrimination, racism, violence, family-related matters, gambling or drinking problems. |
| Specific resource | The resources used in the production and delivery of health and welfare services, be they material, financial, human or information.<br>The SPECIFIC RESOURCE entity provides for the actual instances of these resources. |
| Spiritual wellbeing | The wellbeing of a person, based on their perception of or relationship to sacred or religious theory. |
| Standard | An accepted or approved example of something against which others are judged or measured.<br>Compare with BENCHMARK. |
| State of health and wellbeing | The health and wellbeing of a PARTY (usually a PERSON) measured or assessed in aggregate (e.g. the total wellbeing of a PARTY) or in component terms (e.g. HEALTH STATUS, SOCIAL WELLBEING, ECONOMIC WELLBEING, CULTURAL WELLBEING and SPIRITUAL WELLBEING .<br>For example, SF-36 instrument of health status measurement, an illness diagnosis, an injury, enough money to buy food, ability to look after oneself etc.).<br>The STATE OF HEALTH AND WELLBEING entity replaces the STATE OF WELLBEING entity in Version 1 of the National Health Information Model. |
| Stated outcome | The information recorded by a PARTY in a role about an OUTCOME which has occurred, as distinct from an OUTCOME which was planned or expected. The STATED OUTCOME is distinguished as an entity from the EXPECTED OUTCOME. |
| Surveillance/monitoring event | An instance of a PARTY's involvement in a surveillance or monitoring EVENT within the health and welfare sector. |
| Value | The VALUEs of a PERSON about health, health care and the health and welfare systems. |
| Vision/mission | The highest level statement of why something is to happen or where a situation or organisation should be in a set period of time. Vision or mission statements normally contain the aspirations of those stating them. |

# National Health Information Model

Version 2.0

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## *Party Characteristic*

**Person Characteristic**
- Demographic characteristic
- Physical characteristic
- Labour characteristic
- Lifestyle characteristic
- Social characteristic
- Education characteristic
- Parenting characteristic
- Accommodation characteristic
- Cultural characteristic
- Insurance / benefit characteristic
- Legal characteristic
- Other person characteristic

**State of health and wellbeing**
- Aggregate health and wellbeing
- Component health and wellbeing
  - Health status
    - Physical wellbeing
    - Mental wellbeing
    - Functional wellbeing
  - Social wellbeing
  - Economic wellbeing
  - Cultural wellbeing
  - Spiritual wellbeing

**Person view**
- Attitude
- Belief
- Expectation
- Value

**Party group characteristic**

**Organisation characteristic**

## Party

**Person**

**Party group**

**Organisation**
- Legally constituted organisation
- Organisation sub-unit

## Party role

**Party relationship role**

**Person role**
- Citizen role
- Family member role
- Carer role
- Advocate role
- Resource role
- Other person role

**Party group role**

**Organisation role**
- Service funder role
- Service purchaser role
- Other organisation role

**Recipient role**

**Service provider role**

**Research role**

**Other role**

## Location

**Location group**

**Location element**
- Address element
- Geographic standard

**Setting**
- Organisational setting
- Service delivery setting
- Other setting

## Expenditure

**Capital expenditure**

**Recurrent expenditure**

## Outcome

**Stated outcome**

**Expected outcome**

**Need / issue**

**Care plan**

## Event

**Person event**
- Birth event
- Life event
  - Self help event
  - Crisis event
    - Illness event
      - Acute event
      - Non-acute event
    - Injury event
    - Other crisis event
  - Other life event
- Death event

**Health and welfare service event**
- Advocacy event
- Assessment event
- Education event
- Exit / leave from service event
- Other health and welfare service event
- Payment / contribution event
- Planning event
- Request for / entry into service event
- Screening event
- Service provision event
- Surveillance / monitoring event

**Legal status event**

**Community event**

**Environmental event**

**Research event**

**Other event**

## *Business Factors*

**Business statement**
- Health and welfare policy / plan
- Other policy / plan element
- Health and welfare policy / plan element
  - Vision / mission
  - Goal / objective
  - Priority
  - Performance indicator

**Business program**
- Health and welfare program
- Health and welfare program element
  - Program strategy
  - Program activity
  - Program evaluation

**Business agreement**
- Funding agreement
- Employment agreement
- Other agreement

**Performance goal**
- Benchmark
- Standard

## *Enabling factors*

**Resource**
- Aggregate resource
- Specific resource
  - Material resource
  - Financial resource
  - Human resource
  - Information resource

**Other enabling factor**
- Knowledge factor
- Accessibility factor
- Availability factor

## *Environmental Factors*

**Physical environment**
- Natural environment
- Built environment

**Social environment**
- Judicial system
- Educational system
- Community organisation
- Other social environment