ISO TC TC 215/SC N339

Date: August 2003

ISO/PDTS

ISO TC TC 215/SC /WG 1

Secretariat: ANSI

Health informatics — Health indicators definitions, relationships and attributes

Warning

This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document type: Technical Specification
Document subtype:
Document stage: (20) Preparatory
Document language: E

Contents

Contents iii
1 Scope 1
2 Normative references 1
3 Terms and definitions 2
4 Health indicators conceptual framework with associated attributes 6
4.1 Framework 6
5 Health Status 9
5.1 Health status dimension description 9
6 Non-medical determinants of health 10
6.1 Non-medical determinants of health dimension description 10
7 Health System Performance 11
7.1 Health system performance dimension description 11
8 Community and health system characteristics 12
8.1 Community and health system characteristics dimension description 12
9. Dimension relationships 13
9.1 General 13
9.2 Relationships 14
9.2.1 Relationships – General 14
9.2.2 Relationships – Health status 15
9.2.3 Relationships – Non-medical determinants of health 15
9.2.4 Relationships – Health system performance 16
9.2.5 Relationships – Community and health system characteristics 18
10. Attributes 19
10.1 General 19
10.2 Attribute visibility and type 19
10.2.1 Visibility of an attribute 19
10.2.2 Type of an attribute 19
10.3 Health indicator class attributes and definitions 19
10.3.1 Health status dimension 19
10.3.2 Non-medical determinants of health dimension 21
10.3.3 Health system performance dimension 24
10.3.4 Community and health system characteristics dimension 28
Annex A 30
Annex B 31
Bibliography 33

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

ISO/PDTS [ISO designation yet to be assigned] Health indicators definitions, relationships and attributes, was prepared by Technical Committee ISO/TC 215, *Health Informatics / Working Group 1 Health records and modelling coordination.*

Introduction

Heightened interest in the measurement and monitoring of the performance of health care systems, as well as accountability and responsiveness to payors and stakeholders, is now evident on an international scale. Consequently, many countries have begun the systematic definition and collection of health information for monitoring health system performance. This trend is concomitantly driven, and driven by, an enhanced data infrastructure that allows for more explicit and rigorous examination of both the health of populations and their health care systems. More often than not, this has taken the form of the collection of specific health indicators with which to describe a variety of health and health system-related trends and factors.

The term health indicator refers to a single summary measure, most often expressed in quantitative terms, that represents a key dimension of health status, the health care system or related factors. A health indicator must be informative, and also be sensitive to variations over time and across jurisdictions.

In order for a health indicator to be useful for monitoring health or health system performance, however, explicit criteria must be applied for its choice and definition. The selection should be based on some agreement about what is to be measured and for what purpose, and informed by a clear conceptual framework. This implies a common framework, to be used internationally, for structuring the way health and health system performance is measured.

This technical specification describes a comprehensive, high-level taxonomy of the key types of indicators that are useful for assessing population health and health services. It identifies the relationships and attributes important in defining these health indicators. From the perspective of electronic systems a formal representation of these indicators is an important step toward operationalizing the implementation of these indicators. Additionally, these definitions will help to improve the consistency with which the indicators are applied and, most directly, the interoperability between implementations. Although the syntax is not directly specified, one can easily imagine an XML representation of the health indicators.

Using *ISO/TS 21667 Health informatics - Health indicators conceptual framework* along with the formal definitions and attributes specified in this specification will undoubtedly foster a common language for communication between countries, and ultimately, lead to greater commonalities for indicator development. This could, and in fact should, lead to greater potential for generating internationally comparable health data in the long term, in order to permit consistent reporting, dissemination and analysis.

In order for these health indicators to be useful in electronic systems, they must be defined formally as well as systematically. This requires a set of attributes for each indicator and a set of semantics linking the indicators into an ontology of health indicators. This creation of a high-level ontological representation is essential for the consistent use of these indicators in electronic environments and reporting systems. Furthermore, to begin to aggregate this data from detailed underlying coded clinical representations (eg using a nomenclature which uses a compositional system for the representation of detailed clinical data such as Galen or SNOMED-CT®) will require computable formal definitions for these indicators.

These definitions are crafted to provide aggregation across a continuum of specificity with regard to health data. For instance, one might want to aggregate data for these indicators from data encoded in an administrative classification eg ICD10 (Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems) which in turn may have been aggregated from data encoded using a detailed nomenclature. This 'record-once-and-use-many-times' philosophy, ie repurposing of data, is one of the important goals of computerizing health information.

Health informatics — Health indicators definitions, relationships and attributes

1 Scope

This technical specification establishes definitions for a set of common health indicators, and is intended to specify a common vocabulary, a common set of semantics and conceptual definitions for ISO/TS 21667.

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this Technical Specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Technical Specification are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 704	*Terminology work - Principles and methods*
ISO/DIS 860	*Terminology work - Harmonization of concepts and terms*
ISO 1087-1	*Terminology work – Vocabulary – Part 1: Theory and application*
ISO 1087-2	*Terminology work – Vocabulary – Part 2: Computer applications*
ISO 11179-3	*Information technology – Specification and standardization of data elements – Basic attributes of data elements*
ISO 12200	*Computer applications in terminology – Machine-readable terminology interchange format (MARTIF) – Negotiated interchange*
ISO 12620	*Computer applications in terminology – Data categories*
ISO TS 21667	*Health informatics – Health indicators conceptual framework*
ISO/IEC 2382-4	*Information technology – Vocabulary – Part 4: Organization of data*
ISO/IEC/TR 9789	*Information technology – Guidelines for the organization and representation of data elements for data interchange – Coding methods and principles*
ISO TS 17117	*Health Informatics — Controlled health vocabularies — vocabulary structure and high-level indicators*
E-1238	*Standard Specification for Transferring Clinical Observations Between Independent Computer Systems*
E-1239	*Standard Guide for Description of Reservation / Registration – Admitting, Discharge, Transfer (R-ADT) Systems for Electronic Health Record (EHR) Systems*
E-1284	*Standard Guide for Construction of a Clinical Nomenclature for Support of Electronic Health Records*
E-1384	*Standard Guide for Content and Structure of the Electronic Health Record (EHR)*
E-1633	*Standard Specification for Coded Values Used in the Electronic Health Record*
E-1712	*Standard Specification for Representing Clinical Laboratory Test and Analyte Names*
ENV 12017	*Health Informatics - Medical Informatics Vocabulary*
ENV 12264	*Health Informatics - Categorical Structures of Systems of Concepts – Model for Representation of Semantics*

3 Terms and definitions

For the purposes of this Technical Specification, the following terms and definitions apply.

3.1
health indicators conceptual framework
A framework that:

a) defines the appropriate dimensions and sub-dimensions that are required to describe the health of the population, and the performance of a health care system;

b) is sufficiently broad (high-level) to accommodate a variety of health care systems; and

c) is comprehensive and, as such encapsulates all of the factors that are related to health outcomes, health system performance and utilization, and regional and national variations

NOTE See Annex C of ISO TS 21667 for a more complete discussion of the underlying rationale for this framework.

3.2
terminology
a set of terms representing a system of concepts within a specified domain

NOTE This implies a published purpose and scope from which one can determine the degree to which this representation adequately covers the domain specified.

3.3
controlled health vocabulary
terminology intended for clinical use

NOTE This implies enough content and structure to provide a representation capable of encoding comparable data at a granularity consistent with that generated by the practice within the domain being represented as well as within the purpose and scope of the terminology.

3.4
classification
a terminology that aggregates data at a prescribed level of abstraction for a particular domain

NOTE This establishment of the level of abstraction that can be expressed using the classification system is often done to enhance consistency when the classification is to be applied across a diverse user group. An illustration of this activity is the use of the system with some of the current billing classification schemes.

3.5
ontology
an organization of concepts for which one can make a rational argument

NOTE Colloquially, this term is used to describe a hierarchy constructed for a specific purpose.

EXAMPLE A hierarchy of qualifiers would be a qualifier ontology.

3.6
qualifier
a string, which when added to a term, changes the meaning of the term in a temporal or administrative sense

EXAMPLE ‘History of’ or ‘recurrent’.

3.7
modifier
a string, which when added to a term, changes the meaning of the term in the clinical sense

EXAMPLE ‘clinical stage’ or ‘severity of illness’.

3.8
canonical term
a preferred atomic or pre-coordinated term for a particular medical concept

3.9
term
a word or words corresponding to one or more concepts

3.10
reference terminologies
the set of canonical concepts, their structure, relationships and, if present, their systematic and formal definitions

NOTE These features define the core of the controlled health terminology.

3.11
atomic reference terminologies
a reference terminology that consists of only atomic concepts and their systematic definitions

NOTE In this type of reference terminology, no two or more concepts can be combined to create a composite expression that has the same meaning as any other single concept contained in the atomic reference terminology.

3.12
colloquial terminologies
the set of terms, which consist of commonly-used entry points, that map to one or more canonical terms within the vocabulary

3.13
compositionality
composite concepts are created from atomic and pre-coordinated concepts and must be able to be combined to create compositional expressions

EXAMPLE ‘Colon cancer’ comprises ‘malignant neoplasm’ and ‘large bowel’ as atomic components. In a compositional system, concept representations can be divided into atomic and composite concept representations. Composite concept representations can be further divided into ‘named pre-coordinated concept representations’ and ‘post-coordinated representation expressions. Within a composite concept, it may be possible to separate the constituents into three categories: ‘kernel concept’, ‘qualifier (also called ‘status’) concept’, and ‘modifier concept’.

NOTE A concept is a notion represented by language and identifies one idea. However, the term ‘concept’ in this Technical Specification is used to refer to the representation of a concept rather than the thought itself.

3.14
atomic concept
a representation of a concept that is not composed of other simpler concept representations within a particular terminology

NOTE In many cases atomic concepts will correspond to what philosophers call ‘natural kinds’. Such an entity cannot be meaningfully decomposed. Concepts should be separable into their constituent components, to the extent practical. These should form the root basis of all concepts.

EXAMPLE In SNOMED-CT®, ‘colon’ is a synonym for ‘large bowel’ and ‘cancer’ is a synonym for ‘neoplasm, malignant’. Therefore, the term ‘colon cancer’ is non-atomic as it can be broken down into ‘large bowel’ and ‘neoplasm, malignant’. Each of these two atomic terms has a separate and unique concept identifier, as does the pre-coordinated term ‘colon cancer’.

3.15
composite concept
a concept composed as an expression made up of atomic concepts linked by semantic relations (such as roles, attributes or links). [see notes in 3.10]

3.16
pre-coordinated concept
such an entity can be broken into parts without loss of meaning (can be meaningfully decomposed) when the atomic concepts are examined in aggregate. These are representations that are considered single concepts within the host vocabulary. Ideally, these concepts should have their equivalent composite concepts explicitly defined within the vocabulary

EXAMPLE The term 'colon cancer' is non-atomic; however, it has a single unique identifier, which means to SNOMED-CT® that it represents a 'single' concept. It has the same status in the vocabulary as the site 'large bowel' and the diagnosis 'neoplasm, malignant'.

3.17
post-coordinated concept
a composite concept is not pre-coordinated and, therefore, must be represented as an expression of multiple concepts using the representation language. The system attempts to construct a set of concepts from within a controlled vocabulary to more completely represent a user's query

EXAMPLE The concept 'bacterial effusion, left knee' is not a unique term within the SNOMED-CT® terminology. It represents a clinical concept that a patient has an infected left knee joint. This example cannot be represented by a single concept identifier; consequently a system must build a representation from multiple concept identifiers to fully capture the intended meaning of this case or lose information to free text.

3.18
types of atomic and pre-coordinated concepts
unique concept representations can be classified within a vocabulary into at least three distinct types: kernel concepts, modifiers, and qualifiers that contain status concepts. This separation allows user interfaces to provide more readable and, therefore, more useful presentations of composite concepts

3.18.1
kernel concept
an atomic or pre-coordinated concept that represents one of the one or more main concepts within a pre-coordinated or post-coordinated composition

3.18.2
modifiers and qualifiers - terms which refine the meaning of a kernel concept
constituents of a composite concept that refine the meaning of a kernel concept are known as modifiers or qualifiers

EXAMPLE1 'Stage 1a' in the expression 'having colon cancer stage 1a' or 'brittle, poorly controlled' in the expression 'brittle, poorly controlled diabetes mellitus' are examples of qualifiers and modifiers. In general, these concepts are expressed as a link plus a value ('attribute-value-pair'). Terminologies must support a logical structure that can support temporal duration and trend. Attributes must be themselves elements of a terminology, and fit into a practical model that extends a terminology.

EXAMPLE2 Two Cancers may be further defined by their stage and histology, have been symptomatic for a specifiable time, and may progress over a given interval. Attributes are required to capture important data features for structured data entry and pertinent to secondary data uses such as aggregation and retrieval. Kernel concepts can be refined in many ways including a clinical sense, a temporal sense and by status terms, such as 'recurrent'.

3.19
Normalization of content
the process of supporting and mapping alternative words and shorthand terms for composite concepts

NOTE All pre-coordinated concepts must be mapped to or logically recognizable by all possible equivalent post-coordinated concepts. There should be mechanisms for identifying this synonymy for user created (new) post-coordinated concepts as well (i.e. when there is no pre-coordinated concept for this notion in the vocabulary). This functionality is critical to define explicitly equivalent meaning, and to accommodate personal, regional, and discipline specific preferences. Additionally, the incorporation of terms as synonyms, represented in a language other than that primarily used in the host vocabulary, can achieve a simple form of multilingual support.

3.20
normalization of semantics
in compositional systems, there exists the possibility of representing the same concept with multiple potential sets of atoms, which may be linked by different semantic links. In this case the vocabulary needs to be able to recognize this redundancy / synonymy (depending on your perspective). The extent to which normalization can be performed formally by the system should be clearly indicated

EXAMPLE The concept represented by the term "Laparoscopic Cholecystectomy" might be represented in the following two dissections:

Surgical Procedure: Excision"{Has Site Gallbladder}, {Has Method Endoscopic}

and

Surgical Procedure: Excision"{Has Site Gallbladder}, {Using Device Endoscope}.

3.21
multiple hierarchies
concepts should be accessible through all reasonable hierarchical paths, ie they must allow multiple semantic parents. A balance between number of parents (as siblings) and number of children in a hierarchy should be maintained. This feature assumes obvious advantages for natural navigation of terms (for retrieval and analysis), as a concept of interest can be found by following intuitive paths, ie users should not have to guess where a particular concept was instantiated

EXAMPLE One example of multiple semantic parentage is 'stomach cancer' which can be viewed as a 'neoplasm' or as a 'gastrointestinal disease'.

3.22
consistency of view
a concept in multiple hierarchies must be the same concept in each case. The example of stomach cancer (see Clause 3.21) must not have changes in nuance or structure when arrived at via the cancer hierarchy as opposed to the gastrointestinal disease hierarchy. Inconsistent views could have catastrophic consequences for retrieval and decision support, by inadvertently introducing variations in meaning that may be unrecognised and therefore be misleading to users of the system

3.23
explicit uncertainty
notions of 'probable', 'suspected', 'history of' or differential possibilities such as a differential diagnosis list, must be supported. The impact of 'certain' versus 'very uncertain' information has obvious impact on decision support and other secondary data uses. Similarly, in the case of incomplete syndromes, clinicians should be able to record the partial criteria consistent with the patient's presentation. This criterion is listed separately as many current terminological systems fail to address this adequately.

3.24
representational form
the representational form of the identifiers within the terminology should be meaningless. Computer coding of concept identifiers must not place arbitrary restrictions on the terminology, such as numbers of digits, attributes, or composite elements. To do so subverts meaning and content of a terminology to the limitations of format, which in turn, often results in the assignment of concepts to the wrong location because it might no longer 'fit' where it belongs in a hierarchy. These reorganizations confuse people and machines alike, as intelligent navigation agents are led astray for arbitrary reasons. The long, sequential, alphanumeric tags used as concept identifiers in the UMLS project of the National Library of Medicine exemplify well this principle.

4 Health indicators conceptual framework with associated attributes

4.1 Framework

The health indicator conceptual framework shall be as outlined in Tables 1 through 4. Equity spans across all dimensions of the framework, and can apply to any of the concepts or indicators contained therein.

Table 1 – Health indicators conceptual framework: Health status dimension

Sub-Dimension	Well-being	Health conditions	Human function	Deaths
Concept	HI00000001	HI00000002	HI00000003	HI00000004
Attributes	• Significant others • Nutrition • Economics • Satisfaction • Comfort • Happiness • Self-Esteem	• Diagnosis • Manifestations • Site • Etiology	• Disability • Impairment • Functional status • Related diagnosis	• Immediate cause • Acute conditions • Chronic conditions • Age • Sex • Expected life span

Table 2 – Health indicators conceptual framework: Non-medical determinants of health dimension

Sub-Dimension	Health behaviors	Social and community factors	Environmental factors	Genetic factors	Socio-economic factors
Concept	HI00000005	HI00000006	HI00000007	HI00000008	HI00000009
Attributes	• BMI • Tobacco use • EtOH use • Seat belts • Caffeine use • Exercise • Firearm safety • Fire safety	• Emphasis on healthcare • Emphasis on disease prevention • Social support for the patient • School readiness • Cost of housing • Literacy written • Literacy spoken	• Water purity • Distance to a healthcare facility • Handling of sewage • Fuels • Regulations regarding the environment	• Genetic fingerprint • Proteomic fingerprint • Post-transcriptional Modification of proteins • Phenotypic groupings • Rates of inheritable disorders • Associated disorder	• Economic status • Employment status • Employment availability • Education level • Education utilization • Social class • Profession • Net worth

Table 3 – Health indicators conceptual framework: Health system performance dimension

Sub-Dimension	Acceptability	Appropriateness	Competence	Continuity	Efficiency	Safety	Effectiveness	Security	Communication	Accessibility
Concept	HI00000010	HI00000011	HI00000012	HI00000013	HI00000014	HI00000015	HI00000016	HI00000017	HI00000018	HI00000019
Attributes	• Satisfaction scale • Value	• Practice • Measure • Value	• Practice • Measure • Value	• Practice type • Measure • Context • Value	• Practice • Measure • Value • Cost	• Practice • Condition • Harm • Risk of Harm • Level of Harm	• Recurrence • Survival rate • Admission rate	• Confidentiality • Authentication • Authorization • Non-repudiation	• Timely • Accurate • Sufficient • Pertinent • Interpretable	• Diagnosis • Age • Race • Sex • Culture • Religion • Country of origin • Location • Economic factors • Insurance

Table 4 – Health indicators conceptual framework: Community and health system characteristics dimension

Sub-Dimension	Resources	Population	Health system
Concept	HI00000020	HI00000021	HI00000022
Attributes	• Type • Level of funding • Source of funding • Level of expenditure on training • Level of expenditure on research • Number of units • Cost per unit	• Density of physicians • Speciality • Location • Average salary • Salary range (95% confidence interval) • Cost of care	• Type of utilization of services • Level of utilization of services • Type of accreditation • Level of accreditation • Duration of accreditation • Stability of health care services

5 Health Status

5.1 Health status dimension description

The dimension of health status is described in Table 5.

Table 5 — Health status dimension description

Sub-Dimension	Description	Examples of indicators
Well-being	Broad measures of the physical, mental and social well-being of individuals	• Self-rated health • Self-esteem
Health conditions	Alterations or attributes of the health status of an individual which may lead to distress, interference with daily activities, or contact with health services; it may be a disease (acute or chronic), disorder, injury or trauma, or reflect other health-related states such as pregnancy, aging, stress, congenital anomaly, or genetic predisposition (WHO)$_1$	• Arthritis • Diabetes • Chronic pain • Depression • Food and waterborne diseases • Injury hospitalization
Human function	Levels of human function are associated with the consequences of disease, disorder, injury and other health conditions. They include body function/structure (impairments), activities (activity limitations, and participation (restrictions in participation). (WHO)$_2$	• Functional health • Disability days • Activity limitation • Health expectancy • Disability free life expectancy
Deaths	A range of age-specific and condition specific mortality rates, as well as derived indicators.	• Infant mortality • Life expectancy • Potential years of life lost • Circulatory deaths • Unintentional injury deaths
NOTE 1 World Health Organization (2000) NOTE 2 World Health Organization (2001)		

6 Non-medical determinants of health

6.1 Non-medical determinants of health dimension description

The dimension of non-medical determinants of health is described in Table 6.

NOTE 1 In order to better understand geographic or temporal variations in health status and health system performance, a variety of non-medical determinants of health have been included in the framework.

NOTE 2 Non-medical determinants of health are those that fall outside of the sphere of medical/health care, generally speaking, but that have been shown to affect health status, and in some cases, access to health care services.

Table 6 — Non-medical determinants of health dimension description

Sub-Dimension	Description	Examples of indicators
Health behaviors	Aspects of personal behavior and risk factors that epidemiological studies have shown to influence health status.	• Smoking rate • Physical activity
Socioeconomic factors	Indicators related to the socioeconomic characteristics of the population, that epidemiological studies have shown to be related to health.	• Unemployment rate • Low income rate • High school graduation •
Social and community factors	Measures the prevalence of social and community factors, such as social support, life stress, or social capital that epidemiological studies have shown to be related to health.	• School readiness • Social support • Housing affordability • Literacy
Environmental factors	Environmental factors with the potential to influence human health.	• Water quality
Genetic factors	Factors outside those normally influenced by individual behaviors or by the social, economic or physical environment. Genetic factors determine predisposition to certain conditions.	• Rates of genetically determined diseases (eg Down's syndrome)

7 Health System Performance

7.1 Health system performance dimension description

The dimension of health system performance is described in Table 7.

Table 7 — Health system performance dimension description

Sub-Dimension	Description	Examples of indicators
Acceptability	All care/services provided meets the expectations of the client, community, providers and paying organizations, recognizing that there may be conflicting, competing interests between stakeholders, and that the needs of the clients/patients are paramount (CCHSA) [1]	• Patient satisfaction

Table 7 (continued)

Sub-Dimension	*Description*	*Examples of indicators*
Accessibility	The ability of clients/patients to obtain care/service at the right place and the right time, based on respective needs (CCHSA)[1]	• Waiting times • Practice availability • Availability of dentists
Appropriateness	Care/service provided is relevant to the clients'/patients' needs and based on established standards (CCHSA)[1]	• Inappropriately used surgery • Appropriate use of ACEI at discharge for heart failure
Competence	An individual's knowledge and skills are appropriate to the care/service being provided (CCHSA)[1]	
Continuity	The ability to provide uninterrupted coordinated care/service across programs, practitioners, organizations, and levels of care/service, over time (CCHSA)[1]	
Effectiveness	The care/service, intervention or action achieves the desired results (CCHSA)[1]	• Cancer survival • Recurrence of hernia after repair • Smoking cessation during pregnancy (effectiveness of maternal health care) • Chronic care management: admission rates for asthma, diabetes, epilepsy
Efficiency	Achieving the desired results with the most cost-effective use of resources (CCHSA)[1]	• Avoidable hospitalizations • Cost per case mix-adjusted separation • Cost-effective prescribing
Safety	Potential risks of an intervention or the environment are avoided or minimized (CCHSA)[1]	• Hospital-acquired infection rate
Security	The safety and integrity of confidential information within the clinical environment	• HIPAA

NOTE 1 Canadian Council for Health Services Accreditation (1996)

8 Community and health system characteristics

8.1 Community and health system characteristics dimension description

The dimension of community and health system characteristics is described in Table 8.

Table 8 — Community and health system characteristics dimension description

Sub-Dimension	Description	Examples of Indicators
Resources	contextual information about financial, physical, human or other types of resources	• number of physicians per capita • provider compensation • asset ratios • % expenditure on teaching compared to service delivery • % expenditure on research
Population	contextual information about the characteristics of the population	• health insurance enrolment • % population over 65 years of age • % residing in urban centers
Health Services	contextual information about the configuration, organization, sustainability or utilization of the health care system	• number of coronary artery bypass graft (CABG) per capita • number of home care services provided per capita

9. Dimension relationships

9.1 General

Tables 1 through 4 and 5 through 8, respectively, provide examples of indicators that are useful to monitor in order to understand health status from the perspective of a population for the four dimensions of the health indicators conceptual framework. However, these dimensions are not independent. Indeed they each have influences on other categories of indicators, according to Figure 1.

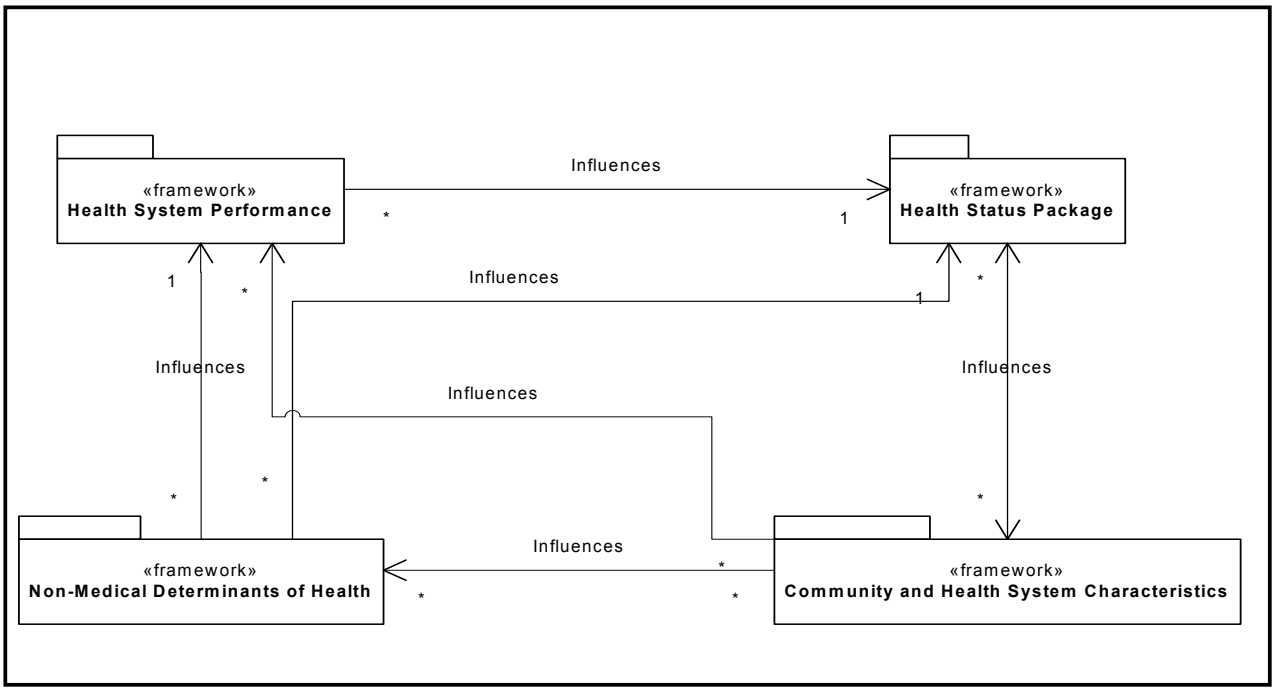


Figure 1 – Relations: Health indicators

NOTE Figure 1 in Unified Modeling Language (UML) defines the high level interactions of the major determinants / indicators of health status. **Health system performance**, **non-medical determinants of health**, and the **community and health system characteristics** all Influence the **health status package**. In turn, the **health status** dimension has bearing on the characteristics of the community and the health systems associated with that community.

9.2 Relationships

9.2.1 Relationships – General

It is clear from the depiction in Figure 1 that health status is influenced by the other three determinants of health status. On further examination it becomes clear that community and health system characteristics also influences both health system performance and the non-medical determinants of health. Less obvious but also important is the influence of health status on the community and health system characteristics. Health status clearly changes the community as well as many of the services that are offered to that community. The communities with poor health status may have lower employment rates that can affect the rate of health insurance enrolment as well as other health factors. Changes in the community can cause changes in non-medical determinants of health, which in turn influence the overall health status of the population. These community characteristics influence the performance of the health system due to factors both within and outside of the health system's direct control. The health system performance influences the health status of the population, which changes the community characteristics. The way in which relations influence specific sets of classes or categories can be classified by weight of influence. The weight of each type of relation can be specifically qualified by value. By way of example, the '*Requires*' relationship is stronger than the '*Leads to*' relation, which in turn is stronger than the '*Influences*' relation (which directionally is non-specific).

9.2.2 Relationships – Health status

Health status is complex (see Figure 2). Health conditions can lead directly to death or can, through changes in well-being or human function, lead to death. Well-being in turn can influence health conditions and, through health conditions, well-being can influence human function. This link between well-being, human function and health conditions emphasizes the integral communication between happiness, health and function. The symmetric *Influences* relationship between health conditions and well-being represents the intertwined double headed caduceus that symbolizes excellent health care. The emphasis of this central relationship promotes and stresses the importance of holistic allopathic healthcare.

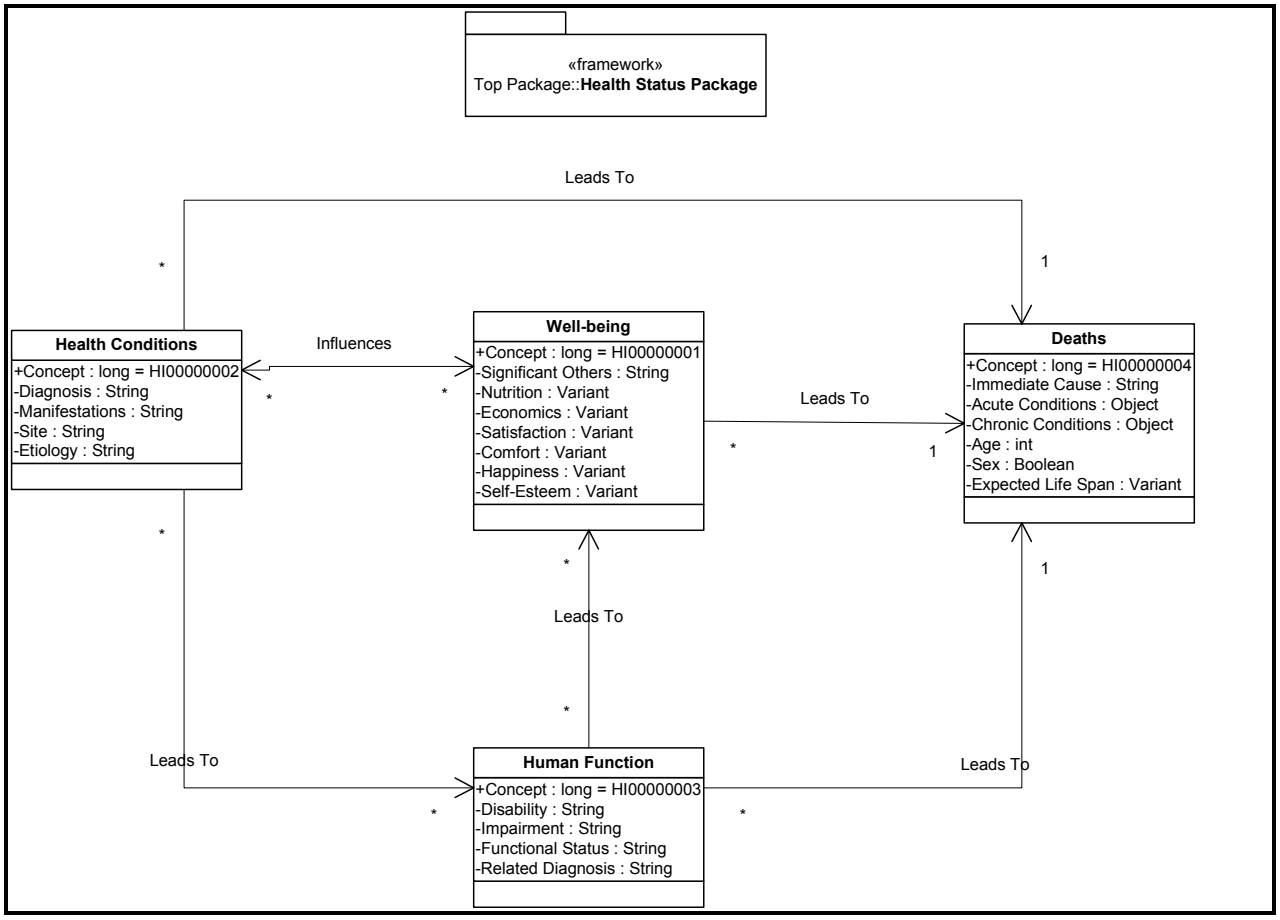


Figure 2 – Relationships: Health status

NOTE Figure 2 in UML depicts the relationships of the **health status** dimension. **Health conditions**, lack of **well-being** and poor **human function** (such as disabilities) can *lead (cause) to* **death**. This death rate is an important indicator of **health status**. **Health conditions** can *cause* **death** in multiple ways and can *cause* impairment in **human function**. **Health conditions** *affects* the **well-being** of individuals and populations and **well-being** can have an important e*ffect on* **health conditions**.

9.2.3 Relationships – Non-medical determinants of health

The non-medical determinants of health span the gambit from nature to nurture (see Figure 3). The relationship of each of these entities to health status can vary greatly between populations. Cultural aspects of care are considered under the health behaviors and social and community factors categories. As longitudinal care becomes an increasing reality, it is clear that the non-medical indicators will become more important in the care of a

population. Life style changes are among the most important interventions available to healthcare systems globally. Emphasis on these determinants of health will provide a more positive change in health status (in terms of quality of life and years of life saved) than any other single health intervention known today.

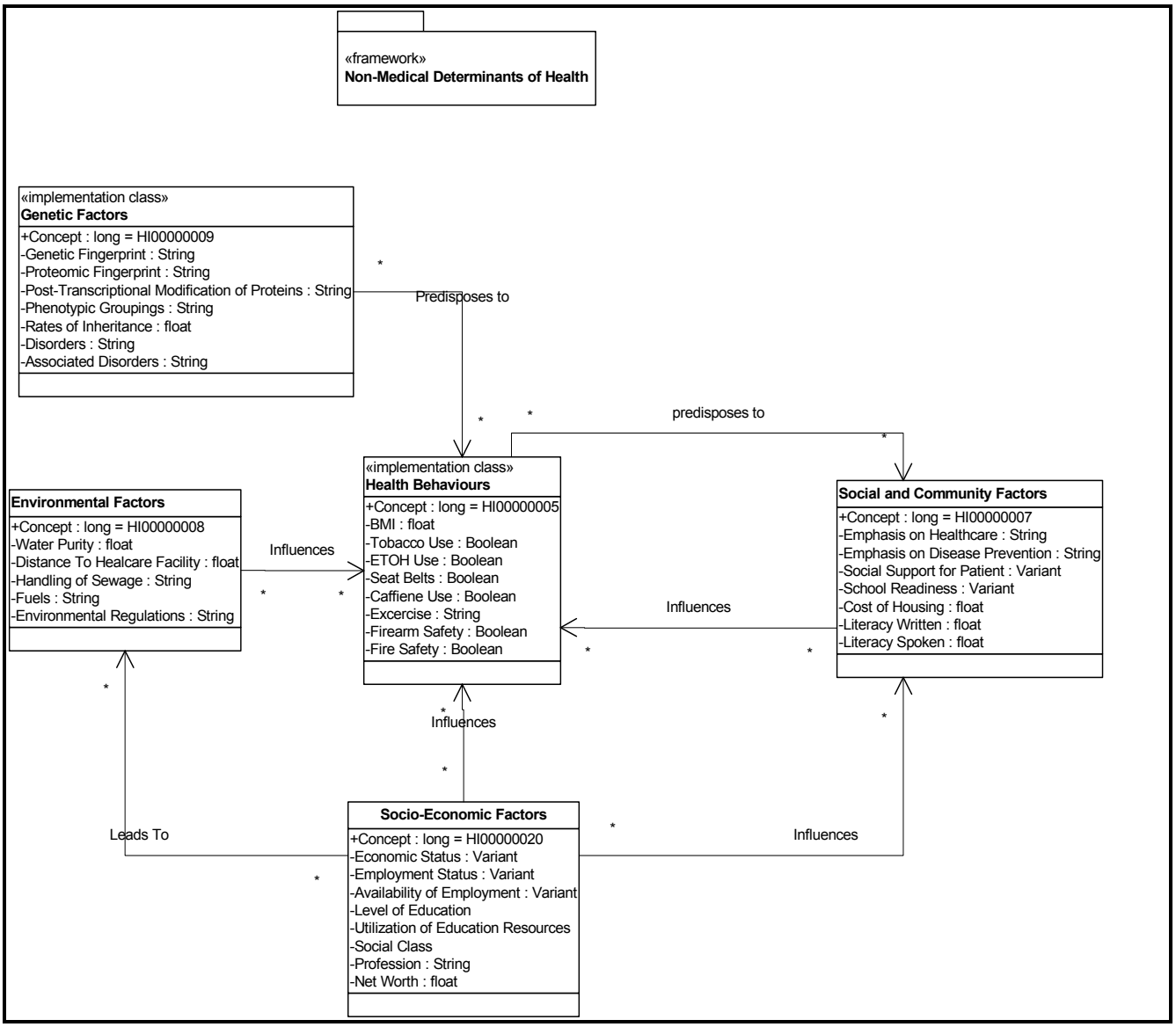


Figure 3 – Relationships: Non-medical determinants of health

NOTE Figure 3 in UML depicts the relationships of the non-medical determinants of health. **Environmental factors** and **social and community factors** *influence* **health behaviors** while **genetic factors** *predispose to* **health behaviors**. In turn, **health behaviors** and **genetic factors** *predispose to* **social and community factors**.

9.2.4 Relationships – Health system performance

Health system performance is centered on acceptable and appropriate care. Features such as competence, continuity, efficiency and safety clearly influence or lead to acceptability (see Figure 4). Appropriateness and acceptability influence one another. Competence requires efficiency and leads to acceptability. Competence

influences safety. Competence in medical training is emphasized to achieve the goal of acceptable practice. Acceptability is not a minimum criterion, but instead is excellence of care with the provision of evidence-based practice supplemented by experience-based practice where sufficient evidence does not exist to direct medical decision making.

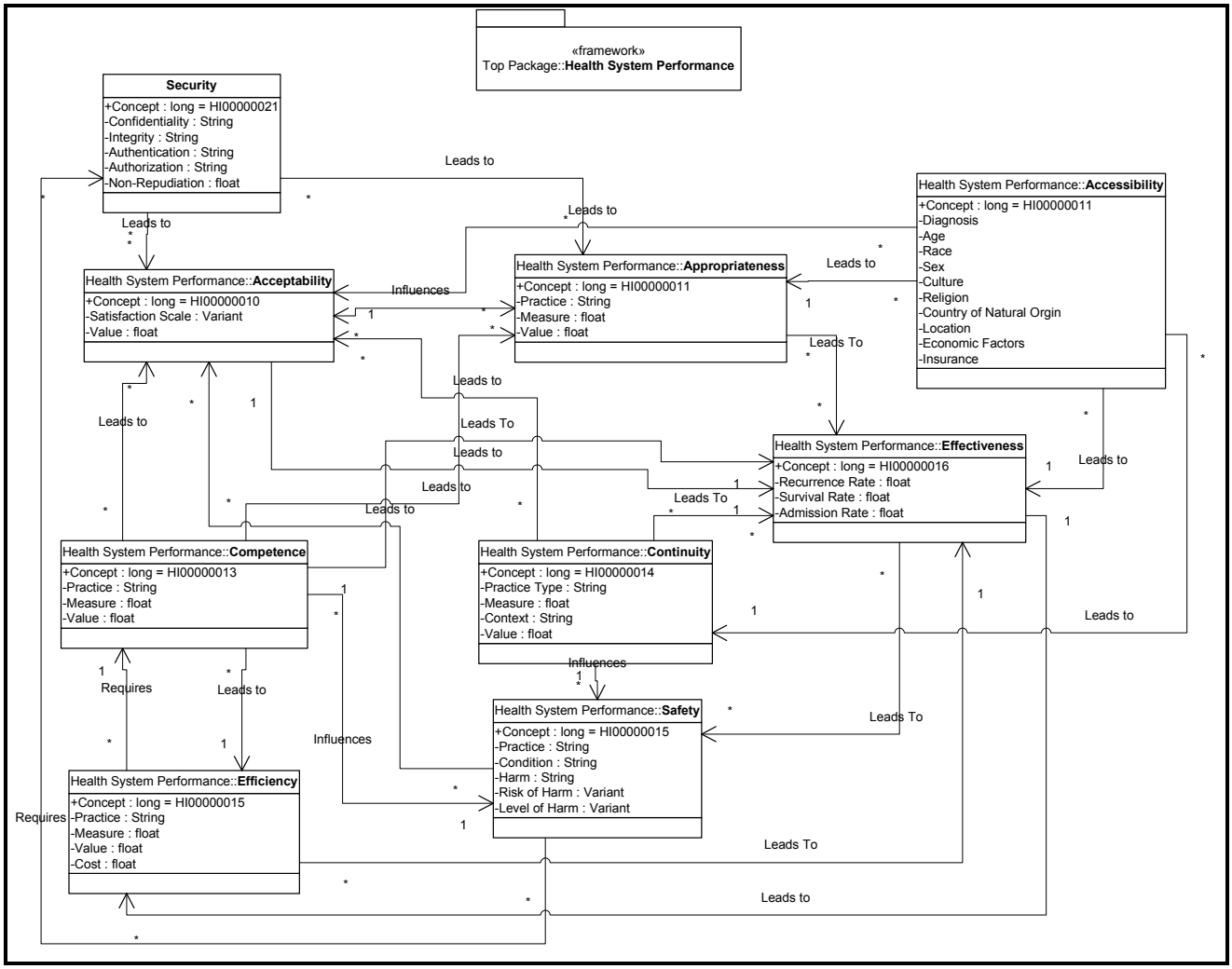


Figure 4 – Relationships: Health system performance

NOTE Figure 4 in UML depicts the relationships of the **health system performance** dimension. **Acceptability** *influences* **Appropriateness** and **Appropriateness** *influences* **Acceptability**. **Competence**, **safety** and **continuity** *lead to* **Acceptability**. **Competence** *leads to* **Appropriateness**. **Continuity** and **Competence** both *influence* **safety**. **Competence** *leads to* **efficiency** and **efficiency** *requires* **competence**.

9.2.5 Relationships – Community and health system characteristics

Community and health system characteristics show the interaction between health systems, populations and resources (see Figure 5). As resources become more constrained this set of indicators becomes more influential with regard to the overall health of a population. Populations require care. They have to have resources to set up the appropriate health infrastructure and utilize the health system's resources in the course of providing care. The health system is sustained by resources from the population and the health of the population influences what resources are within the means of the population and also what resources will be extended to the healthcare system.

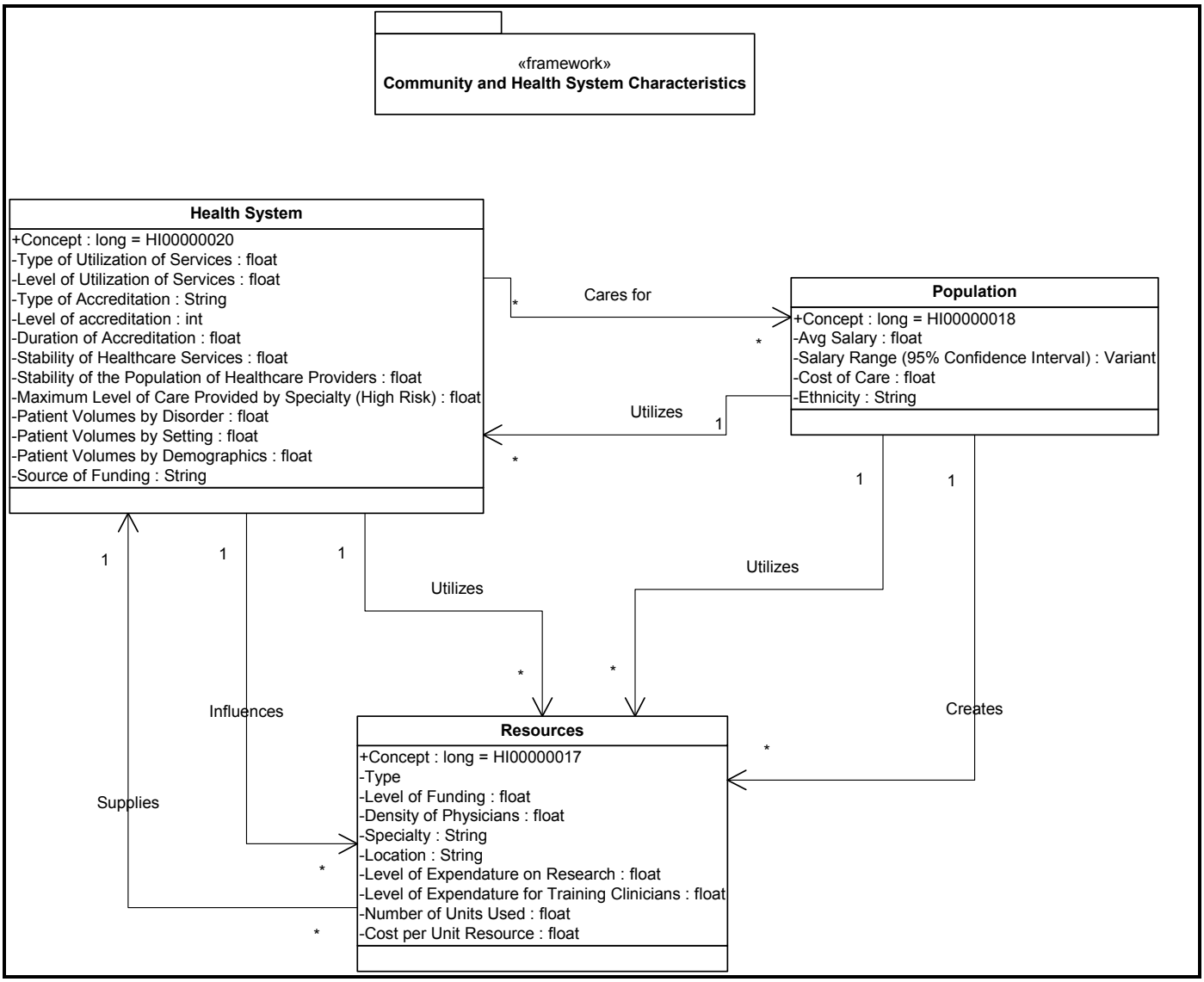


Figure 5 – Relationships: Community and health system characteristics

NOTE Figure 5 in UML depicts the relationships of the **community and health system characteristics**. The **health system** *cares for* a **population** which *utilizes* the **health system**. The **population** *creates* and *utilizes* **resources** that are *supplied to* the **health system**. The **health system** *utilizes* these **resources** in the provision of care.

10. Attributes

10.1 General

Each of the classes of health indicators is an object that passes knowledge up both in detail and in aggregate to the root class. Each class can aggregate the data from its subordinate classes based on their attributes and relationships. The root class understands the relationships between each of its members and is capable of aggregating the information into a level of health status from all of the indicators.

10.2 Attribute visibility and type

The data contained in the classes of health indicators are represented as attributes specific to that class. Attributes retain two main properties of *Visibility* and *Type*, which determine how other classes interact with each other.

10.2.1 Visibility of an attribute

The visibility of an attribute or class determines how other classes interact with other attributes or classes. Attribute and classes can be defined as public, protected or private. Attributes that are available to all other classes are declared to be public. Public attributes are visible to all classes, and can be referenced directly. In Figures 2 through 5, public attributes are preceded by the '+' sign. Protected attributes, represented by the '#' symbol, can be referenced only by the class that defines the attribute, or any subclass of the parent class. Private attributes are represented by the '-' symbol, and can be referenced only by the class that defines the attribute. If any class requires access to a private attribute of another class it must do so through an interface provided by the owning class.

10.2.2 Type of an attribute

An attribute's type refers to the data type for that attribute: an integer, string, object etc. When a class references an attribute for another class, it will receive a value of the type for that attribute. Each health indicator class has a public *Concept* attribute of type long, which uniquely represents each health indicator. The attributes specific to each health indicator class are defined in Clause 10.3.

10.3 Health indicator class attributes and definitions

10.3.1 Health status dimension

10.3.1.1 Health status dimension: Class "death"

Table 9 – Health status dimension: Class "death"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Immediate cause	The most direct cause of death, as opposed to predisposing conditions that contributed to the patient's instability
Acute conditions	Conditions that have been present only during the episode of illness leading up to the patient's demise.
Chronic conditions	Conditions that were present prior to the onset of the episode of illness, which led up to the patient's demise
Age	The patient's age in years from birth. This value is an integer
Sex	An identifier of the genetic gender of the patient at their time of death (eg XX, XY, XXY, XYY, XO, XXX). It may also be useful to hold the patient's stated or phenotypic gender in the model
Expected life span	The current life expectancy by category for any given population at any given point in time

10.3.1.2 Health status dimension: Class "health conditions"

Table 10 – Health status dimension: Class "health conditions"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Diagnosis	Any health condition, which can be ascribed to an individual, can be used in this field. If a coding scheme identification is used, the identification of the coding scheme must be attributed with the coded entity
Manifestations	Any symptom, finding or value that can be associated with a patient's condition
Site	The body location of the manifestation or diagnosis defines the site
Etiology	The cause of the diagnosis or manifestation noted above

10.3.1.3 Health status dimension: Class "human function"

Table 11 – Health status dimension: Class "human function"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Disability	The level of disability of a patient or on average for a population is represented as a percentage
Impairment	The specific function that is not as usable as it is in its normal form
Functional status	The International Classification of Functioning, Disability and Health (ICF) indicator for the functional status
Related diagnosis	If applicable, this field would contain the diagnosis related to the patient's impairment / disability. For example patient cannot walk 200 feet secondary to COPD (Chronic Obstructive Pulmonary Disease)

10.3.1.4 Health status dimension: Class "well-being"

Table 12 – Health status dimension: Class "well-being"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each Health Indicator
Significant others	Immediate family or loved ones, including spouses, lovers, children and parents
Nutrition	This field will hold the nutritional status of the individual
Economics	Financial capabilities influence healthcare. This will hold the socio-economic status of the individual
Satisfaction	Patient conception of the quality, availability and cost of their care
Comfort	Are the conditions to which the patient is exposed adequate to support a healthy lifestyle?
Happiness	What is the overall level of the patient's mood?
Self esteem	Does the patient's self image predispose them to a healthy lifestyle?

10.3.2 Non-medical determinants of health dimension

10.3.2.1 Non-medical determinants of health dimension: Class "environmental factors"

Table 13 – Non-medical determinants of health dimension: Class "environmental factors"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Water purity	A measure of the contaminant level of the drinking water for a population within a particular region
Distance to healthcare facility	A measure of the average distance required to travel to reach a healthcare facility for a population in a specific region
Handling of sewage	The methods employed by a region in the management and disposal of waste material
Fuels	The specific fuels employed by a given region that can impact to the overall health for that region
Environmental regulations	The specific environmental regulations that are enforced for a particular region

10.3.2.2 Non-medical determinants of health dimension: Class "genetic factors"

Table 14 – Non-medical determinants of health dimension: Class "genetic factors"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Genetic fingerprint	A patients genetic sequence in part or in whole
Proteomic fingerprint	The proteins produced by a given patient
Post-transcriptional modification proteins	Any post-transcriptional modifications to the proteins produced by a particular patient, these can be aggregated for population study
Phenotypic groupings	Phenotypic manifestations
Rates of inheritance	The rate of transmission of a disorder from one generation to another
Disorders	Any health condition, which can be ascribed to an individual, can be used in this field. If a coding scheme identification is used, the identification of the coding scheme must be attributed with the coded entity
Associated disorders	Any other condition not specified by the disorders attribute which directly contributed to the development or severity of the primary disorder

10.3.2.3 Non-medical determinants of health dimension: Class "health behaviors"

Table 15 – Non-medical determinants of health dimension: Class "health behaviors"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
BMI	Body mass index (BMI) is a measure of body fat based on height and weight
Tobacco use	A measure of the rates of tobacco use for a given patient or population
ETOH use	The level to which the Alcohol and Alcohol Problems Science Database is employed in direct patient care
Seatbelts	A measure of the frequency of use of seatbelts for a given patient or population
Caffeine use	The level of the use of caffeine products for a patient
Exercise	The measure of the frequency of exercise for a given patient
Firearm safety	The level of firearm safety obtained by a particular individual
Fire safety	The level of fire safety training available to and obtained by individuals for a given population

10.3.2.4 Non-medical determinants of health dimension: Class "social and community factors"

Table 16 – Non-medical determinants of health dimension: Class "social and community factors"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Emphasis on healthcare	The overall community attention directed towards positive healthcare practices
Emphasis on disease prevention	The overall community attention directed towards positive healthcare practices as it relates to the prevention of disease
Social support for patient	Availability of social support for the patient in the family or community
School readiness	The percentage of the population which is at grade level by age in a given population
Cost of housing	A measure of the percentage of income directed towards housing and housing-related costs for a given population
Literacy (written)	A measure of the level of written literacy for a given population
Literacy (spoken)	A measure of the level of spoken literacy for a given population

10.3.2.5 Non-medical determinants of health dimension: Class "socio-economic factors"

Table 17 – Non-medical determinants of health dimension: Class "socio-economic factors"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Economic status	Economic Status is the attained social status for an individual defined on the basis of education, income, and family occupation
Employment status	Classifications of the employment status for an individual such as full-time, part-time or temporary
Availability of employment	A measurement of the availability of employment within an area against the available working population
Level of education	The level of education attained by an individual (ranging from less than high school to doctorate)
Utilization of education resources	The degree to which an individual utilizes the available educational opportunities.
Social class	The social category within a societal system to which an individual relates to and associates with
Profession	An individual's employment occupation
Net worth	The measure of an individual's assets and liabilities

10.3.3 Health system performance dimension

10.3.3.1 Health system performance dimension: Class "acceptability"

Table 18 – Health system performance dimension: Class "acceptability"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Satisfaction scale	The identity of the scale used to judge to what degree patients are satisfied with the acceptability of the Health system performance
Value	The value is the measure identifying the degree of satisfaction derived from the scale noted above

10.3.3.2 Health system performance dimension: Class "accessibility"

Table 19 – Health system performance dimension: Class "accessibility"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Diagnosis	Any health condition, which can be ascribed to an individual, can be used in this field. If a coding scheme identification is used, the identification of the coding scheme must be attributed with the coded entity
Age	The age of the patient
Race	The ethnicity of the patient
Sex	The genetically determined sex of the patient
Culture	The name of the social structure to which the patient belongs
Religion	The religion of the patient
Country of Natural Origin	The country where the ancestors of the patient were known to reside
Location	The geographical site of the patient at the time of the data sampling
Economic Factors	Monetary influences on the ability to gain appropriate access to care
Insurance	Information regarding the insurance coverage for the patient

10.3.3.3 Health system performance dimension: Class "appropriateness"

Table 20 – Health system performance dimension: Class "appropriateness"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Practice	The type of healthcare being delivered would be represented in this field. For example, a specialty of medicine or naturopathic medicine is a specific practice
Measure	The specific method used to judge appropriateness is identified here
Value	The value derived from the scale used in the Measure component that specifies the patient's actual view of the appropriateness of the healthcare that they receive

10.3.3.4 Health system performance dimension: Class "communication"

Table 21 – Health system performance dimension: Class "communication"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Timely	A measure of the time to communicate information between entities
Accurate	A measure of the accuracy of the information being communicated
Sufficient	Is the communication sufficient for relaying the required information
Pertinent	Is the information communicated pertinent to the specifics of the case
Interpretable	Is the communication interpretable by the party that receives the communication

10.3.3.5 Health system performance dimension: Class "competence"

Table 22 – Health system performance dimension: Class "competence"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Practice	The type of healthcare being delivered would be represented in this field. For example, a specialty of medicine or naturopathic medicine is a specific practice
Measure	The specific method used to judge appropriateness is identified here
Value	The value derived from the scale used in the Measure component that specifies the patient's actual view of the appropriateness of the healthcare that they receive

10.3.3.6 Health system performance dimension: Class "continuity"

Table 23 – Health system performance dimension: Class "continuity"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Practice type	The type of healthcare being delivered would be represented in this field. For example, a specialty of medicine or naturopathic medicine is a specific practice
Measure	The specific method used to judge appropriateness is identified here
Context	The type of care that is measured. For example, a diabetic having regular follow-up visits to check their HgA1C
Value	The value derived from the scale used in the Measure component that specifies the patient's actual view of the appropriateness of the healthcare that they receive

10.3.3.7 Health system performance dimension: Class "effectiveness"

Table 24 – Health system performance dimension: Class "effectiveness"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Recurrence rate	The rate at which patients present with a repeat episode of a problem after finishing a course of treatment for the same condition
Survival rate	The rate of survival for a particular disorder
Admission rate	The rate of hospital admission associated with a particular condition

10.3.3.8 Health system performance dimension: Class "efficiency"

Table 25 – Health system performance dimension: Class "efficiency"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Practice	The type of healthcare being delivered would be represented in this field. For example, a specialty of medicine or naturopathic medicine is a specific practice
Measure	The specific method used to judge appropriateness is identified here
Value	The value derived from the scale used in the Measure component that specifies the patient's actual view of the appropriateness of the healthcare that they receive
Cost	The cost associated with a particular episode of care or treatment of a particular condition. This should be aggregatable for a population or set of disorders

10.3.3.9 Health system performance dimension: Class "safety"

Table 26 – Health system performance dimension: Class "safety"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Practice	The type of healthcare being delivered would be represented in this field. For example, a specialty of medicine or naturopathic medicine is a specific practice
Condition	A condition is a diagnosis or manifestation of a patient
Harm	An injury to a patient secondary to exposure or lack of exposure to the healthcare system
Risk of Harm	This measure expresses the patient's risk of coming to harm based on their exposure or lack of exposure to the healthcare system
Level of Harm	The measure of the degree of injury experienced by the patient

10.3.3.10 Health system performance dimension: Class "security"

Table 27 – Health system performance dimension: Class "security"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Confidentiality	The level to which information, the unauthorized disclosure of which poses a threat to patient security is managed
Integrity	The degree to which the security model maintains its cohesiveness and cannot be circumvented through fragmentation
Authentication	Authentication verifies that security messages received by the security model really come from their stated source
Authorization	The process of allowing secure systems access into the security framework
Non-Repudiation	Preventing an entity from denying previous commitments or actions

10.3.4 Community and health system characteristics dimension

10.3.4.1 Community and health system characteristics dimension: Class "health system"

Table 28 – Community and health system characteristics dimension: Class "health system"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Type of utilization of services	Any service which might be offered in a healthcare setting
Level of utilization of services	The level of service offered. For example they may have cardiac surgery available at an institution but they may not have cardiac transplantation
Type of accreditation	By which organization and/or class of accreditation
Level of accreditation	If appropriate the level of the accreditation or rating may be specified here
Duration of accreditation	The time frame over which the accreditation is active
Stability of health care services	The length of time over which the services been offered in the community
Stability of the population of health care providers	The rate of turn over of healthcare providers in the community
Maximum level of care provided by specialty (high risk)	The level of service provided. For example, "a level one trauma centre" or "providing transplantation services"
Patient volumes by disorder, setting, demographics	The actual patient volumes stratified by disorder, setting and demographics

10.3.4.2 Community and health system characteristics dimension: Class "population"

Table 29 – Community and health system characteristics dimension: Class "population"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Density of physicians	The number of practicing physicians per capita for a given region
Specialty	Health care specialty
Location	Geographic location of the population
Average salary	Average salary of families in the population
Salary range	The salary range of families in the population
Cost of care	The cost of care for a particular service at a given location for a given population
Ethnicity	Ethnicity is an attribute of population that specifies the race of origin

10.3.4.3 Community and health system characteristics dimension: Class "resources"

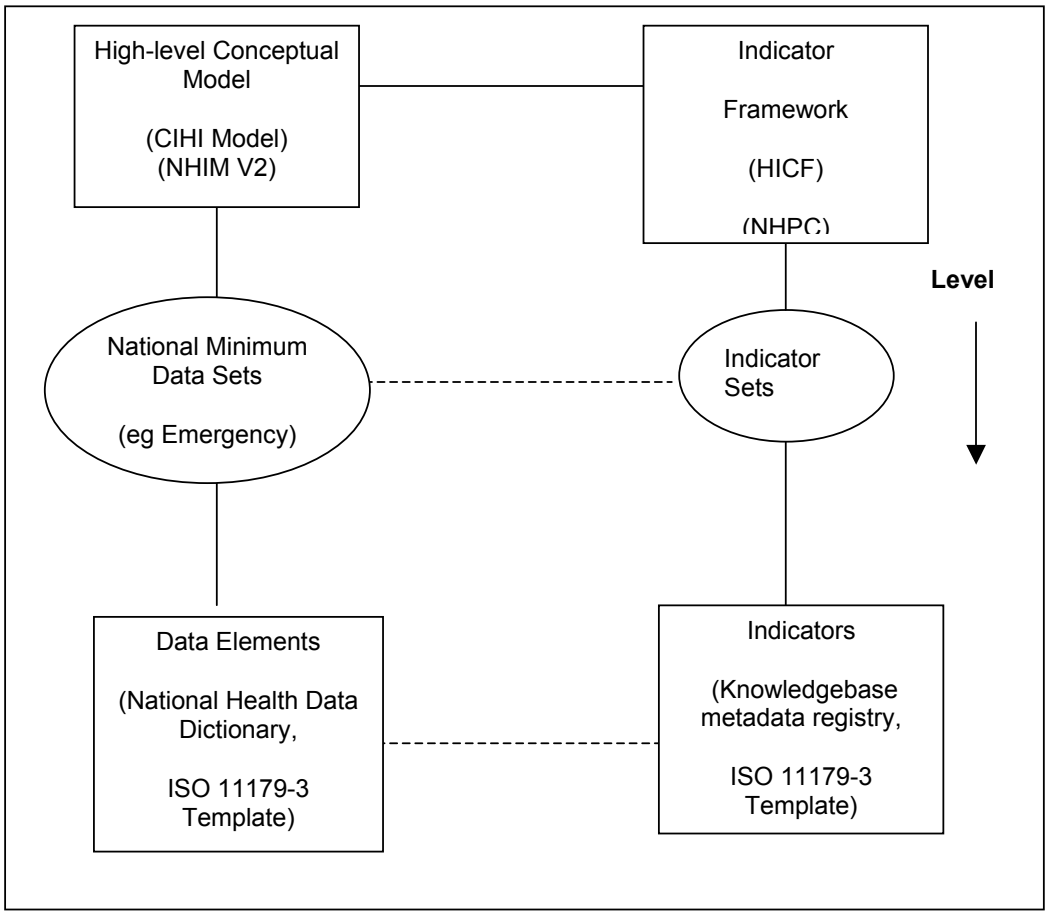
Table 30 – Community and health system characteristics dimension: Class "resources"

Attribute	Definition
Concept	An attribute of type long that is a unique identifier, which represents each health indicator
Type	Type of resource, For example "MRI scanners" or more general needs such as "Electric Power"
Level of funding	The total level of funding for this resource within a given population
Source of funding	Government, private, corporate, etc.
Level of expenditure of physician training	The average level of expenditure in this population for physician training
Level of expenditure on research	The total level of expenditure for research within a given community
Number of units used	The number of units utilised for any specific resource instantiation
Cost per unit	The unit cost for any one specific resource instantiation

Annex A

(Informative)

A conceptual framework for linking national health information model and indicator framework structures



This illustrates the connections that apply both horizontally (eg between models and indicators frameworks; between data elements and indicators that are data elements commonly are often derived from existing data elements) and vertically (eg between models and data elements, and between indicator frameworks and indicators). The diagram also recognises the role of data sets that provide information about some specific or topic. Note that ISO 11179-3 can be adapted to the documentation of data elements, indicators, and data sets such as national minimum data sets and indicators sets

Annex B

(Informative)

Reference Terminologies

Introduction

Vocabulary construction and organization is seen as an essential part of a functional Electronic Health Record[1]. Concept level understanding of our day-to-day clinical practice will enable more accurate and more available outcomes research, evidence based medicine, and effective cost management of medicine *without a decline in service*. This promise is hampered by the lack of a robust clinically relevant large-scale vocabulary, with a structure that supports synonymy, multiple ontologies, semantic relationships, and compositionality. As we move toward a greater understanding of the relationships between terms, workers are striving to determine the optimal level of granularity for the terms in these vocabularies. One solution would be to separate the truly atomic terms and their ontologies from the compositions. This multiaxial schema for vocabulary design is clearly controversial. An example of this type of construction would be "Coronary Artery Disease (CAD) Status Post CABG" in which we have multiple atomic concepts. On first cut, the Coronary Artery Disease can be separated from the s/p CABG. This is only possible, if there exists a mechanism for reconstruction. This is clinically very important because the patient with "CAD s/p CABG" is clearly a different presentation than a patient with "CAD" without a history of prior cardiac surgery. More controversial is the corollary, that the construction of "Coronary Artery" and "Atherosclerotic Vascular Disease", should be an equivalent concept to "CAD"

Although we may wish to say many things about "CAD" as a unit, there are still more granular ways to represent the same concepts. This similarity can be seen in many other constructions, for example the combination of "Large Bowel" and "Neoplasm, malignant" is equivalent to "Colon Cancer". This is particularly important for billing systems where the code for "colon cancer" must not have a different ICD9-CM code than the composition of the term "neoplasm, malignant" modified by the site "large bowel". One challenge in the development of a canonical vocabulary is to eliminate redundancy. Composition, while powerful, is also a source of considerable redundancy.

If composition causes such angst, why do it? Why not ignore this functionality? The answer was further reinforced by the results of a recent usability trial conducted at the Mayo Clinic[2]. Users demand the ability to form problem statements that represent the concepts of their practice. We do not and cannot anticipate everything a clinician might wish to say about a patient. Thus without fully functional natural language processing, we require other tools and resources to make the most out of currently available controlled medical vocabularies. One solution is compositionality. All of these complex and varied statements that clinicians make regarding their patients are derived from a manageable number of atomic concepts (estimated to fall somewhere between (20,000 and 1,000,000) [3,4,5].

Terminology structures

Terminology structures determine the ease with which practical and useful interfaces, for term navigation, entry, or retrieval can be supported (ISO 704, ISO 1087-1, ENV 12264).

Compositional terminologies

Large-scale controlled health vocabularies are becoming commercially available. One of the barriers to implementation of these systems is the perception that they will change the way clinicians must represent data. Clinicians fear that the individual flavour of their institution may be compromised by this mandate. In order to move toward standard representation of our patient's conditions, we will need to provide a mechanism for mapping local parlance into large-scale concept based controlled health vocabularies.

Although these colloquial local terminologies are appropriate for integration into a controlled representation for a particular organization they may not be appropriate to disseminate to all users of the terminological system. For example, at our institution it is common to list the name of the surgeon who performed the CABG along with the fact that the patient had heart surgery. (This helps clinicians to know the technique used and the accessibility of

records such as an Operation Note). Nevertheless, this activity of local colloquial terminology integration will likely be important for most, if not all, efforts to disseminate large-scale controlled health vocabularies.

For a vocabulary to be useful it must evolve and its content must grow. The UMLS contains over 750,000 concepts but still does not cover all clinically useful terminology. Local additions of colloquial terminology fall into one of two categories. One area of needed evolutionary capacity is specialty specific terminology. The other is colloquial additions of a general nature. For example, at Mayo it is common to refer to uncomplicated "low back pain" as "mechanical low back pain." General and specialty specific local terminologies will likely continue to be used and, indeed, add richness to medical vocabularies.

As Cimino states, "…a formal methodology is needed for expanding content." [1] However, if one adds terms to a vocabulary indiscriminately, one risks redundancy and combinatorial explosion making the vocabulary unwieldy and difficult to search in a timely fashion. "An alternative approach is to enumerate all the atoms of a terminology and allow users to combine them into necessary coded terms, allowing compositional extensibility."[1, 3, 4] One risk of this approach is that it has the potential of making the use of the vocabulary more complex.

Bibliography

Acheson D (1998). *Independent Inquiry into Inequalities in Health Report*. London: The Stationery Office.

Baird, PA (1994). The Role of Genetics in Population Health, in Evans RG, Barer ML, Marmor T (eds). *Why are Some People Healthy and Others Not?* New York: Aldine de Gruyter.

Bosma H, Marmot MG, Hemingway, H, Nicholson AC et al. (1997). Low job control and risk of coronary heart disease in Whitehall II (prospective cohort) study. *British Medical Journal* 314(7080):558-565.

Brännström, I, Weinehall L, Persson LA, Wester PO, Wall S (1993). Changing social patterns of risk factors for cardiovascular disease in a Swedish community intervention program. *International Journal of Epidemiology* 22(5):1026-1036.

Canadian Council on Health Services Accreditation (CCHSA) (1996). *A Guide to the Development and Use of Performance Indicators.* Ottawa: CCHSA.

Canadian Institute for Health Information (CIHI) (2001). *CIHI - Health indicators conceptual framework.* Toronto: CIHI.

Cattell V (2001) Poor people, poor places, and poor health: the mediating role of social networks and social capital. *Social Science & Medicine* (52)10:1501-1516.

Connolly VM, Kesson CM (1996). Socioeconomic status and clustering of cardiovascular disease risk factors in diabetic patients. *Diabetes Care* 19(5):419-422.

Droomers M, Schrijvers CTM, van de Mheen H, Mackenbach JP (1998). Educational differences in leisure-time physical inactivity: a descriptive and explanatory study. *Social Science & Medicine* 47(11):1665-1676.

Evans RG and Stoddart GL (1994). Producing health, consuming health care, in Evans RG, Barer ML, Marmor T (eds). *Why are Some People Healthy and Others Not?* New York: Aldine de Gruyter.

Everson SA, Lynch JW, Chesney MA, Kaplan GA et al., (1997). Interaction of workplace demands and cardiovascular reactivity in progression of carotid atherosclerosis: Population-based study. *British Medical Journal* 314(7080):553-558.

Fenn P; Diacon S; Gray A; Hodges R; Rickman N (2000). Current cost of medical negligence in NHS hospitals: analysis of claims database. *British Medical Journal* 2000 Jun 10;320(7249):1567-71.

Ferrie JE, Shipley MJ, Marmot MG, Stansfeld SA, Davey Smith G (1995). Health effects of anticipation of job change and non-employment: longitudinal data from the Whitehall II study. *British Medical Journal* 311(70150:1264-1269.

Ferrie JE, Shipley MJ, Marmot MG, Stansfeld SA, Davey Smith G (1998). An uncertain future: the health effects of threats to employment security in white-collar men and women. *American Journal of Public Health* 88(7):1030-1036.

Frank JW (1995). Why "Population health"? *Canadian Journal of Public Health* 86(3):162-164.

Hallqvist J, Diderichsen F, Theorell T, Reuterwall C, Ahlbom A and the SHEEP study group (1998). Is the effect of job strain on myocardial infarction risk due to interaction between high psychological demands and low decision latitude? Results from Stockholm Heart Epidemiology Program (SHEEP). *Social Science & Medicine* 46(11):1405-1415.

Hirdes JP, Forbes WF (1992). The importance of social relationships, socioeconomic status and health practices with respect to mortality among health Ontario males. *Journal of Clinical Epidemiology* 45(2):175-182.

House JS, Landis KR, Umberson D (1988). Social relationships and health. *Science* 241:540-544.

Hurst J and Jee-Hughes M (2001). *Performance measurement and performance management in OECD Health Systems*. Labour Market and Social Policy - Occasional Papers no. 47. Paris: OECD.

Iversen L, Andersen O, Andersand PK, Christoffersen K, Keiding N (1987). Unemployment and mortality in Denmark, 1970-1980. *British Medical Journal* 295:879-884.

Peter L. Elkin, MD, Steven H. Brown, MD, John Carter, Brent A. Bauer, MD, Dietlind Wahner-Roedler, MD, Larry Bergstrom, MD, Mark Pittelkow, MD, Cornelius Rosse, MD, D.Sc. "Guideline and quality indicators for development, purchase and use of controlled health vocabularies". *International Journal of Medical Informatics*, Vol 68/1-3 pp 175-186, Sep 2002.

PL Elkin, M Peleg, R Lacson, E Bernstam, R Greenes, EH Shortliffe. "Toward standardization of electronic guideline representation", *MD Computing*, 11/ 2000, p39-44.

Jee M and Or Z (1999*). Health outcomes in OECD countries: A framework of health indicators for outcome-oriented policymaking*. OECD Labour Market and Social Policy - Occasional Papers No. 36. Paris: OECD.

Kawachi I, Kennedy B, Lochner K, Prothrow-Stith D (1997). Social capital, income inequality, and mortality. *American Journal of Public Health* 87(9):1491-8.

Knutsson A, Goine H (1998). Occupation and unemployment rates as predictors of long term sickness absence in two Swedish counties. *Social Science & Medicine* 47(1):25-31.

Kohn L., Corrigan J., and Donaldson M., (eds) (1999). *To Err Is Human: Building a Safer Health System Committee on Quality of Health Care in America*, Washington: Institute of Medicine.

Lavis JN and Anderson GM (1996). Appropriateness in health care delivery: Definitions, measurement and policy implications. *Canadian Medical Association Journal* 154(3):321-328.

Leape LL. Reducing errors in medicine. *British Medical Journal* 1999;319:136-137.

Lomas J (1998). Social capital and health: Implications for public health and epidemiology. *Social Science & Medicine*, 47(9):1181-1188.

Mackenbach JP (1993). The contribution of medical care to mortality decline: McKeown revisited. Paper presented at the 11th Honda Foundation Discoveries Symposium, Toronto, October, 1993.

McKeown T (1976). *The Role of Medicine: Dream, Mirage or Nemesis*. London: Nuffield Provincial Hospitals Trust.

McKeown T (1978). Determinants of health. *Human Nature* 1(4):57-62.

McKinlay JB and SM McKinlay (1977). The questionable contribution of medical measures to the decline of mortality in the United States in the twentieth century. *Millbank Memorial Fund Quarterly* Summer, 1977:405-428.

Marmot MG, Bosma H, Hemingway H, Brunner E, Stansfeld S (1997). Contribution of job control and other risk factors to social variations in coronary heart disease incidence. *The Lancet* 350(9073):235-239.

Marmot MG, Shipley MJ, Rose G (1984). Inequalities in death-specific explanations of a general pattern? *Lancet* 1(8384):1003-1106.

Moser KA, Fox AJ, Jones DR (1984). Unemployment and mortality in the OPCS Longitudinal Study. *Lancet* 2(8415):1324-1329.

Mulligan J, Apleby J, Harrison A (2000). Measuring the performance of health systems. *British Medical Journal* 321:191-192.

Nutbeam D (1999). Achieving population health goals: Perspectives on measurement and implementation from Australia. *Canadian Journal of Public Health* 90 (Supplement 1): S43-S46.

Szreter S (1988). The importance of social intervention in Britain's mortality decline c. 1850-1914: a re-interpretation of the role of public health. *Society for the Social History of Medicine* 1(1):1-37.

Theorell T, Tstutsumi A, Hallquist J, Reuterwallet C et al. (1998). Decision latitude, job strain and myocardial infarction: A study of working men in Stockholm. *American Journal of Public Health* 88(3):382-388.

Whitehead M (2000). *The concepts and principles of equity and health*. Copenhagen: World Health Organization Regional Office for Europe.

WHO (1998). *Health for all in the 21st Century.* Geneva: World Health Organization.

WHO (2000). *The World Health Report 2000. Health Systems: Improving Performance*. Geneva: World Health Organization.

WHO (2001). *The International Classification of Functioning, Disability and Health – ICF.* Geneva: World Health Organization.

Wickrama KAS, Lorenz FO, Conger RD, Matthews L, Elder GH Jr. (1997). Linking occupational conditions to physical health through marital, social and intrapersonal processes. *Journal of Health and Social Behaviour* 38(December):363-375.

Wilkinson R, Kawachi I, Kennedy B (1998). Mortality, the social environment, crime and violence. In: Bartley M, Blane D, Davey Smith G, eds. *Sociology of health inequalities*. Oxford: Blackwell.

Wilson C (1999). *Achieving Quality in Health. Taking Responsibility for Performance*. Toronto: Christopher Wilson Consulting Inc.

Winkleby, MA, Jatulis DE, Frank E, Fortmann SP (1992). Socioeconomic status and health: How education, income and occupation contribute to risk factors for cardiovascular disease. *American Journal of Public Health* 82(6):816-820.

Wolfson M (1994). Social Proprioception: Measurement, data and information from a population health persepctive. In Evans RG, Barer ML, Marmor T (eds). *Why are Some People Healthy and Others Not?* New York: Aldine de Gruyter.

