Coordination of SNOMED-CT and ICD-10: Getting the Most out of Electronic Health Record Systems

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Executive Summary

A standard electronic health record (EHR) and interoperable national health information infrastructure require the use of uniform health information standards, including a common medical language. Data must be collected and maintained in a standardized format, using uniform definitions, in order to link data within an EHR system or share health information between systems. The lack of standards has been a key barrier to electronic connectivity in healthcare. Together, standard clinical terminologies and classifications represent a common medical language, allowing clinical data to be effectively utilized and shared between EHR systems. Therefore, standard clinical terminologies and classifications, with maps to link them, must be incorporated into EHR systems to achieve system interoperability and the benefits of a national health information infrastructure.

Neither a clinical terminology nor a classification can, by itself, serve all of the purposes for which health information is currently used or will be used in the future. Terminologies and classifications are designed for distinctly different purposes and satisfy diverse user data requirements.

Classification systems such as ICD-9-CM, ICD-10-CM, and ICD-10-PCS group together similar diseases and procedures and organize related entities for easy retrieval. They are typically used for external reporting requirements or other uses where data aggregation is advantageous, such as measuring the quality of care, monitoring resource utilization, or processing claims for reimbursement. Classification systems are considered "output" rather than "input" systems and are not intended or designed for the primary documentation of clinical care. They are inadequate in a reference terminology role because they lack granularity and fail to define individual clinical concepts and their relationships. Yet they are the most common source of clinical data today, readily available as a byproduct of the healthcare reimbursement process.

Reference terminologies such as SNOMED-CT® are "input" systems and codify the clinical information captured in an EHR during the course of patient care.

They are inadequate for serving the secondary purposes for which classification systems are used because of their immense size, considerable granularity, complex hierarchies, and lack of reporting rules. The benefits of using a reference terminology such as SNOMED-CT increase exponentially if the reference terminology is linked to modern, standard classification systems for the purpose of generating health information necessary for secondary uses such as statistical and epidemiological analyses, external reporting requirements, measuring quality of care, monitoring resource utilization, and processing claims for reimbursement. The linkage of terms in different systems to extract information for multiple purposes is accomplished through mapping.

The full value of the health information contained in an EHR system will only be realized if both systems involved in the map are up to date and accurately reflect the current practice of medicine. Therefore, it makes no sense to map a robust terminology such as SNOMED-CT to an outdated classification system such as ICD-9-CM. AHIMA believes the following steps are essential:

- The federal government must initiate the regulatory process for the adoption of ICD-10-CM and ICD-10-PCS.
- The healthcare industry must incorporate terminology standards in their EHR development initiatives.
- Robust rules-based maps, designed for different use cases, must be developed from SNOMED-CT to ICD-10-CM and ICD-10-PCS in order to maximize the value of the clinical data and the benefits of an EHR system.

- These maps should be made publicly available through the Unified Medical Language System and should become a standard component of any EHR system.

These steps are among the first the industry should take toward maximizing the power of healthcare data and, in doing so, building a better healthcare system for the 21st century.

Introduction

A standard electronic health record (EHR) and a national health information infrastructure require the use of standardized medical language and terminologies to transmit clinical data across diverse information systems. Data must be collected and maintained in a standardized format, using uniform definitions, in order to link data within an EHR system or share health information between systems.

A standard EHR will allow for interoperable health data exchange. Interoperability or the sharing of healthcare data is an essential component of a national health information infrastructure that will greatly improve the effectiveness of clinical care (through improved availability and access to patient-specific health information and use of decision support models), cost-effectiveness and value of research, the safety of patient care, public health monitoring, bioterrorism response, reimbursement, and healthcare policy decisions. Interoperability requires the use of uniform health information standards. The lack of standards for health information has been a key barrier to electronic connectivity in healthcare.

Incorporation of clinical terminologies into EHR systems is an important step in the creation of information systems capable of monitoring quality and driving the practice of evidence-based medicine. A standard clinical terminology provides standardization of clinical terms, thus supporting easy transmission of patient data across information systems.[1] The use of clinical practice guidelines and other decision support tools to enhance the quality of healthcare depends on the use of common terms and concepts in health records and knowledge resources. Adoption and use of standards for clinical terminologies will facilitate significant improvements in the quality of patient care, promote patient safety, control rising healthcare costs, enhance the productivity of clinical research, and strengthen the ability of the US to identify and respond to health emergencies.[2] A standard clinical terminology interacting within an EHR system enables:

- Access to complete and legible clinical data with links to medical knowledge for real-time clinical decision support
- Information exchange between providers thereby speeding care delivery and reducing duplicate testing and prescribing
- Information retrieval to produce practitioner alerts (e.g., allergy alerts, reminders for preventive medicine screening tests, notifications of potential drug interactions or abnormal test results)
- Access to standards of care for benchmarking, measuring and interpreting effectiveness, improving quality of care, measuring outcomes, developing and monitoring pay-for-performance programs, and measuring performance.[3]

Classification systems allow granular clinical concepts captured by a terminology to be aggregated into manageable categories for secondary data purposes. These purposes include:

- Measuring the quality, safety (or medical errors), and efficacy of care
- Making clinical decisions based on output from multiple systems
- Enabling the connectivity of information systems for continuity of care
- Designing payment systems and processing claims for reimbursement
- Conducting research, epidemiological studies, and clinical trials
- Setting health policy
- Designing healthcare delivery systems
- Monitoring resource utilization
- Improving clinical, financial, and administrative performance
- Identifying fraudulent or abusive practices
- Managing care and disease processes
- Tracking public health and risks
- Providing data to consumers regarding costs and outcomes of treatment options.

Together, standard clinical terminologies and classifications represent a common medical language that allows clinical data to be shared between EHR systems. Therefore, standard clinical terminologies and classifications, with maps linking them, must

be incorporated into EHR systems in order to achieve system interoperability and the benefits of a national health information infrastructure.

This white paper:

- Explains why both a standard clinical reference terminology, such as SNOMED-CT, and classification systems, such as ICD-10-CM and ICD-10-PCS, must be incorporated into EHR systems in order to fully achieve system interoperability and the benefits of a national health information infrastructure
- Describes the important role of maps between terminologies and classifications in effectively using clinical information for multiple purposes and the need for robust, rules-based maps between SNOMED-CT and ICD-10-CM and ICD-10-PCS
- Informs the healthcare industry of the necessity of adopting ICD-10-CM and ICD-10-PCS as replacements for ICD-9-CM in order to maximize the value of clinical data, realize the full benefits of adoption of a common reference terminology such as SNOMED-CT, and reap the rewards of the national investment in information technology.

Medical Code Sets in the Spotlight

This white paper focuses on four medical code sets currently used to encode clinical data: SNOMED-CT, ICD-9-CM, ICD-10-CM, and ICD-10-PCS. The Systemized Nomenclature of Medicine, Clinical Terms (SNOMED-CT), was developed by the College of American Pathologists. In 2003, the National Library of Medicine entered into a five-year agreement to license SNOMED-CT for use in the US.

The ICD-9-CM diagnostic and procedural coding systems are medical code sets adopted as standards for healthcare electronic transactions under the Health Insurance Portability and Accountability Act (HIPAA). In the US, the ICD-9-CM diagnostic coding system is required for reporting diseases, injuries, impairments, other health problems and their manifestations, and causes of injury, disease, impairment, or other health problems. The ICD-9-CM procedural coding system is required for hospital reporting of procedures performed on hospital inpatients. ICD-9-CM has been used in the US since 1979.

The International Classification of Diseases and Related Health Problems, 10th revision (ICD-10), was developed by the World Health Organization. ICD-10-CM is a US clinical modification of ICD-10 developed by the National Center for Health Statistics to replace the ICD-9-CM diagnostic coding system. ICD-10-PCS is a procedural coding system developed by the Centers for Medicare and Medicaid Services to replace the ICD-9-CM procedural coding system. ICD-10 is currently used by more than 100 countries worldwide for morbidity and mortality reporting. The US is the only G8 country that has not implemented ICD-10 (or a clinical modification) for morbidity purposes.

SNOMED-CT

SNOMED-CT is a comprehensive, multilingual, controlled clinical reference terminology, or common reference terminology, with comprehensive coverage of diseases, clinical findings, etiologies, procedures, living organisms, and outcomes used for recording clinical data.

SNOMED-CT provides a common language that enables a consistent way of capturing, sharing, and aggregating health data across specialties and sites of care. It contains concepts linked to clinical knowledge to enable accurate recording of data without ambiguity. It can be used to index, store, and retrieve patient information for clinical purposes.

SNOMED-CT is designed for use in electronic, not paper-based, health record systems. SNOMED-CT codes will be embedded in EHR systems and will work behind the scenes to encode the clinical information recorded in the health record. It would be impractical to attempt to manually assign SNOMED-CT codes. The number of terms and level of detail represented in a reference terminology cannot be effectively managed without automation.

Designed to support the EHR, SNOMED-CT enables:

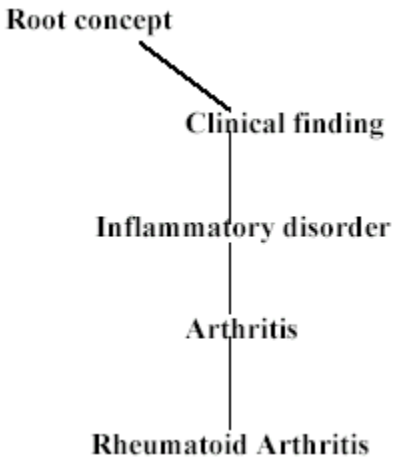
- The development of richer computer-aided clinical decision support systems
- Critical care monitoring (e.g., standardized capture of clinical details such as vital signs, signs/symptoms, medications, interventions, tests, and problem lists)

- The development of clinical alert and reminder systems
- Integration of medical device data output with EHR systems
- Improved communication among clinicians
- Use in clinical trials
- Use in computerized physician order entry (CPOE) systems (e.g., standardized capture of type of diagnostic test being ordered)
- Improvements in quality of data available for research and measurement of clinical outcomes
- Improvements in completeness, accuracy, and consistency of health record documentation
- Advancements in disease management programs
- The practice of evidence-based medicine.

Use of SNOMED-CT standardizes detailed clinical information to enable more accurate documentation of patient care and will enhance the reporting and analysis of medical outcomes. Automated methods of data abstraction during the documentation process could potentially detect deficiencies in patient care and provide automatic rapid feedback to clinicians and thus provide real-time opportunities for improvement at the point of care.

The SNOMED-CT structure ensures interoperability across software applications of diseases, treatments, etiologies, clinical findings, therapies, procedures, and outcomes. The breadth and depth of the terminology, as well as the computer-readable hierarchies, enable faster, reliable, and consistent retrieval of robust clinical information based on flexible queries. SNOMED-CT's depth allows healthcare organizations to "unlock the true power of health information."[4]

The basic elements of SNOMED-CT are comprised of concepts, descriptions, attributes, relationships, and hierarchies or organizations of concepts. Concepts are the basic units of SNOMED-CT and are unique units of thought to which a concept identifier has been assigned. Descriptions are terms or names that are assigned to specific SNOMED-CT concepts. Attributes are properties or characteristics of concepts, and relationships are the connections between concepts. Hierarchies are comprised of parent-child relationships, meaning that there are broad concepts at the top of the hierarchy ("parent") followed by "child" concepts that are more specialized or specific. An example of a parent-child relationship would be "arthritis" and "arthropathy," in which "arthopathy" is the parent and "arthritis" is the child because arthritis is a type of arthropathy:



A concept-based terminology such as SNOMED-CT will standardize medical terms, enabling accurate communication among diverse systems. This would allow healthcare personnel and organizations to collect and analyze data more effectively, compare the quality of care, develop effective treatment protocols, and conduct outcomes research.[5]

ICD-9-CM, ICD-10-CM, and ICD-10-PCS

Throughout this paper, ICD-9-CM, ICD-10-CM, and ICD-10-PCS are referred to as "classifications." They are also sometimes called "administrative terminologies" because they are commonly used for external reporting and other administrative purposes, such as statistical and epidemiological analyses, reimbursement for healthcare services, and public health reporting.

ICD-9-CM encompasses both a diagnostic and procedural coding system. The ICD-9-CM diagnostic coding system is a US clinical modification of the World Health Organization's ICD-9 and is maintained by the National Center for Health Statistics. Diagnosis codes are comprised of three, four, or five digits. Codes are either numeric or alphanumeric. The World Health Organization no longer supports ICD-9. The procedural component of ICD-9-CM was developed and is maintained by the Centers for Medicare and Medicaid Services. ICD-9-CM procedure codes are comprised of either three or four digits and are numeric.

ICD-10-CM is a US clinical modification of the World Health Organization's international classification system, ICD-10, and is maintained by the National Center for Health Statistics. It is a morbidity classification system that classifies diagnoses and other reasons for healthcare encounters. The code structure is alphanumeric, with codes comprised of three to seven characters. ICD-10-PCS is a procedural coding system developed under contract by the Centers for Medicare & Medicaid Services for reporting hospital inpatient procedures. It has a seven-character alphanumeric code structure.

ICD-9-CM is 30 years old, obsolete, and no longer fits with a 21st century healthcare system. Terminology and classification of numerous conditions and procedures are outdated and inconsistent with current medical knowledge and application. The system is unable to adequately accommodate new advances in medicine and medical technology.

In 2003, the National Committee on Vital and Health Statistics (NCVHS) recommended the Department of Health and Human Services initiate the regulatory process for the adoption of ICD-10-CM and ICD-10-PCS as replacements for ICD-9-CM. As of May 2005, the regulatory process has not yet begun (ICD-10 has been used for mortality reporting in the US since 1999).

By delaying the adoption of more contemporary code set standards to replace the outdated ICD-9-CM diagnosis and procedure codes, the US continues to incur unnecessary healthcare costs and other related expenses while forfeiting the advantages available through more advanced and relevant coding systems. The full benefits of a common reference terminology such as SNOMED-CT won't be realized if that system is mapped to an obsolete classification system such as ICD-9-CM.

Terminologies and Classifications: Distinct Purposes

Multiple clinical terminologies as well as classification systems are necessary to capture and effectively use the breadth and depth of clinical data in an EHR. Both terminologies and classifications are necessary to satisfy varying intended purposes or "use cases," applications, and user groups. The desired characteristics of a terminology or classification vary with the intended purpose(s) of each system.

Standardized terminologies, such as SNOMED-CT, facilitate electronic data collection at the point of care (i.e., an input system); retrieval of relevant data, clinical concepts, information, and knowledge; and data reuse for multiple purposes, including automated surveillance, clinical decision support, and quality and cost monitoring.[6] A concept-based terminology such as SNOMED-CT helps to provide the structure essential to the development of EHR systems. Since SNOMED-CT is intended as an input system, it does not work well as an interface terminology (a type of terminology used for presentation to end users) or for the administrative purposes for which a classification system is designed because of its immense size, considerable granularity, complex hierarchies, and lack of reporting rules.[7] A clinical terminology intended to support clinical care processes should not be manipulated to meet reimbursement and other external reporting requirements, as such manipulation would have an adverse effect on patient care, the development and use of decision support tools, and the practice of evidence-based medicine.

Classification systems such as ICD (ICD-9-CM, ICD-10-CM, ICD-10-PCS) represent abstractions and combinations of clinical concepts that are designed to support non-clinical documentation needs, such as reimbursement or regulatory reporting. They do not work well as an interface or reference terminology because they lack granularity, fail to define individual concepts and their relationships, and have complex rules for code selection. These include rules and conventions that require context available elsewhere in a patient record (e.g., gender, age, etiology, time interval, congenital versus acquired) and additional data specific to the episode of care that suggests the coding sequence (such as reason for seeking care, principal diagnosis, relationships between diagnoses).

The clinical content coverage of classifications is not as comprehensive as that of terminologies because classifications are not intended to represent the complete clinical content of a health record. The ICD system was not intended or designed for the

primary documentation of clinical care. It is an output, not an input coding system. Classification systems are intended for secondary data uses, including measurement of quality of care, reimbursement, statistical and public health reporting, operational and strategic planning, and other administrative functions. For example, in ICD-9-CM and ICD-10-CM, a hospital stay for a newborn is represented by codes identifying the type of birth (i.e., liveborn infant, single or multiple birth, born in hospital or outside of hospital, and vaginal versus cesarean delivery) and any medical conditions or risk factors the infant may have. In contrast, SNOMED-CT codes would describe the complete clinical detail for the healthcare encounter. The APGAR score alone would be represented by separate SNOMED-CT codes for the cardiac score, respiratory score, muscle tone, reflex response, and color.[8] There are more than 40 unique concepts for "chest pain" in SNOMED-CT, including nuances of chest pain characteristics such as "crushing," "radiating," "dull," and "chest pain on exertion." In contrast, the June 2003 draft of ICD-10-CM classifies all types of chest pain into five codes according to whether the chest pain occurs upon breathing, is precordial, pleurodynia, another type of chest pain, or an unspecified type.

ICD-9-CM codes reported on reimbursement claims represent medical conditions and other reasons for healthcare encounters and procedures performed during the encounter. If SNOMED-CT codes representing the same healthcare encounter were to be reported on reimbursement claims, the result would be the submission of the entire health record, with all of the clinical detail, for that encounter.[9]

Attachment A illustrates the difference in level of specificity between SNOMED-CT and ICD-10-CM for one type of medical condition (diabetes mellitus).

Sometimes classifications and terminologies are used for purposes for which they are not designed or well suited. For example, a classification system is inadequate for use in a clinical decision support system because it does not provide the desired level of clinical specificity, but it has sometimes been used for this purpose due to its widespread availability. While classifications are inadequate to support patient care processes, they are ideal for supporting many administrative purposes.

Together, terminologies, such as SNOMED-CT, and classification systems, such as ICD-10-CM and ICD-10-PCS, provide the common medical language necessary for interoperability and the effective sharing of clinical data. To maximize the value of health information, classifications and terminologies should be used appropriately according to their purpose(s) and design. Instead of selecting a single classification or terminology to serve all clinical data functions, multiple classifications and terminologies should be used for those functions for which they are ideally suited, and they should be coordinated. For example, if a highly granular terminology, such as SNOMED-CT, is used to standardize data capture in an EHR, it should be mapped to a broader classification system, such as ICD-9-CM or its successor, ICD-10-CM, for statistical, reimbursement, and other purposes.[10]

Organizations need to evaluate the appropriateness of a clinical terminology or classification for a specific function or need.[11] Given the myriad uses of clinical data, neither a controlled clinical reference terminology nor a classification system can fully meet all healthcare data needs. However, coordination of these terminologies maximizes the benefits of each of them.

See Attachment B for examples of the distinctions in purposes and users of reference terminologies and classification systems.

For an example of how a reference terminology and a classification are used together in an EHR system, see the article titled "SNOMED-CT Helps Drive EHR Success" (Attachment C).

Mapping: Creating Connections

Multiple terminologies that have different purposes and that represent concepts in different ways can work together in harmony in an EHR via mappings and algorithms.[12]

When terminologies are integrated, one terminology is actually embedded in another terminology. Mapping provides a linkage between multiple terminologies or between terminologies and classifications by identifying the related term(s) or concept(s) in each system. Mapping, sometimes referred to as a crosswalk, is also used to link two versions of the same terminology or classification (such as a map between ICD-9-CM and ICD-10-CM).

Coding and mapping are very different activities. Coding involves the use of clinician documentation and other clinical data contained in an individual patient health record as the source for determining the appropriate code assignment within a terminology or classification. Coding conventions and guidelines are applied in determining code assignment. Also, appropriate

code selection sometimes depends upon the context of a specific patient record. When additional information must be attached to a concept in order to fully and accurately represent information in a health record, and this information fundamentally changes the meaning of the concept, it is called "context."

Mapping is the process of linking content from one terminology to another or to a classification. Maps result in an expression of the relationships between the terminologies or classification systems involved. Mapping requires deciding how concepts in different terminologies match, are similar, or differ. It provides a link between terminologies and classifications in order to:

- Use data collected for one purpose for another purpose
- Retain the value of data when migrating to newer database formats and schemas
- Avoid entering data multiple times and the associated risk of increased cost and errors.[13]

A diagram depicting the relationship between classifications and terminologies through the mapping process can be found in Attachment D.

Unlike coding, mapping is not specific to a particular patient encounter. Context is not available as part of the mapping process.[14] Creation of a map generally involves an automated translation software engine. Automated maps create efficiency by minimizing duplicative data entry and patient data integration across a wide variety of applications.[15]

Maps standardize linkages to a certain extent and therefore improve coding accuracy simply and efficiently through automated algorithms. Mapping considers different purposes, levels of detail, and coding guidelines of source (terminology being mapped from) and target (terminology being mapped to).

The mapping process employs a standard method in which the terminology context or classification description principles are interpreted between systems. It begins with the development of heuristics (rules of thumb used for solving problems) and guidelines that support the use case or purpose of the map, respecting the conventions of the source and target to preserve the granularity and flexibility of both.[16] Defined mapping rules must be developed and consistently applied to minimize incompatibilities without compromising clinical integrity.

Because terminologies have different structures and intended uses, crossmapping does not necessarily involve one-to-one relationships. There can also be many-to-one and one-to-many relationships, as well as concepts that are not mappable because the concept only exists in the source or target terminology.

Know the Map's Purpose

Each map from source to target should have a purpose. Every map must have an articulated use case that defines its audience, purpose, and methods. Maps may need to be refined for particular use cases and users, and multiple maps between two terminologies may need to be developed, depending on the intended use(s) of the map.

For example, a map that is intended to simply identify the corresponding closest concept in another terminology does not require the application of coding rules, conventions, or guidelines. But in order for ICD-9-CM codes resulting from a map to be appropriate for use in meeting reimbursement requirements, algorithms that consider ICD-9-CM coding rules and conventions and reporting requirements (such as adhering to coding guidelines and identifying the principal diagnosis) need to be developed and applied to the mapping process.

Mapping: How SNOMED and ICD Work Together

Through mapping and integration, SNOMED-CT is linked with other terminologies or classifications so that:

- Healthcare data collected for one purpose can be used for another purpose
- Data can be more easily migrated to newer database formats and schemas
- Data can be entered once and reused, avoiding multiple data entry and reducing the risk of higher cost and errors.[17]

Clinical data captured at the point of care can be efficiently and effectively used for administrative purposes such as vital and health statistics trending, health policy decision-making, and reimbursement. Driven by a philosophy of "code once, use many times," after clinical care is recorded in an EHR using SNOMED-CT, mapping tables can be used to identify the related

code(s) in ICD. This process allows data encoded in SNOMED-CT to be aggregated into smaller groupings for data reporting and analysis. Mapping from the reference terminology to classification systems avoids duplicate data capture, while facilitating enhanced health reporting, billing, and statistical analysis.[18]

While maps are always subject to human review, the goal is to automate as much of the mapping process as possible using a rules-based approach.[19] Standardized encoded data can be extracted from EHRs to classify the information (i.e., through mapping). This approach may facilitate the implementation of future classification systems, since it has the potential to decrease training and implementation support requirements and to improve data quality.[16][20]

A map from SNOMED-CT to ICD-9-CM already exists, and, according to SNOMED International, the purpose of this crossmapping is to support the process of deriving an ICD-9-CM code from patient data.[21] The SNOMED-CT to ICD-9-CM map consists of correlates between SNOMED-CT concepts in the disease and general patient-finding hierarchies and the closest ICD-9-CM target code or codes. The map provides users with an approximation of the closest ICD-9-CM code(s). However, the mapping table is not intended for direct billing or reimbursement activities without additional authoritative review.[22] Since SNOMED-CT's scope of content is much broader than ICD-9-CM, less than 30 percent of the content of SNOMED-CT can be mapped to ICD-9-CM.[23]

It is anticipated that ICD-10-CM and ICD-10-PCS will soon be adopted as replacements for ICD-9-CM in order to modernize the US system for classifying diseases and inpatient procedures. Advances in medical knowledge can result in changes in the meaning and usage of medical terms, as well as the development of new medical terms. Therefore, when an up-to-date coding system is mapped to an outdated system, the map is less reliable and meaningful information is lost. For example, "monkeypox" is a unique concept in both SNOMED-CT and ICD-10-CM, but it is classified to the ICD-9-CM code for "other specified viral exanthemata." Alzheimer's disease is differentiated by early and late onset in ICD-10-CM and SNOMED-CT, but not in ICD-9-CM. Epilepsy terms in SNOMED-CT and ICD-10-CM reflect current medical terminology, whereas the terminology in ICD-9-CM does not. For example, the term "localization-related symptomatic epilepsy" does not appear in ICD-9-CM. In each of these instances, important information is lost in the translation from SNOMED-CT to ICD-9-CM. This would not be the case if SNOMED-CT was mapped to ICD-10-CM.

The use of a map from SNOMED-CT to ICD-10-CM and ICD-10-PCS will allow clinical information captured at a very granular level to be aggregated for reporting and statistical analysis purposes. Mapping a reference terminology to modern classification systems:

- Decreases administrative costs
- Decreases time in revenue cycle
- Increases specificity and accuracy of data
- Maintains comparable data.

Mapping between SNOMED-CT and ICD is an imperfect science. It is very difficult to adequately represent some of the ICD coding conventions for a computer's purposes. The codes produced by the crossmap will need to be evaluated in the context of the complete medical record and applicable reporting rules and reimbursement requirements before being submitted to payers and other external entities.

See Attachment E for examples of government recognition of the need for maps from terminologies to classifications.

How Maps Will Change Work Processes

The development of maps between terminologies and classifications will not eliminate administrative coding or the need for expertise in code selection. Fully automating the process of mapping from a reference terminology to a classification system is challenging because of the inherent differences between a terminology and a classification.[24]

Maps will standardize translation of coding systems to a certain extent and therefore improve coding accuracy simply and efficiently. But human review is still necessary before reporting a code resulting from a map to ensure accuracy with regard to the context of a specific patient encounter and compliance with applicable coding guidelines and reimbursement policies.

As rules-based maps are developed for multiple use cases and become increasingly sophisticated, the level of human review at the individual code level will diminish and workplace roles will focus on the development and maintenance (including quality

control) of maps for a variety of use cases and the development of algorithmic translation and concept representation.

Availability of computer-aided coding applications would relieve the shortage of expert coders and enable them to perform other critical data management roles in the electronic health information management (HIM) environment. Investment in research and development of future machine-readable coding systems would be facilitated with a move to the latest version of the ICD systems more in step with the rest of the world and the technology available.

Role of the National Library of Medicine

To ensure the availability of standard, valid, "fit for purpose" maps, it is important to designate a central coordinating body for map development and distribution. Since the National Library of Medicine's Unified Medical Language System (UMLS) is already recognized as a major mechanism for the distribution of clinical terminologies and classifications, the National Library of Medicine has been designated as the central body responsible for coordinating and developing and disseminating mappings between terminologies and between terminologies and classifications. The maps will be distributed via the UMLS Metathesaurus.

The UMLS Metathesaurus is one of three knowledge sources developed and distributed by the National Library of Medicine as part of its UMLS project. The Metathesaurus provides a uniform, integrated distribution format for more than 100 biomedical and health-related vocabularies, classifications, and coding systems. The Metathesaurus includes vocabularies and coding systems designated as standards for the electronic exchange of administrative and clinical data in the US.

Next Steps for the 21st Century

To make the most of the power of summary required for healthcare reporting and indexing offered by classification systems, valid maps are urgently needed to link from a highly specific terminology to a contemporary classification system. Continued use of the outdated ICD-9-CM system diminishes the value of the US investment in SNOMED-CT. It makes no sense to map a robust terminology such as SNOMED-CT to an outdated classification system such as ICD-9-CM. The anticipated benefits of an EHR cannot be achieved if the reference terminology employed in the EHR, such as SNOMED-CT, is aggregated into a 30-year-old classification system such as ICD-9-CM for administrative use and indexing.

ICD-10-CM and ICD-10-PCS must be adopted immediately as replacements for ICD-9-CM in order to fully maximize the value of clinical data. The longer ICD-10 implementation is delayed, the longer and more expensive it will be to achieve a fully functioning EHR with the interoperability necessary for the sharing of healthcare data. The ICD-9-CM diagnostic and procedural coding systems are outdated and obsolete. Continued use of ICD-9-CM as a medical code set standard threatens to jeopardize the ability of the US healthcare industry to effectively collect and use accurate, detailed healthcare data and information for the betterment of domestic and global healthcare. (See the American Health Information Management Association's position statement advocating prompt adoption of ICD-10-CM and ICD-10-PCS, which is available online at http://www.ahima.org/dc/positions [web page no longer available].)

The benefits of using a reference terminology such as SNOMED-CT increase exponentially if the reference terminology is linked to modern, standard classification systems for the purpose of generating health information necessary for statistical analysis, reimbursement, and other secondary uses. Robust, rules-based maps, designed for different use cases, must be developed from SNOMED-CT to ICD-10-CM and ICD-10-PCS in order to maximize the benefits of an EHR system and national health information infrastructure.

The construct, greater specificity, and representation of modern clinical medicine provided by ICD-10-CM and ICD-10-PCS will greatly facilitate the automated generation of ICD codes ultimately anticipated in an EHR environment. ICD-10-CM and ICD-10-PCS are better suited for use in EHR systems than ICD-9-CM because:

- They permit more robust mapping from SNOMED-CT
- Their data are more easily retrievable in an electronic format than ICD-9-CM data
- They are more amenable to computer-assisted coding.

Mapping from SNOMED-CT to ICD-10-CM and ICD-10-PCS will facilitate the administrative reporting process by enabling computer-assisted ICD coding. These maps will improve the value of clinical data by facilitating retrieval at the desired level of

detail, depending on the purpose for which the data are to be used. A map from SNOMED-CT to ICD-10-CM and ICD-10-PCS will facilitate the ICD coding process, diminishing the need and expense of manual coding. This will result in improved coding efficiency, productivity, and accuracy, but will not entirely replace the need for coding professionals.[25]

In computer-assisted coding, computer software automatically generates a set of medical codes for review, validation, and use based upon clinical documentation provided by healthcare practitioners. The detailed and logical structure of ICD-10-CM and ICD-10-PCS will increase the use of computer-assisted coding tools. A granular clinical terminology used for data capture in an EHR, such as SNOMED-CT, greatly simplifies the task of generating automated codes in a classification system.[26]

Wanted: An Information Model

Coordination of terminologies is only part of the process necessary for achieving electronic exchange of clinical information for multiple purposes. The National Committee on Vital and Health Statistics (NCVHS) has noted that certain interoperability and data comparability objectives for patient medical record information (PMRI) may not be achievable through terminology standardization alone. A standard representation of the full meaning of patient medical data requires integrating terminology models with models of context and other structural relationships, as well as negation and time. Together, the terminology model and the additional elements necessary to fully represent the meaning of clinical information constitute a complete information model.[27]

If context, structure, and time are not included in the standardized representation, then uniform data standards for PMRI and its electronic exchange will remain incomplete. For example, the coded representation of “myocardial infarction” has different clinical significance when it appears in the context of “current diagnosis,” “past medical history,” or “family history.” In the absence of context information, the full meaning of “myocardial infarction” may remain ambiguous, leading to incorrect reporting or decision-support behavior.[28]

Other examples of contextual factors that influence the interpretation of medical data include negation (e.g., “no complaints of chest pain”), time frames (e.g., acute onset versus presence of symptom for several months), severity (e.g., mild versus severe), and multiple meanings for the same term (e.g., “patient is cold” versus “patient has a cold”). Qualifying terms, such as “possible” versus “confirmed,” and demographic data elements, such as patient sex and age, also affect the meaning of patient medical information.

Mapping from a reference terminology to a classification often requires the consideration of multiple coded concepts in multiple contexts of the patient medical record. For example, mapping from a reference terminology to ICD-9-CM code 511.0, Pleurisy without mention of effusion or current tuberculosis, cannot be achieved without knowledge of where the coded concepts for findings and diagnoses are represented in a structured medical record. If PMRI standards do not include a comprehensive information model and terminology model, mapping between these terminologies will require knowledge of the specific medical record structures at each institution. Until integration of terminology standards and information model standards has occurred, coordination of terminology standards with widely used message standards (such as Health Level 7) is necessary to minimize ambiguities and redundant data representations.[29]

Conclusion

The need for standardized terminologies in healthcare has long been recognized. As long ago as the 1960s, it was believed that a clinical vocabulary (or terminology) was the rock upon which medical communication and information are built.[30] It has also been recognized that a reference terminology and a classification each have a specific purpose (and different target users) and, therefore, they complement, rather than compete with, each other.[31]

Aggregation of clinical data will continue to be necessary after EHRs incorporating a reference terminology have been implemented, because it makes the data more manageable for secondary information purposes. The benefits of using a reference terminology such as SNOMED-CT increase exponentially if the reference terminology is linked to classifications and other administrative terminologies for the purpose of generating health information necessary for statistical analysis, reimbursement, and other secondary uses.

Recently, the US government has taken the lead in identifying certain terminology standards and procuring the necessary licenses. It is now time for the federal government and healthcare industry to recognize that the full benefits of an EHR will

not be totally realized unless ICD-10-CM and ICD-10-PCS are also adopted as health information standards. Modernization of code sets is an essential building block in the national health information infrastructure.

ICD-10-CM and ICD-10-PCS are better suited for use in EHR systems than ICD-9-CM, as they represent modern medical practice and clinical knowledge, permit more robust mapping from SNOMED-CT, and are more amenable to use in an electronic environment. AHIMA believes the following steps are essential:

- The federal government must initiate the regulatory process for the adoption of ICD-10-CM and ICD-10-PCS.
- The healthcare industry must incorporate terminology standards in its EHR development initiatives.
- Robust rules-based maps, designed for different use cases, must be developed from SNOMED-CT to ICD-10-CM and ICD-10-PCS to maximize the value of the clinical data and the benefits of an EHR system.
- These maps should be made publicly available through the UMLS and should become a standard component of any EHR system.

These steps are among the first the industry should take toward maximizing the power of healthcare data and, in doing so, building a better healthcare system for the 21st century.

Glossary

Administrative terminologies are primarily designed for statistical and epidemiological reporting, reimbursement for healthcare services, analysis of managerial processes, and other secondary data aggregation and analysis purposes. They are not intended or designed for the primary documentation of clinical care. They represent abstractions and combinations of clinical concepts that were defined to support health information needs outside of direct patient care, such as reimbursement, statistical analysis, and regulatory reporting. Administrative terminologies are "output" systems, as opposed to "input" systems. Classifications represent a type of administrative terminology.

Classification: A system that groups together similar diseases and procedures and organizes related entities for easy retrieval. This type of system groups clinical conditions and procedures into manageable, predetermined categories for external reporting purposes, including reimbursement for healthcare services and statistical data analysis, such as epidemiological analysis or trending of disease incidence. A classification system contains standardized codes with defined statistical meaning. Since the main purpose of a classification is statistical analysis and reporting, this type of system is intentionally limited to a relatively small number of mutually exclusive categories. To support statistical reporting needs, classifications use a complex system of conventions, instructional notes, and reporting rules to support statistical reporting needs. Essentially, terminologies and nomenclatures are more granular than a classification, since a classification categorizes and aggregates clinical concepts rather than supporting detailed descriptions of distinct clinical concepts. A classification provides the ability to aggregate the terms in a reference terminology for administrative purposes. Since a classification aggregates or classifies clinical terms, it is also considered a type of clinical terminology and may be referred to as an "administrative," "aggregate," or "reporting" terminology.

Controlled clinical reference terminologies codify clinical information that is captured in an EHR during the course of patient care, allowing the creation of detailed, electronic clinical health records through direct entry at the point of care. "Controlled" means that the content of the terminology is managed with careful quality assurance procedures in place to ensure that the terminology is structurally sound, biomedically accurate, and consistent with current practice. A controlled terminology supports collection of structured data within the provider's own environment and promotes standardization of terminology for external uses. Internally, the terminology aids data capture, enhances database management, and helps build a data warehouse for use in executive and clinical decision support.[32] SNOMED-CT is an example of a controlled clinical reference terminology.

Electronic health record (EHR) system includes longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or healthcare provided to an individual; immediate electronic access to person- and population-level information by authorized, and only authorized, users; provision of knowledge and decision support that enhance the quality, safety, and efficiency of patient care; and support of efficient processes for healthcare delivery.[33]

Interface or application terminologies are used in EHR systems for presentation to end users, such as terms in "pick lists," in order to facilitate electronic data collection at the point of care. Interface terminologies might also be known as "terms tables." The creation of preselected subsets or pick lists comprised of select terms from the reference terminology facilitates clinicians' selection of the appropriate concept.[34] MEDCIN is an example of an interface terminology.

Nomenclature: A recognized system of names.

Reference terminology: An explicit, formal specification or ontology of concepts and the relationships linking them. Ontologies enable each medical idea or concept to be represented and defined according to medical truth.[35] A reference terminology contains the core set of specialized standardized terms that facilitates precise communication by eliminating ambiguity. It might be referred to as a concept and relationships table. It allows the clinical concepts to be defined in a formal and computer-processable way. Relationships between concepts and between terms and concepts are indicated by their place in a polyhierarchy, with interconnections between hierarchies. Codes are meaningless, and terminologies can have many dimensions by virtue of parent-child relationships that constitute their structure. Terminologies aim to represent clinical knowledge through these relationships.[36] A reference terminology provides a common reference point for comparison and aggregation of data about the entire healthcare process. The goal is to be as granular as possible within its scope in order to unambiguously represent all of the clinical aspects in a health record. By creating compatible definitions, a reference terminology supports reproducible transmission of patient data between information systems. It supports consistent and understandable coding of clinical concepts and so is a central feature for the function of EHRs.[37]

Terminology: A set of terms representing the system of concepts of a particular subject field (in healthcare, a set of terms that describe health concepts). A clinical terminology is composed of standardized terms and their synonyms, which record patient findings, circumstances, events, and interventions with sufficient detail to support clinical care, decision support, outcomes research, and quality improvement; and can be efficiently mapped to broader classifications for administrative, regulatory, oversight, and fiscal requirements. Terminologies provide a way to input clinical data into a health record. NCVHS defines healthcare terminology as a collective term used to describe the continuum of code set, classification, and nomenclature (or vocabulary).[38] Although they technically have slightly different definitions, "terminology" and "vocabulary" are often used interchangeably.

Vocabulary: A set of words used by an individual or group within a particular subject field.

Attachment A

Comparison of SNOMED-CT and ICD-10-CM . Diabetes Mellitus Example *
* This comparison table is provided for illustrative purposes only. It does not represent an official map between SNOMED-CT and ICD-10-CM.
** Not every unique SNOMED-CT concept for diabetes mellitus has been included in this table.
*** .N/A. means that the concept does not exist in ICD-10-CM.

SNOMED-CT Concept ID **	SNOMED-CT Concept Description	ICD-10-CM Code	ICD-10-CM Code Description
11530004	Brittle diabetes	E10.9	Type 1 diabetes mellitus without complication
190371008	Type I diabetes mellitus - poor control	E10.9	Type 1 diabetes mellitus without complication
190392008	Type II diabetes mellitus - poor control	E11.9	Type 2 diabetes mellitus without complication
371055001	Type I diabetes mellitus with ketoacidosis	E10.10	Type 1 diabetes mellitus with ketoacidosis without coma
190334006	Diabetes mellitus, juvenile type, with ketoacidotic coma	E10.11	Type 1 diabetes mellitus with ketoacidosis with coma
395204000	Hyperosmolar non- ketotic state in type 2 diabetes mellitus	E11.00	Type 2 diabetes mellitus with hyperosmolarity without nonketotic hyperglycemic- hyperosmolar coma (NKHHC)

237621004	Diabetic severe hyperglycemia	E14.65	Unspecified diabetes mellitus with hyperglycemia
70694009	Diabetes mellitus AND insipidus with optic atrophy AND deafness	E14.39 E14.69 E23.2 H47.299 H91.90	Unspecified diabetes mellitus with other diabetic ophthalmic complication; Unspecified diabetes mellitus with other specified complication; Diabetes insipidus; Other optic atrophy, unspecified eye; Unspecified hearing loss, unspecified ear
237619009	Diabetes-deafness syndrome maternally transmitted	E13.9	Other specified diabetes mellitus without complications
237613005	Hyperproinsulinemia	E13.9	Other specified diabetes mellitus without complications
83728000	Polyglandular autoimmune syndrome, type 2	E13.9	Other specified diabetes mellitus without complications
91352004	Diabetes mellitus due to structurally abnormal insulin	E13.9	Other specified diabetes mellitus without complications
123763000	Houssay's syndrome	E13.9	Other specified diabetes mellitus without complications
82260000	Pregestational diabetes mellitus AND/OR impaired glucose tolerance, modified White class R	E14.9 R73.02	Unspecified diabetes mellitus without complications; Impaired glucose tolerance (oral)
59079001	Diabetes mellitus associated with hormonal etiology	E09.9	Drug or chemical induced diabetes mellitus without complication
237600004	Malnutrition-related diabetes mellitus - fibrocalculous	E46 E08.9	Unspecified protein-calorie malnutrition; Diabetes mellitus due to underlying condition without complication
42954008	Diabetes mellitus associated with receptor abnormality	E13.9	Other specified diabetes mellitus without complications
413183008	Diabetes mellitus induced by non-steroid drugs without complication	E09.9	Drug or chemical induced diabetes mellitus without complications
190406000	Malnutrition-related diabetes mellitus with ketoacidosis	E46 E08.10	Unspecified protein-calorie malnutrition; Diabetes mellitus due to underlying condition with ketoacidosis without coma
190409007	Malnutrition-related diabetes mellitus with neurological complications	E46 E08.40	Unspecified protein-calorie malnutrition; Diabetes mellitus due to underlying condition with diabetic neuropathy, unspecified
111554008	Rare form of secondary diabetes mellitus, due to disorder other than malnutrition, protein deficiency, pancreatic disease, hormonal disease, drugs, receptor abnormality, OR genetic syndrome	E08.9	Diabetes mellitus due to underlying condition without complications
237601000	Secondary endocrine diabetes mellitus	E34.9 E08.9	Endocrine disorder, unspecified; Diabetes mellitus due to underlying condition without complications
190416008	Steroid-induced diabetes mellitus without complication	E09.9 T38.0x1 OR T38.0x5	Drug or chemical induced diabetes mellitus without complication; Poisoning by glucocorticoids and synthetic analogues,

			accidental (unintentional) OR Adverse effect of glucocorticoids and synthetic analogues . requires 7th digit to identify initial encounter, subsequent encounter, or sequela
82980005	Anemia of diabetes	E14.69 D63.8	Unspecified diabetes with other specified complication; Anemia in other chronic diseases classified elsewhere
237632004	Hypoglycemic event in diabetes	E14.640	Unspecified diabetes mellitus with hypoglycemia without coma
170766006	Loss of hypoglycemic warning	E14.640	Unspecified diabetes mellitus with hypoglycemia without coma
237635002	Nocturnal hypoglycemia	E14.640	Unspecified diabetes mellitus with hypoglycemia without coma
237636001	Recurrent severe hypoglycemia	E14.640	Unspecified diabetes mellitus with hypoglycemia without coma
398140007	Somogyi phenomenon	E14.640	Unspecified diabetes mellitus with hypoglycemia without coma
401088000	Diabetes mellitus with persistent proteinuria	E14.69 R80.1	Unspecified diabetes mellitus with other specified complication; Persistent proteinuria, unspecified
401087005	Diabetes mellitus with persistent microalbuminuria	E14.69 R80.1	Unspecified diabetes mellitus with other specified complication; Persistent proteinuria, unspecified
48951005	Bullosis diabeticorum	E14.69 M79.8	Unspecified diabetes mellitus with other specified complication; Other specified soft tissue disorders
238984005	Diabetic rubeosis	E14.628	Unspecified diabetes mellitus with other skin complication
238983004	Diabetic thick skin syndrome	E14.628	Unspecified diabetes mellitus with other skin complication
62260007	Pretibial pigmental patches in diabetes	E14.628	Unspecified diabetes mellitus with other skin complication
237650006	Insulin resistance in diabetes	E11.9	Type 2 diabetes mellitus without complications
405749004	Newly diagnosed diabetes	N/A ***	N/A
315216001	Diabetes mellitus excluded	N/A	N/A
34170007	Adult diabetes diet	N/A	N/A
79367009	Child diabetes diet	N/A	N/A
312888008	Attending diabetes clinic	N/A	N/A
170753006	Understands diet - diabetes	N/A	N/A
170774007	Diabetes: practice program	N/A	N/A
185753003	Attends diabetes monitoring	N/A	N/A
170752001	Has seen dietitian - diabetes	Z71.3	Dietary counseling and surveillance
185754009	Refuses diabetes monitoring	N/A	N/A
309593006	Education score - diabetes	N/A	N/A

273413007	Diabetes wellbeing questionnaire	N/A	N/A
160274005	No family history diabetes	N/A	N/A
270445003	Diabetes monitoring check done	N/A	N/A
412777005	Diabetes clinical management plan	N/A	N/A
161641009	At risk of diabetes mellitus	N/A	N/A
408392008	Under care of diabetes specialist nurse	N/A	N/A
309635005	H/O: Admission in last year for diabetes foot problem	N/A	N/A

Attachment B

Distinctions between Terminologies and Classifications *

* This list is provided for illustrative purposes only and is not all-inclusive.

** The purposes for which a reference terminology or classification is used are not necessarily mutually exclusive. Depending on the nature of the specific data requirements and desired level of granularity, either a terminology or a classification might be used for the same purpose.

GOAL/USERS**	REFERENCE TERMINOLOGY	CLASSIFICATION
Capture the detail of diagnostic studies, history and physical examinations, visit notes, ancillary department information, nursing notes, vital signs, outcomes measures, and any other clinically relevant observations about the patient. - Healthcare providers	X	
Send and receive clinical data in an understandable and usable manner thereby speeding care delivery and reducing duplicate testing and prescribing - Healthcare providers - Information systems (IS) personnel	X	
Improve the quality of healthcare through the effective utilization of information found in other information management systems - Healthcare providers - IS personnel	X	
Allow the computer to manipulate standardized data and find information relevant to individual patients for the purpose of producing automatic reminders or alerts - Healthcare providers - IS personnel	X	
Permit retrieval of relevant data, information and knowledge for the purpose of generating patient- specific assessments or recommendations designed to aid clinicians in making clinical decisions - Healthcare providers - IS personnel	X	
Provide an organized system of data collection and retrieval resulting in the linkage of published research with clinical care thereby improving the quality of care through outcomes measurement and the practice of evidence-based medicine - Data analysts	X	

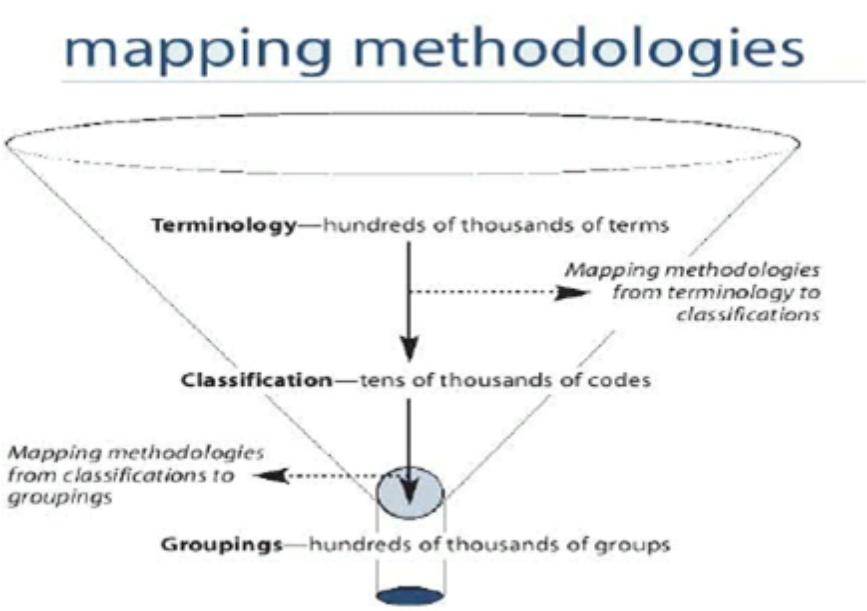
- Quality management personnel - Utilization management personnel		
Provide data to consumers regarding costs and outcomes of treatment options - Consumers		X
Allow collection and reporting of basic health statistics - Researchers - Epidemiologists		X
Provide data used for designing payment systems and processing claims for reimbursement - Accounting personnel - Billing personnel - Payers		X
Identify fraudulent or abusive practices - Compliance personnel - Auditors		X
Provide data used for monitoring public health and risks - Public health professionals		X
Provides aggregate data for monitoring resource utilization and improving clinical, financial, and administrative performance - Management		X

Attachment C

SNOMED CT Helps Drive EHR Success
by Kathy Giannangelo, RHIA, CCS, and Lyle Berkowitz, MD
Journal of AHIMA 76, no.4 [April 2005]: 66-67.

Attachment D

Attachment D



Source: The Canadian Institute for Health Information: CCICD-10 Implementation Tool Kit

Attachment E

Government Support for Maps from Terminologies to Classifications

NCVHS: Call for Maps to HIPAA Code Sets
The need for different terminologies and maps among them is supported by the recommendations of several national groups, including the National Committee on Vital and Health Statistics (NCVHS).

In 2003, NCVHS recommended a set of patient medical record information (PMRI) terminology standards to the secretary of Health and Human Services. It also recommended that the federal government recognize a .core set. of PMRI terminologies as a national standard. These core terminologies would comprise the minimal set of terminologies required to adequately cover the domain of PMRI and meet essential technical criteria as reference terminologies. SNOMED-CT was recommended as one of the initial terminologies in the core set. To form a cohesive, internally consistent terminology resource, NCVHS noted the core set of terminologies should be integrated by creating relationships within the National Library of Medicine.s Unified Medical Language System (UMLS).[39]

NCVHS further recommended that the federal government recognize an additional group of terminologies as important related terminologies and that it promote the creation and maintenance of mappings between these and the core set of PMRI terminologies. The important related terminologies include those that are neither suited nor intended for representing clinically specific data but are standards for administrative, financial, or regulatory functions. Others are prominent legacy terminologies that are intended for representing clinically specific data but were not included in the core set of terminologies.

Although these terminologies did not meet the criteria for inclusion in the core PMRI terminology standards, their use in administrative and clinical processes will continue and should be compatible with the recommended PMRI standard. Compatibility of the core set of PMRI terminologies with these important related terminologies (specifically in the form of mappings) will enhance the value and accelerate the adoption of the PMRI terminology standards, NCVHS says.

The important related terminologies include those designated as HIPAA (the Health Insurance Portability and Accountability Act) medical code sets, including ICD-9-CM. NCVHS recommended that mapping to terminologies designated as medical code sets under HIPAA be considered the first priority.[40] Presumably, any successors to current HIPAA medical code set

standards (for instance, the replacement of ICD-9-CM with ICD-10-CM and ICD-10-PCS) would also be considered important related terminologies to which core terminologies should be mapped.

The expanded availability of SNOMED-CT made possible by the 2003 government licensing agreement increases the urgency of replacing ICD-9-CM with ICD-10-CM/PCS so the development of mapping tools to ICD-10-CM and ICD-10-PCS can be initiated.

IOM: Integrated Health Information Infrastructure
The 2003 Institute of Medicine (IOM) report .Patient Safety: Achieving a New Standard for Care. noted that a common clinical reference terminology is expected to reduce costs, increase efficiency, and improve the quality of data exchange, clinical research, patient safety, sharing of computer guidelines, and public health monitoring.[41]

According to the IOM, several supplemental terminologies are necessary to support the requirements for an integrated information infrastructure that supports multiple methods of collecting, analyzing, disseminating, and incorporating patient safety data with consideration for the differences among healthcare settings. These terminologies include the HIPAA-designated medical code sets.

The supplemental terminologies must support system functionality and knowledge-based activities such as:

- Automated chart reviews and surveillance
- Voluntary reporting
- Natural language processing of narrative text
- Decision-support tools (e.g., alerts and reminders)
- Use of computer-readable evidence-based clinical guidelines.

The report also noted that supplemental terminologies should be mapped through computer- executable aggregation logic to the core terminologies to provide the functionalities associated with the use of data standards and information systems.[42]

PITAC: Standardized Clinical Vocabulary Is Essential
A year later, another group, the President.s Information Technology Advisory Committee, recommended that standard, automated mapping from SNOMED-CT to ICD-10-CM should be freely available. The group noted that standardized clinical vocabulary is essential to computerized decision- support tools using sharable protocols that lower error rates and improve the quality of healthcare. Medical language must be recorded in standard ways so its meaning can be shared with EHR systems in a manner that is interoperable. This requires the availability of a core set of standard clinical terms that can be incorporated into EHR systems at every level to describe clinical concepts including problems, diagnoses, assessments, interventions, test results, procedures, and outcomes. [43]

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