



# Chapter 1

## Introduction

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### 1.1 PURPOSE

This document contains the specifications for version 2.2 of the Health Level Seven (HL7) Standard for electronic data exchange in healthcare environments, with special emphasis on inpatient acute care facilities (i.e., hospitals). It summarizes the work of a committee of healthcare providers (users), vendors and consultants established in March 1987 on the occasion of a conference hosted by the Hospital of the University of Pennsylvania. Its participants, who represent users as well as vendors, share a common goal of simplifying the implementation of interfaces between computer applications from different, and often competing, vendors. This committee, which subsequently became known as the HL7 Working Group, endeavors to standardize the format and protocol for the exchange of certain key sets of data among healthcare computer application systems. Meetings are held approximately every four months in scattered locations throughout the United States. HL7 sanctioned national groups also exist in many other countries outside of the United States including Australia, Germany, Japan, the Netherlands, and New Zealand.

This document is being presented to interested parties. It is a status report that is published to solicit the involvement of the broadest possible group of participants as this protocol is being put into use. Comments are solicited on all aspects of the Standard.

This effort is expected to yield a voluntary, ad hoc standard that is open to **all** who develop healthcare data processing systems. As the Standard has been put into production, experience has been gained and is reflected in this latest revision.

There have been two parallel efforts over the last three years since the last Standard publication (version 2.1). First, version 2.2 represents an evolutionary change over version 2.1 that was published in 1990. Version 2.2 is the result of more than three years work, and thousands of hours of effort by members of all three communities since the publication of version 2.1 in June 1990. Its primary goals include maintaining backwards compatibility with version 2.1, correcting errors discovered after the publication of 2.1, and extending the Standard within the format and context of version 2.1.

Also, within the last three years, HL7 has adopted new formal by-laws and voting procedures. These procedures are modeled on the balloting procedures of other relevant healthcare industry computer messaging standards organizations (e.g., ASTM) and are designed to conform to the requirements of the American National Standards Institute (ANSI). In June 1994, HL7 became an ANSI Accredited Standards Organization. HL7 is participating in ANSI's Health Information Standards Planning Panel (HISPP) as well.

HL7 as an organization, has experienced significant growth over the last three years. Currently, HL7 has almost 1300 members in all membership categories and regularly attracts 250-300 members and non-members to each of its three yearly meetings. As of mid-1993, HL7 had documented over 170 healthcare provider organizations that have implemented computer interfaces based on the HL7 Standard. As of December 1994, HL7 estimates that over 1,000 undocumented implementations exist in both the United States and in other countries. It is possible for a healthcare provider institution to use HL7 without actually being an HL7 member through a member vendor or through outright purchase of the Standard without joining HL7.

## **1.3 BACKGROUND**

The term "Level 7" refers to the highest level of the Open System Interconnection (OSI) model of the International Standards Organization (ISO). This is not to say that HL7 conforms specifically to ISO defined elements of the OSI's seventh level. Also HL7 does not specify a set of ISO approved specifications to occupy layers 1 to 6 under HL7's abstract message specifications. HL7 does, however, conform to the conceptual definition of an application-to-application interface placed in the seventh layer of the OSI model.

In the OSI conceptual model, the functions of both communications software and hardware are separated into seven layers, or levels. The HL7 Standard is primarily focused on the issues that occur within the seventh, or application, level. These are the definitions of the data to be exchanged, the timing of the exchanges, and the communication of certain application specific errors between the applications. However, of necessity, protocols that refer to the lower layers of the OSI model are sometimes mentioned to help implementors understand the context of the Standard. They are also sometimes specified to assist implementors in establishing working HL7-based systems.

The HL7 Working Group is composed of volunteers who give their time on a personal basis or under sponsorship of their employers. Membership in the HL7 Working Group has been, and continues to be, open to anyone wishing to contribute to the development and refinement of Level 7 Interface Standard for network technology in healthcare.

The Standard currently addresses the interfaces among various systems that send or receive patient admissions/registration, discharge or transfer (ADT) data, queries, orders, results, clinical observations, billing, and master file update information. **It does not try to assume a particular architecture with respect to the placement of data within applications but is designed to support a central patient care system as well as more distributed environment where data resides in departmental systems.**

If we consider the multitude of healthcare information systems applications as well as the variety of environments in which healthcare is delivered, it is evident that there are many more interfaces which could benefit from standardization. The interfaces chosen were considered to be of high priority by the members participating in the standards writing process. HL7's intent is to prepare a complete standard for these interfaces, built on a generic framework that is sufficiently robust to support many other interfaces. This Standard has been put into production and is being used as a basis for extending the existing interface definitions and also adding other definitions.

It is expected that one result of publishing this specification will be the recruitment of more Working Group members with special interest in some newer and not yet fully specified areas. Some of the areas that have already been identified are:

- a) decision support
- b) nursing applications

- c) additional specific ancillary departments
- d) computerized medical records
- e) information needs associated with healthcare delivery systems outside of the acute care setting.

The above notwithstanding, the Working Group members feel that the interfaces addressed here are sufficient to provide significant benefit to the healthcare community.

This document is structured as follows. The balance of this chapter contains a rationale for developing the Standard, the goals of the Standard, and issues which have been considered by the Working Group pertaining to scope and operational approach. It is hoped that this will help the readers understand the basis for decisions that have been made in developing the Standard. Subsequent chapters specify, respectively:

- a) the overall structure for all interfaces including a generalized query interface
- b) patient admission, discharge, transfer and registration
- c) order entry
- d) patient accounting (billing) systems
- e) clinical observation data, such as laboratory results, that are sent as identifiable data elements (rather than display oriented text)
- f) A generalized interface for synchronizing common reference files (master files).

## 1.5 NEED FOR A STANDARD

The organization and delivery of healthcare services is an information-intensive effort. It is generally accepted that the efficacy of healthcare operations is greatly affected by the extent of automation of information management functions. Many believe that healthcare delivery agencies that have not automated their information systems are not able to compete effectively in the healthcare market of the 1990's.

In the past two decades, healthcare institutions, and hospitals in particular, have begun to automate aspects of their information management. Initially, such efforts have been geared towards reducing paper processing, improving cash flow, and improving management decision making. In later years a distinct focus on streamlining and improving clinical and ancillary services has evolved, including bedside (in hospitals and other inpatient environments) and "patient-side" systems (in ambulatory settings). Within the last few years, interest has developed in integrating all information related to the delivery of healthcare to a patient over his or her lifetime (i.e., an electronic medical record). It has also been envisioned that all or part of this electronic medical record should be able to be communicated electronically anywhere as needed.

It is not uncommon today for the average hospital to have installed computer systems for admission, discharge, and transfer; clinical laboratories; radiology; billing and accounts receivable, to cite a few. Often these applications have been developed by different vendors or in-house groups, with each product having highly specific information formats. As hospitals have gradually expanded information management operations, a concomitant need to share critical data among the systems has emerged. Comprehensive systems that aim at performing most, if not all,

healthcare information management are in production by selected vendors. These systems may be designed in a centralized or a distributed architecture. Nevertheless, to the extent that such systems are truly complete, their use would mitigate the need for an external data interchange standard such as HL7.

There are, however, many pressures on an institution to develop or acquire individual departmental applications on a modular basis. One source of such pressure is the special departmental needs that may not be addressed well (or perhaps at all) by a comprehensive vendor (i.e., so called "best-of-breed"). Another is the need to evolve the overall systems environment of a hospital through a series of incremental, departmental decisions rather than in a single, revolutionary acquisition. These pressures could be met by an environment containing a comprehensive system supplemented by departmental systems, or one consisting entirely of separate and discrete systems.

Network technology has emerged as a viable and cost-effective approach to the integration of functionally and technically diverse computer applications in healthcare environments. However, these applications have developed due to market structure rather than through a logical systems approach, they are therefore often ad-hoc and idiosyncratic. Extensive site-specific programming and program maintenance are often necessary for interfacing these applications in a network environment. This occurs at considerable expense to the user/purchaser while often keeping vendor staff from other initiatives such as new product development. The need for extensive site-specific interface work could be greatly reduced if a standard for network interfaces for healthcare environments were available and accepted by vendors and users alike.

In summary, it is important that both vendors and users not be faced with the problem of supporting incompatible transaction/communications structures. Instead, a framework must be developed for minimizing incompatibility and maximizing the exchange of information between systems. It is proposed that HL7 can act as a superstructure in this environment to facilitate a common specification and specifications methodology. It is indeed both practical and economical to develop, and commit to, standard interfaces for computer applications in healthcare institutions.

## **1.7 GOALS OF THE STANDARD**

The specifications of this Standard were developed in accordance with **apriori** specified goals. Future extensions of the Standard should also support these goals.

HL7's purpose is to facilitate communication in healthcare settings. The **primary goal** is to provide standards for the exchange of data among healthcare computer applications that eliminates or substantially reduces the custom interface programming and program maintenance that may otherwise be required. This primary goal can be delineated as a set of goals:

- a) the Standard should support exchanges among systems implemented in the widest variety of technical environments. Its implementation should be practical in a wide variety of programming languages and operating systems. It should also support communications in a wide variety of communications environments, ranging from a full, OSI-compliant, 7-level network "stack" to less complete environments including primitive point-to-point RS-232C interconnections and transfer of data by batch media such as floppy disk and tape.
- b) immediate transfer of single transactions should be supported along with file transfers of multiple transactions
- c) the greatest possible degree of standardization should be achieved, consistent with site variations in the usage and format of certain data elements. The Standard should accommodate necessary site-specific

variations. This will include, at least, site specific tables, code definitions and possibly site specific message segments (i.e., HL7 Z segments).

- d) the Standard must support evolutionary growth as new requirements are recognized. This includes support of the process of introducing extensions and new releases into existing operational environments.
- e) the Standard should be built upon the experience of existing production protocols and accepted industry-wide standard protocols. It should not, however, favor the proprietary interests of specific companies to the detriment of other users of the Standard. At the same time, HL7 seeks to preserve the unique attributes that an individual vendor can bring to the marketplace.
- f) while it is both useful and pertinent to focus on information systems within hospitals, the long-term goal should be to define formats and protocols for computer applications in all healthcare environments.
- g) the very nature of the diverse business processes that exist within the healthcare delivery system prevents the development of either a universal process or data model to support a definition of HL7's target environments. In addition, HL7 does not make a priori assumptions about the architecture of healthcare information systems nor does it attempt to resolve architectural differences between healthcare information systems. **For at least these reasons, HL7 cannot be a true "plug and play" interface standard.** These differences at HL7 sites will probably require site negotiated agreements.
- h) a primary interest of the HL7 Working Group has been to employ the Standard as soon as possible. Having achieved this, HL7 has also developed an infrastructure that supports a consensus balloting process and has applied to the American National Standards Institute (ANSI) to be recognized as an Accredited Standards Organization (ASO).
- i) cooperation with other related healthcare standards efforts (e.g., ACR/NEMA DICOM, ASC X12, ASTM, IEEE/MEDIX, NCPDP, etc.) has become a priority activity of HL7. HL7 has participated in the ANSI HISPP (Health Information Systems Planning Panel) process since its inception in 1992.

## 1.9 HISTORY OF HL7 DEVELOPMENT

The HL7 Working Group has met approximately every 3-4 months since March 1987 to develop and review this specification. The group is structured into committees to address each of the functional interfaces under development, with additional committees to address the overall control structure and various administrative aspects of the group. These committees have the responsibility to author and maintain the chapters in the HL7 Interface Standard. In addition, from time to time various special interest groups are formed within HL7 to develop ideas and sponsor particular perspectives that are not covered by any single existing committee. If a special interest group's activities warrant and a new chapter is considered necessary, they may petition the HL7 Technical Committee Chair and the Executive Committee to form a Technical Committee.

In the initial three meetings, a version 1.0 draft Standard was prepared covering the overall structure of the interfaces, ADT, order entry, and display-oriented queries. Although the patient accounting system was recognized as very important, the time frame did not allow it to be addressed in the first draft. This draft was presented to a Plenary meeting of the overall group in Tyson's Corner, VA on October 8, 1987.

Version 2.0 was prepared subsequent to Plenary I in Tyson's Corner and presented at Plenary II in Tucson in September 1988. Since Plenary II, editing and revisions for Version 2.1 and then 2.2 have been ongoing. Since

then the Working Group has grown to nearly 300 individuals, far exceeding its original size of 12 and the following has been accomplished:

- a) specifications for the various functional areas have been refined and expanded
- b) formal liaison was developed with several other standards efforts: the ANSI HISPP (Healthcare Information Standards Planning Panel) for the coordination of healthcare standards efforts, the ASC X12N group for external EDI Standards, the ASTM E31.11 group for Clinical Data Exchange Standards, the ACR/NEMA DICOM group for standards relating to imaging and other aspects of Radiology Information Systems, and the IEEE P1157 group for medical data interchange ("MEDIX").
- c) the generic control structure was modified, on the basis of comments, to be adaptable to a wider variety of communications environments and to facilitate cooperation with other standards groups
- d) a chapter on the interface to a patient accounting system has been added
- e) a chapter on the reporting of ancillary results has been prepared, based on the ASTM 1238-88 Standard and with the direct, active participation of members of the ASTM E31.11 committee
- f) a computerized data dictionary of all data elements and other message components has been created. Those portions of this document that contain detailed listings of data were generated directly from that dictionary. Appendix A contains cross references and other information generated from this electronic data dictionary.
- g) inconsistencies and mistakes were discovered in the version 2.0 and 2.1 Standard. These have been addressed and documented in version 2.2.
- h) extensive additions have occurred in the Order/Entry and Clinical Observations Chapters to include data element oriented results, pharmacy orders and administrations interface.
- i) message acknowledgments have been extended to include a separate enhanced mode that defines the "accept acknowledgment." While this mode of acknowledgment has always been allowed, it is now obvious how HL7 supports any environment when intermediaries exist in the network with implicit time delays (such as store and forward services, "Interface Engines" that perform fan out services, etc.). Immediate acknowledgments are available to release the sending system from the need to resend the message.
- j) distinctions have been documented between the HL7 abstract message definition which is purely a level 7 (application level) definition vs. the HL7 encoding rules for converting an abstract message into a string of characters that comprise an actual message. These encoding rules are actually a suggested potential alternative where a fully defined level 6 (presentation level) definition does not exist (e.g., ISO's ASN.1 Basic Encoding Rules (BER)).

## **1.11 OVERVIEW**

This section contains a description of the conceptual basis of the HL7 Standard, the approach to accommodating intra-site variations and evolutionary changes, and the way it has been structured in order to accommodate varying current and future communications environments.

### 1.12.1 HL7 encoding rules

Message formats prescribed in the HL7 encoding rules consist of data fields that are of variable length and separated by a field separator character. Rules describe how the various data types are encoded within a field and when an individual field may be repeated. The data fields are combined into logical groupings called segments. Segments are separated by segment separator characters. Each segment begins with a three-character literal value that identifies it within a message. Segments may be defined as required or optional and may be permitted to repeat. Individual data fields are found in the message by their position within their associated segments.

All data is represented as displayable ASCII characters (hexadecimal values between 20 and 7E, inclusive). All the special separators and other special characters are also displayable ASCII characters, except that the segment separator is the ASCII Carriage Return character.

The encoding rules distinguish between data fields that have the null value and those that are not present. The former are represented by two adjacent quotation marks, the latter by no data at all (i.e., two consecutive separator characters.) The distinction between null values and those that are not present is important when a record is being updated. In the former case the field in the database should be set to null; in the latter case it should retain its prior value. The encoding rules specify that if a receiving application cannot deal with a data field not being present, it should treat the data field as present but null.

The encoding rules specify that a receiving application should ignore fields that are present in the message but were not expected rather than treat such a circumstance as an error.

### 1.12.3 Local variations

The HL7 Standard is intended to standardize data interchanges, not the underlying applications systems. This means that there will be a wide variety in the manner in which the Standard are applied in different institutions.

The requirement to support diversity within the Standard is addressed in these ways:

- a) The only data fields that are required in the abstract messages are those necessary to support the logic of the relationships among the messages or their basic purpose. Many other fields are specified but made optional.
- b) There are provisions within the specifications to add messages or portions of messages that are local to an institution. The conventions used for this are intended to prevent conflict with future versions of the specification.

### 1.12.5 Evolutionary changes to the standards

All standards must evolve as the applications they support change and as a result of experience using them. In recognition of this, the Standard includes a protocol version ID in all messages.

New transactions or data elements will be added to operational HL7 environments as a result of changes in the Standard or due to changes in the local implementation as permitted within the Standard. It is important that these changes be implementable at a site without requiring all communicating applications to upgrade simultaneously. The special provisions in the Encoding Rules for dealing with fields that are not present or unexpected are very important here. Because of them, new fields can be added first to the sending or



source system; the receiving system will ignore the new fields until it has been updated to use them. Often, these rules also facilitate changing the receiving system first. Until the sending system is changed, the receiving system will find the new data field 'not present' and deal with this according to its rules for data not present.

Similarly, the HL7 Encoding Rules support changes in data field sizes. Fields are found within the message by examining separators, rather than by an offset. Changing the size of a field does not change the procedure used to detect subsequent fields.

### **1.12.7 Applicability to file transfers (batch processing)**

Although the HL7 Standard is defined in terms of the client-server (remote operation) model, its standards are equally applicable to file transfers. One or more messages may be encoded according to the Encoding Rules, grouped in a file and transferred using external media, FTAM, FTP, Kermit, or any other file transfer protocol. Responses may be grouped in a file and similarly transmitted. Chapter 2 provides the general mechanisms for the batch transmittal of HL7 messages.

### **1.12.9 Relationship to other protocols**

A great deal of consideration has been given to the relationship between the HL7 Standard protocol and other protocols. There are three questions:

- a) what is the relationship between the HL7 protocol and "lower layer", service protocols? In strict accordance with the ISO OSI model, HL7 should not replicate features of these protocols. This can even be construed to require HL7 to avoid replicating certain ISO layer 7 functionality contained in the Service Elements.

However, it is the goal of the HL7 group to support healthcare communications in a wide variety of communications environments, including many that are not as complete as ISO will be one day.

- b) what is the relationship between the HL7 Standard protocol and other applications protocols? Protocols of interest include the ASC X12 Standards for Electronic Document Interchange, the ASTM 1238-88 Standards for laboratory data reporting, the ACR/NEMA DICOM Standards for imaging and other aspects of Radiology Information Systems, and the IEEE P1157 Standards for medical data interchange ("MEDIX").

- c) what is the relationship between the HL7 Standard and various proprietary healthcare protocols in use today?

#### **1.12.10.1 Lower layer protocols**

The HL7 Encoding Rules are substantially different from the ASN.1 Basic Encoding Rules (BER) documented in CCITT X.409 and X.209 and ISO 8825 or those employed in LU6.2 or RPC. This is because:

- a) by definition, the HL7 encoding rules will be applied where the environment does not include software to do encoding. Without such software, the burden on applications programmers to develop messaging software that conforms to those encoding rules is onerous.
- b) the encoding rules of these protocols depend on the assumption that lower level protocols provide transparency (i.e., all character codes can be transmitted without being changed by and of the

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lower levels). This assumption is often not met in the communications environments that must serve HL7 for the interim. The techniques that might be used to implement transparency in the Lower Level Protocol are difficult to implement in some present-day applications environments.

The notation chosen to document the message formats in the HL7 Standard is not the Abstract Syntax Notation1 (ASN.1) Basic Encoding Rules (BER) used by ISO and MEDIX. This is because the ASN.1 language is so rich, and the HL7 message format so simple, that when HL7 messages are defined using ASN.1, the result is very repetitious and difficult to read. This is distracting and difficult to explain to application programmers who are neither schooled in recursive languages in general nor ASN.1 in particular.

Contrary to other high level communications environments, there is no notion of association separate from the sending of the message from client to server and the response. This seems appropriate to the client-server model.

Whenever HL7 is applied in a networking environment, addressing will be an issue. This is equally true when it is applied on ISO Standards networks or proprietary networks. Although the Standard does not specify how this addressing will occur, they do provide certain data fields that will be of value in determining addresses. The fields, Receiving Application, Receiving Facility, and Processing ID, are located in the header of all HL7 messages. Receiving Facility is intended for environments where multiple occurrences of the same application are being run on the same computer system or on the same network on behalf of different institutions or other organizational entities. Processing ID is used where various versions of essentially the same application may reside on the same computer for different purposes. The recommended values for the field are Production, Training, and Debugging.

The HL7 committee does not standardize the values for the Receiving Application and Receiving fields, since the code sets chosen for them will be tightly coupled to the overall architecture of applications within an institution. For applicability under the ISO Association Control Service Element, these values will have to be registered as ISO Service Access Points.

### 1.12.10.2 Other applications protocols

The Working Group has given considerable attention to the relationship of the HL7 protocol and other protocols. A considerable liaison effort is underway. This is described below:

- a) ACR/NEMA DICOM. The HL7 Working Group maintains an on-going liaison with the ACR/NEMA DICOM working group. HL7 and ACR/NEMA DICOM are both members of ANSI's HISPP MSDS.
- b) ASC X12 Standards for Electronic Document Interchange. X12 is a family of Standards that provide both general and specific descriptions for data interchange within a number of industries. The HL7 Encoding Rules are modeled on the X12 Standards, although there are differences. The HL7 Standard needs to accommodate on-line exchange of individual transactions on LANs. This difference, and certain applications issues, are responsible for the variance from X12. X12 has recently decided to follow the UN/EDIFACT encoding rules for all X12 standards produced in 1995 or later. However, at this time, this decision will not require retroactive maintenance activity on all existing X12 Standards Transaction Sets.

X12N transactions that facilitate the transfer of healthcare claims and remittance information as well as benefit coordination, enrollment and verification are enjoying dramatically increased use. HL7 has elected to assume that all business transactions between institutions regarding the interchange of claims, benefits or other financial information are the responsibility of ASC X12N, the insurance subcommittee of

X12. HL7 and ASC X12N are both members of ANSI's HISPP Messaging Standards Developers Subcommittee.

In February of 1994, HL7 and X12 signed an agreement to "improve coordination efforts and have identified that technical issues must be harmonized. Both groups agree to migrate to the appropriate level of resolution of potentially overlapping work by utilizing user and standards communities' and anticipated health care reform requirements."

Since then, HL7 and X12 have created two bodies to address the goals of harmonization: (1) HL7 - X12N Coordinating Ad Hoc Steering Committee to oversee efforts, and (2) HL7 - X12N Joint Coordinating Committee to develop and implement specific plans to achieve harmonization. Both committees have convened a meeting in 1994 and will continue their work through 1995.

c) ASTM 1238.88 Laboratory Data Reporting. An active liaison effort between the ASTM committee and the Working group has resulted in minor changes in the ASTM specification to enhance compatibility, changes in the HL7 control specifications to enhance compatibility, and the development of the entire Ancillary Data Reporting chapter, developed jointly by the committees and built on the ASTM Standards. This liaison has now extended to the point where both groups now have the permission to freely use the contents of each others standards efforts "in whole" within their own published Standards.

Some distinctions are more in the terminology chosen than the actual message content. For example, the ASTM "sub-field delimiter" is generally used to separate repetitions of homogenous values. It is called a "repetition separator" in HL7. HL7 and ASTM are both members of ANSI's HISPP MSDS.

(d) IEEE P1157 ("MEDIX"). The MEDIX committee is defining an application level protocol similar in scope to HL7 but built strictly on the ISO protocol stack up to and including the Remote Operation Service Element (ROSE). HL7 varies from this approach by the decision not to depend on ROSE nor use the ASN.1 BER syntax notation. Despite the difference in approaches, the HL7 Working Group has regular liaison with the MEDIX committee. The Working Group has devised a format for the HL7 Standard that is relatively independent of the encoding rules chosen and easily translated into the ASN.1 notation. The transactions defined in this manner should be directly transferable to the MEDIX effort, and transaction messages encoded using the HL7 scheme should be translatable to transactions encoded using the BER. This should facilitate the creation of gateways between the HL7 and future environments.

In addition, HL7 and MEDIX have agreed on a course for convergence. This will occur within the HL7 Abstract Message definitions. MEDIX has further agreed to use the HL7 abstract message definitions as defined in V2.1 as a starting point for the MEDIX message definitions. HL7 and MEDIX are both members of ANSI's HISPP MSDS.

## **1.13 REFERENCE DOCUMENTS**

### **1.14.1 ANSI standards<sup>1</sup>**

ANSI X3.30 -1985 Representation for calendar date and ordinal date

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<sup>1</sup>Available from American National Standards Institute, 1430 Broadway, New York, NY 10018

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ANSI X3.4 -1986 Coded character sets - American National Standard code for information interchange (7-bit ASCII)

ANSI X3.43 -1986 Information systems representation of local time of day for information interchange

ANSI X3.50 -1986 Representations for U.S. customary, SI, and other units to be used in systems with limited character sets

ANSI X3.51 -1986 Representations of universal time, local time differentials, and United States time zone references for information interchange

### 1.14.3 ISO standards<sup>1</sup>

ISO 5218 -1977 Information Interchange-Representation of Human Sexes

ISO 1000 -1981 SI Units and Recommendations for the use of their multiples and of certain other units

ISO 2955 -1983 Information processing-Representation of SI and other units in systems with limited character sets

ISO 8072 -1986 Network Standards

ISO 8601 -1988 Data elements and interchange formats - information interchange (representation of dates and times)

ISO 8859 -1988 Information Processing- 8-bit single-byte coded graphic character sets

### 1.14.5 Codes and terminology sources

ACR Index for Radiological Diagnosis, Revised 3rd Edition

CPT4 Current Procedural Terminology<sup>3</sup>

CAS USAN 1990 and the USP dictionary of drug names<sup>4</sup>

EUCLIDES European standard for clinical laboratory data exchange<sup>5</sup>

Home HealthHome Healthcare Classification System (Virginia Saba, EdD, RN, Georgetown U. School of Nursing, Washington DC)

HIBCC Standard for electronic business data interchange

ICCS Commission on Professional and Hospital Activities

ICD-9 International Classification of Diseases, 9th Revision

ICD9-CM International Classification of Diseases, Clinical Modification Manual of Clinical Microbiology<sup>6</sup>

NANDA (North American Nursing Diagnosis Association, Philadelphia PA)

NDC National drug codes<sup>7</sup>

NIC (Nursing Interventions Classification, Iowa Intervention Project. U. of Iowa)

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<sup>2</sup>Available from ISO 1 Rue de Varembe, Case Postale 56, CH 1211, Geneve, Switzerland

<sup>3</sup>Available from American Medical Association, P O Box 10946, Chicago, IL 60610

<sup>4</sup>William M. Heller, Ph.D., Executive Editor. Available from United States Pharmacopeial Convention, Inc., 12601 Twinbrook Parkway, Rockville, MD 20852.

<sup>5</sup>Available from G. De Moor, M.D., Dept. of Medical Informatics 5K3, State University Hospital Gent, De Pintelaan 185, B 9000 GENT, BELGIUM

<sup>6</sup>Available from American Society for Microbiology, 1913 Eye St., NW, Washington, D.C. 20006.

<sup>7</sup>Available from the National Drug Code Directory, FDA, Rockville, MD, and other sources

NLM	Unified Medical Language <sup>8</sup>
Omaha System	(Omaha Visiting Nurse Association, Omaha NE)
Read	Clinical Classification of Medicine <sup>9</sup>
SNOMED III	Systemized Nomenclature of Medicine <sup>10</sup>
WHO	Drug Codes <sup>11</sup>
UMDNS	Universal Medical Device Nomenclature System <sup>12</sup>
FDA K10	Device Codes Device and analyte process codes <sup>13</sup>

### 1.14.7 Other Applicable Documents

- ASTM E31.12 Draft Dec 1990 - A Standard Specification for Representing Clinical Laboratory Test and Analyte Names *Draft*<sup>14</sup>
- ASTM E1467-91 Standard Specification for Transferring Digital Neurophysiological Data Between Independent Computer Systems<sup>15</sup>
- ASTM E1394 A Standard Specification for Transferring Information Between Clinical Instruments and Computer Systems<sup>15</sup>
- ASTM E1381 Standard Specification for the Low-level Protocol to Transfer Messages between Clinical Instruments and Computer Systems<sup>15</sup>
- McDonald CJ, Hammond WE: Standard formats for electronic transfer of clinical data. *Annals of Internal Medicine* 1989; 110(5):333-335.

## 1.15 SUGGESTIONS AND COMMENTS

The HL7 Working Group welcomes comments and suggestions for improving the Standard. The Working Group is also open to new membership. Both feedback on the Standard and interest in membership should be sent to:

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<sup>8</sup>Available from National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20894

<sup>9</sup>Available from James D. Read, MB, ChB, DRCOG, MRCGP, General Medical Practitioner, Park View Surgery, 26-28 Leicester Rd., Loughborough, Leicestershire LE11 2AG.

<sup>10</sup>Available from American College of Pathology, Skokie, IL

<sup>11</sup> Available from INTDIS, P O Box 26, S-751 03 Uppsala, Sweden

<sup>12</sup> Available from ECRI, 5200 Butler Pike, Plymouth Meeting, PA 19462

<sup>13</sup> Available from Dept. of Health & Human Services, FDA, Rockville, MD 20857

<sup>14</sup>Available from Arden Forrey, Ph.D., 4916 Purdue Ave., NE, Seattle, WA 98105

<sup>15</sup>Available from American Society for Testing and Materials (ASTM) 1916 Race St., Philadelphia, PA 19103-1187.

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