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An American National Standard

Standard Guide for Content and Structure of the Electronic Health Record (EHR)¹

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1. Scope

1.1 This guide covers all types of healthcare services, including those given in ambulatory care, hospitals, nursing homes, skilled nursing facilities, home healthcare, and specialty care environments. They apply both to short term contacts (for example, emergency rooms and emergency medical service units) and long term contacts (primary care physicians with long term patients). The vocabulary aims to encompass the continuum of care through all delivery models.

1.2 This guide has four purposes:

1.2.1 Identify the content and logical structure of an Electronic Health Record (EHR) consistent with currently acknowledged patient record content. The record carries all health related information about a person over time. It may include history and physical, laboratory tests, diagnostic reports, orders and treatments documentation, patient identifying information, legal permissions, and so on.

1.2.2 Explain the relationship of data coming from diverse sources (for example, clinical laboratory information management systems, order entry systems, pharmacy information management systems, dictation systems), and other data in the Electronic Health Record as the primary repository for information from various sources.

1.2.3 Provide a common vocabulary for those developing, purchasing, and implementing EHR systems.

1.2.4 Provide sufficient content from which data extracts can be compiled to create unique setting “views.”

2. Referenced Documents

2.1 ASTM Standards:

E 792 Guide for Selection of a Clinical Laboratory Information Management System²

E 1238 Specification for Transferring Clinical Observations Between Independent Computer Systems²

E 1239 Guide for Description of Reservation/Registration-Admission, Discharge, Transfer (R-ADT) Systems for Automated Patient Care Information Systems²

E 1381 Specification for Low-Level Protocol to Transfer Messages Between Clinical Instruments and Computer Systems²

E 1394 Specification for Transferring Information Between Clinical Instruments and Computer Systems²

E 1460 Specification for Defining and Sharing Modular Health Knowledge Bases (Arden Syntax for Medical Logic Modules)²

E 1467 Specification for Transferring Digital Neurophysiological Data Between Independent Computer Systems²

E 1633 Specification for the Coded Values Used in the Computer-Based Patient Record²

E 1712 Specification for Representing Clinical Laboratory Test and Analyte Names²

E 1714 Guide for Properties of a Universal Healthcare Identifier²

E 1715 Practice for an Object-Oriented Model for Registration, Admitting, Discharge, and Transfer (RADT) Functions in Computer Based Patient Record Systems²

E 1769 Guide for Properties of Electronic Health Records and Record Systems²

2.2 ISO Standards:³

IS 5218 1977 Information Interchange—Representation of Human Sexes

IS 1000 1981 SI Units and Recommendations for the Use of Their Multiples and of Certain Other Units

IS 2955 1983 Information Processing—Representation of SI and Other Units in Systems with Limited Character Sets

IS 8072 1984 Information Processing Standard—Open System Interconnection Transport Service Definition

IS 8601 1988 Data Elements and Interchange Formats—Information Interchange (Representation of Dates and Times)

IS 6937:1994 Information Technology—Coded Graphic Character Set for Text Communication (Revision of Parts 1 and 2)

IS 10367:1991 Standardized Coded Graphic Character Sets for Use in 8 Bit Codes

2.3 Other Health Informatics Standards:

¹ This guide is under the jurisdiction of ASTM Committee E31 on Healthcare Informatics and is the direct responsibility of Subcommittee E31.19 on Electronic Health Record Content and Structure.

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² *Annual Book of ASTM Standards*, Vol 14.01.

³ Available from ISO, 1 Rue de Varembe, Case Postale 56, CH 1211, Geneva, Switzerland.



HL7 Health Level Seven (HL7) Version 2.2 1994⁴
 ACR/NEMA DICOM Version 3.0⁵
 NCPDP National Council for Prescription Drug Programs (NCPDP) Telecommunication Standard Format Version 3 Release 2, 1992⁶
 ANSI ASC X12: Version 3, Release 3 (1992)⁷
 X12.84 Healthcare Enrollment and Maintenance Transaction Set (834)⁸
 X12.85 Healthcare Claim Payment Transaction Set (835)⁸
 X12.87 Healthcare Claim Transaction Set (837)⁸
 2.4 *ANSI Standards:*⁸
 X3.30:1985 [R 1991] Representation for Calendar Date and Ordinal Date
 X3.4:1986 [R 1992] Coded Character Sets—American National Standard Code for Information Interchange (7-bit ASCII)
 X3.43:1986 [R 1992] Information Systems Representation of Local Time of Day for Information Interchange
 X3.50:1986 [R 1992] Representations for U.S. Customary, SI, and Other Units to Be Used in Systems with Limited Character Sets
 X3.51:1994 Representations of Universal Time, Local Time Differentials, and United States Time Zone References for Information Interchange

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *admitting diagnosis*—a statement of the provisional condition given as the basis for admission to the hospital for study.

3.1.2 *ambulatory care*—also called “outpatient care,” that is a comprehensive term for all types of health care provided in an outpatient setting. It may include preventive or corrective healthcare, or both, provided in practitioner’s office or clinic setting, or in the hospital on a nonresident basis (that is, not requiring overnight stay and not included in the census). The term ambulatory usually implies that the patient has come to a location and has departed that same day. (Ambulatory care includes alternative (healthcare vice medicine) medicine, healthcare care, for example, acupuncture.)

3.1.3 *ambulatory surgery center*—a freestanding or hospital-based facility offering surgical procedures on patients who are admitted and discharged from the facility on the day of the surgery.

3.1.4 *ancillary service visit*—appearance of an outpatient in a unit of a hospital or outpatient facility to receive service(s), test(s), or procedures; it is ordinarily not counted as an encounter.

3.1.5 *clinic*—an outpatient facility providing a limited range of healthcare services, and assuming overall healthcare responsibility for the patients.

3.1.6 *clinic patient*—admitted for diagnosis or treatment or follow-up on an ambulatory basis.

3.1.7 *continuing care retirement community*—an organization established to provide housing and services, including healthcare, to people of retirement age.

3.1.8 *electronic health record (EHR)*—an electronic health record is any information related to the past, present or future physical/mental health, or condition of an individual. The information resides in electronic system(s) used to capture, transmit, receive, store, retrieve, link and manipulate multimedia data for the primary purpose of providing health care and health related services.

3.1.9 *emergency patient*—a patient admitted to emergency room service of a hospital for diagnosis and therapy requiring immediate healthcare services.

3.1.10 *emergency services*—immediate evaluation and therapy rendered in emergency clinical conditions, sustained until the patient can be referred to his or her personal practitioner for further care.

3.1.11 *encounter*—(1) An instance of direct provider/practitioner to patient interaction, regardless of the setting, between a patient and a practitioner vested with primary responsibility for diagnosing, evaluating or treating the patient’s condition, or both, or providing social worker services. (2) A contact between a patient and a practitioner who has primary responsibility for assessing and treating the patient at a given contact, exercising independent judgment.

3.1.12 *episode*—one or more healthcare services received by an individual during a period of relatively continuous care by healthcare practitioners in relation to a particular clinical problem or situation.

3.1.13 *health maintenance organization*—an organization that provides health coverage to voluntary enrollees in return for prepayment of a set fee, regardless of the services used.

3.1.14 *home healthcare*—clinical care provided or supervised by a practitioner, administered at the patient’s place of residence.

3.1.15 *hospice*—a program emphasizing psychosocial support and home physical care, with inpatient care when needed, for terminally ill patients and their families.

3.1.16 *hospital*—an establishment with an organized medical staff with permanent facilities that include inpatient beds and continuous medical/nursing services providing diagnosis and treatment for patients.

3.1.17 *hospital-based outpatient care*—a subset of ambulatory care utilizing the hospital staff, equipment, and resources to render diagnostic, preventive or corrective healthcare, or both.

3.1.18 *inpatient admission*—the formal acceptance by a hospital of a patient who is to be provided with room, board, and continuous nursing service in an area of the hospital where patients generally stay overnight.

3.1.19 *intermediate care facility (ICF)*—an institution which primarily provides health-related care and services to individuals who do not require the degree of care or treatment which a hospital or skilled nursing facility is designated to provide, but who, because of their physical or mental condition, require care and services.

⁴ Available from HL7, Mark McDougall, Executive Director, 900 Victors Way, Suite 122, Ann Arbor, MI 48108.

⁵ Available from ACR/NEMA.

⁶ Available from NCPDP, 4201 North 24th Street, Suite 365, Phoenix, AZ 85016.

⁷ Available from DISA (Data Interchange Standards Association).

⁸ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.



3.1.20 *length of stay (LOS)*—the total number of patient days for an inpatient episode, calculated by subtracting the date of admission from the date of discharge. If a patient is admitted and discharged on the same date, the LOS is one day.

3.1.21 *licensed practitioners*—an individual at any level of professional specialization who requires a public license/certification to practice the delivery of care to patients. A practitioner can also be a provider.

3.1.22 *longitudinal patient record*—a permanent, coordinated patient record of significant information, in chronological sequence. It may include all historical data collected or be retrieved as a user designated synopsis of significant demographic, genetic, clinical and environmental facts and events maintained within an automated system.

3.1.23 *long-term care*—healthcare rendered in a non-acute-care facility and to a patient in resident or nonresident status; such illness is not severe enough to require an acute care facility, but the patient is in need of continual supervision and assistance by healthcare practitioners.

3.1.24 *non-licensed practitioner*—an individual without a public license/certification who is supervised by a licensed/certified individual in delivering care to patients.

3.1.25 *outpatient care*—see *ambulatory care*.

3.1.26 *partial hospital program*—facilities of the hospital are regularly used on a scheduled basis for care during a substantial number of daytime or nighttime hours.

3.1.27 *patient health record*—the primary legal record documenting the healthcare services provided to a person, in any aspect of healthcare delivery. This term is synonymous with: medical record, health record, patient care record (primary patient record), client record, resident record. The term includes routine clinical or office records, records of care in any health-related setting, preventive care, life style evaluation, research protocols, special study records and various clinical databases.

3.1.27.1 *Discussion*—As the repository of information about a single patient, this information is generated by healthcare professionals as a direct result of interaction with a patient or with individuals who have personal knowledge of the patient (or with both). The record contains information about the patient and other individuals as they relate to the health of the patient, for example, family history, caregiver support.

3.1.28 *patient record system*—the set of components that form the mechanism by which patient records are created, used, stored, and retrieved. A patient record system is usually located within a healthcare provider/practitioner setting. It includes people, data, rules and procedures, processing and storage devices (for example, paper and pen, hardware and software), and communications and support functions.

3.1.29 *primary diagnosis*—the diagnosis of the condition that is primarily responsible for the patient's symptoms and signs and has the greatest impact on the patient's health, or is the most resource-intensive to treat.

3.1.30 *principal diagnosis*—a statement of the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care.

3.1.31 *provider*—a business entity which furnishes health-care to a consumer; it includes a professionally licensed

practitioner who is authorized to operate a healthcare delivery facility.

3.1.32 *referred (patient)*—registered exclusively for special diagnostic/therapeutic service of the hospital for diagnosis/treatment on an ambulatory basis. Responsibility remains with the referring practitioner.

3.1.33 *resident care facility*—a residential facility that provides regular and emergency health services, when needed, and appropriate supporting services on a regular basis.

3.1.34 *school special education*—specifically designed instruction provided by qualified teachers within the context of school, aimed at the acquisition of academic, vocational, language, social, and self-care skills. Includes adapted physical education and use of specialized techniques to overcome intrinsic learning deficits.

3.1.35 *secondary diagnosis*—a statement of those conditions coexisting during an encounter that affect the treatment received or the length of stay.

3.1.36 *secondary patient record*—a record that is derived from the record used by healthcare practitioners while providing patient care services and it contains selected data elements to aid nonclinical persons (that is, persons not involved in direct patient care) in supporting, evaluating, or advancing patient care. Patient care support refers to administration, regulation, and payment functions. Patient care evaluation refers to quality assurance, utilization review and medical or legal audits. Patient care advancement refers to research. These records are often combined to form what the committee terms a secondary data base (for example, an insurance claims data base).

3.1.37 *sheltered employment*—employment provided in a special industry or workshop for the physically, mentally, emotionally, or developmentally handicapped.

3.1.38 *short stay ambulatory care*—a patient admitted to the hospital for an intended stay of less than 24 h, considered to be an outpatient and not included in inpatient hospital census statistics.

3.1.39 *skilled nursing facility*—a long term skilled facility with an organized professional staff and permanent facilities that provides continuous nursing and other health related services.

3.1.40 *UB-92 uniform bill*—a standardized uniform billing form required by federal authorities for Medicare claims and is used as an industry standard. It replaces the 1982 (UB-82) version.

3.1.41 *vocational rehabilitation*—evaluation and training aimed at assisting a person to enter or reenter the labor force.

4. Significance and Use

4.1 This Guide has Four Parts:

4.1.1 The first part (Section 5) identifies items of information carried in the traditional paper record using the source oriented structures common to paper records. The purpose of this section is to remind users of the spectrum of information that shall be accommodated by the logical structure of a EHR and to present a point of reference for the more abstract description of the patient record that follows.

4.1.2 The second part (Section 6) presents a number of operational principles, including such matters as



security that should guide the implementation and operation of EHRs.

4.1.3 The third part (Section 7) describes a logical organization and content (common data model) of an EHR. It is not a blueprint for constructing or implementing a EHR system. The model organizes the major informational structures and content of the EHR. The focus is on the structure required to store all clinically relevant patient information: those that describe the patient's state; the actions directed at the patient variables; and the actions initiated to diagnose, educate, or treat the patient. These are regarded as repository functions of the EHR. This standard does not describe all of the data structures required by applications that might use information contained in the EHR. In particular, the data structures used to control and guide the process of care such as utilization review or quality assurance, and the goals or thresholds (for example, mean length of stay) that might be used to judge the patient's care are not included.

4.1.3.1 There are many different ways to implement physical structures that could map into the model presented. It is emphasized that this standard should neither impede technical progress nor define the precise manner in which the EHR system is implemented.

4.1.3.2 At this time, this model defines neither all of the detailed implemented physical structures in some systems nor all of the functional capabilities that may have been implemented. The focus is both upon the kinds of information that should be included and upon a global description of the organization of that data within the EHR. This guide does not deal in detail with issues related to charges and billing for patient care, only the documentation required to support usual charging and administrative issues.

4.1.3.3 This standard deals with the health information as it would be stored in the EHR, not as it would be sent as a message to or from the EHR. Pains have been taken to be sure that the information content from existing healthcare informatics messages that lie within the scope of the EHR can be mapped into the EHR structure. Where mappings are one-to-one, the EHR data elements have been cross referenced with the message fields. However, the EHR is not just a collection of messages. It makes stronger assumptions about the context in which it exists, so there is not perfect correspondence between the structure and content of messages on the one hand and the EHR on the other.

4.1.3.4 This guide applies across a range of scales. Though the ultimate goal is a EHR that spans the entire nation and the lifetime of an individual, the reality is that EHRs are mostly of much smaller scope (for example, within institutions, communities, or states) and these can be implemented much sooner. This standard is intended to apply equally to all scopes of time and place. Within the scope of a EHR all master tables and code systems (for example, service catalog, patient registry, patient identifier) will be held in common. It denotes extensions of text content for document format standards and references standard XML designation for document section tags.

4.1.4 The fourth part (Sections 8, 9, 10) describes some alternative views (subsets of information presented in various

orderings) of the content and considers what should be the minimum data elements contained in the EHR. What has been described as the "Longitudinal Health Record" (a very short precis of the patient's entire history) falls into this category. A set of "views" will serve as the user interface to the EHR for various customers. When all of the data is available in a EHR, providing different views of that data to satisfy various user needs and perspectives will be facilitated. Further, the kinds of views that are "required" and their dependencies (differing by institution, by specialty, by health/medical problem, by practitioner) will evolve over time. Section 10 is a repository of data elements to be used as an electronic health record data dictionary (Annex A1).

4.2 General—Healthcare Documentation:

4.2.1 A patient's health record plays five unique roles: (1) It represents that patient's health history, that is, a record of the patient's health states and the health services provided, over time. (2) It provides a method for clinical communication and care planning among the individual healthcare practitioners serving the patient. (3) It serves as the legal document describing the healthcare services provided. (4) It is a source of data for clinical, health services, and outcomes research. (5) It serves as a major resource for healthcare practitioner education.

4.2.2 Keeping complete and accurate records is an essential part of patient care management. Increasing specialization in healthcare and population mobility has increased the fragmentation of the traditional health record. The EHR offers a unified, coordinated, complete repository of patient health information. It includes such things as treatments, prescriptions, test results, diagnostic impressions, and significant genetic, environmental, and clinical healthcare data.

4.2.3 The person's health record consists of the original documentation of their health information and of the associated health and clinical services provided at the various care sites including the results of tests and outcomes of treatments. Each care site will require basic data that may be common to all care sites, data specific to that particular type of care site, and data unique to the individual care site.

4.2.4 The EHR serves all of the functions of the traditional record but has many advantages.

4.2.4.1 It solves the logistic problems of easy access to the paper health/medical record. Information can be concurrently accessed from multiple locations.

4.2.4.2 It will provide efficient communication of information to support coordination of services between care practitioners.

4.2.4.3 It calls for data content to be stored so that it links to automatic reminders and alerts to avoid errors of omission and commission.

4.2.4.4 By providing cross-patient retrievals it will provide the statistics needed by clinical, outcomes, health services and policy researchers as well as administrators and managers, to define better policies and practices to improve the healthcare process and make it efficient.

4.2.5 The longitudinal healthcare record, which is the brief synopsis of the significant facts derived from the primary



documentation, can be constructed from views of the elements described here.

4.3 *The Role of Standards in Healthcare Documentation:*

4.3.1 Healthcare informatics standards are essential for an efficient and affordable EHR. Even within a single institution, much of the information that should be stored in the EHR will come from other electronic sources. Message standards are needed to ensure that this data can be transmitted from a source system and received and stored with a EHR without requiring human intervention. The need for information from other healthcare facilities (the hospital would like nursing home records when the patient is admitted and vice versa when the patient is discharged) is even greater. Finally, standard terminology, codes, and formats are the sine qua non for aggregating many EHRs for research and policy purposes.

4.3.2 The model for a EHR described here provides a general guideline regarding storage of different kinds of information and recommends minimal content requirements. It promotes common approaches to documentation. The model should be flexible enough to permit the storage of any kind of patient information deemed important by an individual provider, ensure that a minimum set of patient data is maintained, as well as information required by diagnostic and therapeutic services of the future.

5. Catalog of Health Record Contents by Source

5.1 This section describes the content of the current paper oriented record by source of data. The purpose of this section is to depict the full range of data that will compose the EHR but described in familiar terms.

5.2 Within the traditional record of care we find the kinds of information shown in Table 1. As Table 1 shows, many categories of information exist, and they can often be broken down into ever more detailed categories depending upon who collects the information and how it is to be used. For example, the physical examination can be broken down into the traditional categories, but subcategories may be possible and, indeed, required. For example, the physical exam of the eye might be recorded as a family of procedures or as a single unit. While one ophthalmologist might break the exams into many subcategories; for example, lid and exterior muscles, conjunctiva, cornea, anterior chamber, and retina; another might not. When more completely structured, the granularity of such exams can be very fine.

5.3 In the traditional record the degree of granularity (expressed detail level) and the degree of structure may vary considerably depending upon specialty, the particular provider, the clinical problem, the kind of care (hospital, office visit, nursing home). The spectrum runs from complete free text (some visit notes) to free text broken down by subheadings of differing degrees (standards formats) of granularity to fully structured data collection instruments (where all questions have multiple choice, coded, or numeric answers). But the degree of granularity can vary among structured data collection instruments, and free text may or may not be allowed as an “escape.” Thus, the EHR must also accommodate varying degrees of granularity in the recording of the same clinical information within one patient’s record.

5.4 *Structured Data versus Free Text*—It is important to distinguish between two main ways of recording patient information. Some is recorded as free text (for example, the dictated visit note) and some structured data, that is, the information is broken into discrete data elements (single concept types) and the values of each data element is recorded as discrete values (that is, terms codes, or surrogate codes such as multiple choice responses) or number values (for example, laboratory test results). Practically, the computer can “understand” structured data because it has a defined context, but it cannot easily understand free text because it has to determine a context. However, the computer can “process” free text and convert it into a structured form.

5.5 Further complicating matters is the great variation among institutions, specialties, and practitioners in the degree to which they record patient information as free text versus structured responses. Test results are commonly represented as fully structured.

5.6 In some hospitals nursing notes are highly structured, with many separate questions calling for multiple choice options for recording patient’s status; in other hospitals the notes are pure text. Major portions of obstetrical histories are recorded on multiple choice instruments in some institutions, as free text in others, and many of these documents originate in the physician’s office. Radiologists break their reports of X-ray studies into description and impression, both of which are recorded as free text. Echocardiograms are usually reported as a set of discrete measurements (for example, left ventricular diameter, ejection fraction for echocardiograms).

5.7 There are many reasons for preferring structured to free text observations. (At the very least, the impressions of imaging studies diagnosis reported at visits and surgeries should be reported in structured forms.) However, rigorous structuring imposes time cost on the observer. In particular, when reporting a patient’s perceptions, anxieties, or other conversationally acquired information, it is impossible to predict what will be said. Forcing such information into a predetermined structure may degrade the richness of the content and could lead to erroneous interpretation of meaning. In some areas traditionally handled through free text, history and physical examinations, hospital discharge summaries, etc., standards are being developed to apply structure (formats). Yet, these areas are just underway. Given historical preferences, and the mass of existing free text information, the EHR must accommodate both structured and free text reporting for the foreseeable future. It may even have to accommodate structured or free text values, or both, for the same variable, depending upon who does the recording. In addition, the EHR must accommodate information from outside sources, such as lab work from a previous admission at another facility. Free text processing is available through several approaches. The encoding of text into machine codes has been one approach. Term analysis, internal coding, and pattern mapping for clinical fact extraction also can be done. This area is in rapid development and should be monitored for application to EHR systems.





TABLE 1 Contents of the Traditional Patient Record

Category	Subcategory	Examples and Components
Patient registration information	Identifying information Locating information Insurance information Guarantor information	Sex, birth date, race Home address, home phone, work phone Name of plan ...
Patient problem list	...	Problem number Problem name Date of onset, status
Patient extended encounters	Hospitalization admission records	Insurance information (for current encounter), guarantor information (for current encounter), chief complaint, diagnoses, clinical variables (observations, tests, measurements), final diagnosis/problem, corrections to registration information, procedures performed, etc.
Encounters	Practitioner hospital notes Practitioner visit notes Home healthcare notes Hospital discharge summary Office/clinic visit Home healthcare visit Practitioner visit within extended stay Emergency room visit	
Patient care plans	Clinical roadmaps Chronic disease management Plans for specific patient problems	Assessment data Plans delineating therapy, education, scheduled appointments
Orders	Medication orders/prescription Test orders (Lab Tests)	(both continuing orders, for example, Hgb QAM, and point orders, for example, glucose stat)
	Diet orders Other treatment orders Physical therapy order Occupational therapy order Respiratory therapy order Nursing treatments order Other observation orders Nursing observations (also independent of orders) Consults (to variety of clinical specialists) Nursing interventions Confirmation of receipt of orders Documentation of completion of each step of process (for example, MAR report)	
Service Instances		
Procedures	Surgical procedure	Pre-procedure orders, pre-operative diagnosis, procedure identifier, provider(s) performing procedures, permissions for procedure, procedure note, duration of procedure, medication used, immunizations, complications, final diagnosis, post-operative orders, after care plans
	Outpatient procedures Invasive diagnostic studies Bedside procedures Imaging studies	Thyroid scan, chest X-ray, cardiac echoes, OB ultrasound, vascular dopplers, cardiac catheterizations EEGs, EKGs, prenatal monitors, cardiac monitors Glaucoma fields, pulmonary function, sleep studies
	Physiologic tracings Other special studies Practitioner notes Provider discrete observation	Physicians', nurses', physical therapists', etc., notes Blood pressure, heart rate, skin fold thickness, eye tonometry, infant's head circumference
	Identifying information Health history	Patient's name and identifying number Chief complaint Source of history Present illness Family Hx Social Hx Functional status Hx Travel Hx Occupational Hx Childhood disease Hx Surgical procedures Hx Allergy Hx Medication Hx Review of systems Smoking Hx total Smoking Hx current, etc.
	Physical exam	General status Px



TABLE 1 Continued

Category	Subcategory	Examples and Components
		Vital signs Px Skin Px Head Px Eyes Px Ears Px Nose Px Mouth/throat/teeth Px Thorax/lungs Px Breasts Px Heart Px, etc.
	Lab Data	
	Toxic exposures	
	Nursing assessments	
Legal documents	Surgical releases	...
	Organ donor permissions	
	Advance directives (release of documents)	
Schedules (surgery/clinic, etc.)	Requests for resource	Send patient to eye clinic
	Assignment of resource	
	Documentation of delivery to resource and return	
Supplies and equipment	Consumables (4×4's)	...
	Attachments	

6. Operational Considerations

6.1 Operational aspects that affect the record’s structure and use need to be addressed in any approach to EHR development. These include: General Principles, Data Types, Identifiers, Initiation of the Record, Access to the Record, Essential Data Elements, Retention of the Record, and Referential or Master Tabular Data.

6.2 *General Principles*—In identifying and defining the general content and structure of the patient health record for the design of systems, certain operational principles apply.

6.2.1 Identify the patient health record as the main patient-specific clinical repository component of all health information systems and, as such, the primary repository source of all documentation of clinical care.

6.2.2 Establish standard minimal components of all patient records, and their content, in all healthcare delivery environments.

6.2.3 Accommodate compilation of data into views (synopses) of the patient care record, visits or episodes appropriate to each healthcare delivery setting and which should be accessible locally and included in the unified longitudinal record.

6.2.4 Ensure that the standardized content conforms to the known health data standards.

6.2.5 Define the logical structure of the patient record which, when used for electronic health record systems, enables consistency in the data organization.

6.2.6 Specify data element definitions that conform to standard nomenclature and are mapped to related formally approved standards.

6.2.7 Identify and reference coding systems consistent with current health reporting retrieval, analysis, and reimbursement needs.

6.2.8 Specify data security and confidentiality measures.

6.2.9 Identify the long-term and short-term clinical value of the data elements contained in the patient health record.

6.2.10 Ensure a patient role in contributing all reported data

as appropriate for EHR content development and outcomes assessment.

6.3 *Data Types*—Each of the data elements identified have representations of their data values that fit into a limited number of classes called data types. These include person names, addresses, text, phone numbers, numeric values, dates and times and “coded” (terms and their surrogate codes from a variety of systems). Refer to Table 2 for a complete list. Coded values, particularly, point to referential master tables. In those tables, the term that is human understandable may have a number of code values from different coding systems associated with it. Indeed, they may even be in different languages. When communicating with other systems using messages, a coding system identifier and the code value for that term in the identified system must all be associated with the value for the data element of interest. The date-time data type permits varying degrees of granularity from day, hours to even decimal seconds; a time zone offset from Greenwich Mean Time can also be used. One of these values sets will be used for each data element defined. Messaging standards may require additional subtypes which will be defined within those standards.

TABLE 2 Data Types

Value	Description
AD	Address
CE	Coded entry (for example, Test Ids, Dx codes)
CK	Composit ID with check digit
CM	Composit miscellaneous
CNA	Composit ID and person name
CQ	Composit quality with units <number>^ <units>
ID	Identifier
MO	Money
NM	Numeric
PN	Person name
RP	Reference pointer
ST	String for short text and numerics
TN	Telephone number
TS	Time stamp (date and time)
TX	Bulk text

6.4 Identifiers— Identification of persons (patients, practitioners) and places (healthcare facilities, locations, and workstations) is an important component of the data collection process. The original source healthcare location information shall be captured for each event of care by using provider identification elements that are established for each setting. Check digits for the provider and patient record number should be included.

6.4.1 National Patient Health Identifier—Each individual patient should be assigned a unique healthcare code number. Fields for the identifiers for blood relatives and, where appropriate, spouses **(1)**⁹ should be included in the patient record to allow these related records to be found when appropriate. The number attributes should be unique, permanent, atomic (a single data item), concise, controllable, assignable, universal, unambiguous, used solely for healthcare and compatible with current standards. It shall provide protection of confidentiality and privacy.

6.4.2 Identification of the Healthcare Setting—The healthcare location and setting information shall be captured by using specific synopsis data sets (Specification E 1633) that are preestablished for each setting. Information technology can be used to facilitate the recording of these data sets. The system shall be capable of receiving and storing this data regardless of the medium but in conformance with the standard transfer format to be defined by ASTM.

6.5 Initiation and Construction of the Patient Health Record:

6.5.1 Registration/Reservation Establishing the Patient Health Record—Patients must be registered into an established EHR system by capturing the demographic information which identifies the patient and opens a formal patient record **(2)**. This information allows repeated and accurate identification of patients from one care setting to another and provides the link for additional healthcare information over time.

6.5.2 Identification of Patients:

6.5.2.1 The original source health care location information shall be captured for each event of care by using provider defined identification elements that are preestablished for each setting and stored as a longitudinal view of the original source record or transferred to a patient designated longitudinal health record system.

6.5.2.2 Authentication of Data Entries—All data entries will be authenticated by user identification, and date and time entries will be recorded automatically.

6.5.3 Registration and Establishment of the EHR Record for Newborns—At birth, a newborn record will be initiated as a patient health record. From the obstetric record of the mother the following data shall be transferred to the newborn's record:

6.5.3.1 Infant's full name,

6.5.3.2 Date of birth,

6.5.3.3 Sex,

6.5.3.4 Explicit identification of both parents,

6.5.3.5 Synopsis of abnormal prenatal findings and events,

6.5.3.6 Synopsis of perinatal abnormal events,

6.5.3.7 Genetic synopses of both parents, and

6.5.3.8 Significant socioeconomic facts on family circumstances.

6.6 Access to Records—Policies and procedures for access to electronic health records must be established within the organizational policy structure.

6.6.1 Privacy of Patient Health Records—Access to patient health records is controlled to maintain privacy. See Guide E 1769 and other ASTM standards for confidentiality and privacy.

6.6.2 Release of Records for Clinical, Administrative and Research Purposes—Records shall be released for clinical uses that provide direct care services to patients in line with appropriate consent policies and procedures. Administrative needs for patient data to be drawn from the electronic health record shall be processed within appropriate legal guidelines and established health facility patient data confidentiality and security programs. Research use of patient data which is drawn from the EHR shall be provided as aggregate, unidentified data whenever possible. Research projects which seek the use of identified patient data shall be reviewed by the appropriate committee of the organization and shall conform to the patient data confidentiality and security program guidelines. Automated systems shall provide the necessary checks needed.

6.7 Essential Data Elements:

6.7.1 Minimum data sets for descriptive purposes have been determined from the health records in major clinical settings and these have been previously published. They are:

6.7.1.1 Department of defense/composite healthcare system **(3)**,

6.7.1.2 Uniform hospital discharge data set **(4)**,

6.7.1.3 Basic ambulatory medical care data set **(5)**,

6.7.1.4 Minimum uniform data set for home care **(6)**,

6.7.1.5 Minimum hospice data set **(7)**,

6.7.1.6 Minimum data set for long-term care **(8)**,

6.7.1.7 Health record core data set **(2)**,

6.7.1.8 Occupational health data set **(9)**,

6.7.1.9 Emergency medical information data set **(10)**,

6.7.1.10 Summarized health profile **(11)**, and

6.7.1.11 The nursing minimum data set **(1)**.

6.7.2 Recommended content of patient care records has also been developed and published by accrediting and certifying organizations. These include the Joint Commission on Accreditation of Healthcare Organization (JCAHO), the National Committee on Quality Assurance (NCQA) and others.

6.8 Retention of Records—Patient health record retention criteria for both written and electronic records must be established to conform to the requirements of Federal and state statutes.

6.9 Master Tables:

6.9.1 A basic approach to defining EHR content is through master tables and data views. A master table is a list of variables that represent the range of attributes currently defined for a given subject. Table 3 is an example of an excerpt from a master table. Others are standard coding systems such as ICD9, a problem list directory, a catalogue of risk assessment questions organized as reference for patient record studies.

⁹ The boldface numbers in parentheses refer to the list of references at the end of this standard.



TABLE 3 Ophthalmology Exam Variables

Pupils	
OD pupil	OS cornea cannot be assessed
OS	OS shallow anterior chamber
	OS cornea cannot be assessed
Amsler Grid	
OD Amsler Grid	Anterior Chamber Findings
OS Amsler Grid	OD AC normal
	OD AC flare only
	OD AC cells only
Corneal Examination	
OD normal cornea	OD AC keratic precipitates
Guttata w/o edema	OD AC posterior synechiae
OD confluent guttata w/o edema	OD pupil mydriasis
OD corneal edema	OD pupil irregular
OD central corneal opacity	OD shallow AC
OD corneal dystrophy or degeneration	OD Transillumination defects, etc.

well as short tables illustrated within this standard and discussed in Specification E 1633. By using master tables we can provide both a short term and a long term approach to methodically addressing EHR content. By developing the master tables from these resources, users can apply the standard in diverse settings. Users would use this guide with the appropriate master tables to select standard recommended and optional vocabulary to define the EHR vocabulary in their organization. Overlap will occur among the tables. Master tables can be developed and refined as necessary. They also provide the means of proposing minimum content as well as the more detailed and comprehensive content by EHR areas. Master tables examples that reflect EHR content vocabulary are:

- 6.9.1.1 Complete patient health history variables,
- 6.9.1.2 Complete patient self reporting history questions catalogue,
- 6.9.1.3 Complete patient assessment/physical exam variables,
- 6.9.1.4 Patient self reporting functional status reporting items (for example, SF-36, Dartmouth 9),
- 6.9.1.5 Health outcomes variables,
- 6.9.1.6 Master table of vital signs variables,
- 6.9.1.7 Master table of instrument monitoring variables, and
- 6.9.1.8 Master table of laboratory tests, etc.

6.9.2 Tests, supplies and equipment have attributes when considered in the abstract (separately from results or use in a particular patient). These are attributes that would be listed in a catalogue of the available tests, supplies or equipment. The attributes of a test might be when it could be obtained, the preparation requirements for specimens, the price, the normal range, the units and so on. Much of the same applies to supplies and equipment. The idea of maintaining a “catalogue” or definition table for items such as supplies, orders, observations and equipment is a powerful construct. It permits easy additions and extensions. (New tests and observations can be created without having to redefine the universe, or rewrite programs.) More attributes can also be added to the item to give the universe of entities new behaviors with little or no effect on the previous version of the world. Most laboratory systems, pharmacy systems, billing systems, inventory systems and other systems that must deal with large numbers of discrete items use a general object, or file to carry context-insensitive attributes and “pointers,” or indexes, to refer to the entry of

interest. Tables are used by the long-surviving EHRs.

6.9.3 The notion of observations in its most general sense is used to mean any aspect of a patient that can be described at a particular time. It follows Allan Rector’s idea of an observation (12) a serum glucose, a chest X-ray impression, a Glasgow coma score, each of the questions on a health or functional status, (for example, SF-36, D-9), a history of present illness, urine output and nurses notes are each an observation. An observation is an attribute of a patient, that is, an atomic unit or “chunk” in which clinical information is recorded. The observation, however, cannot stand alone. It has a context and general attributes that define that context that are independent of the particular patient’s observation, such as: units of measure in which it is reported, its name and synonyms, its class, information about how it is grouped in reports or where it is stored and so forth. This context-independent data is stored in master tables. These tables make it possible to accommodate different degrees of granularity and easily adapt to change. New entries are easily added to these tables since new concepts arise continually in patient care. It is again important to note that this document describes observations in an implementation independent fashion using a notation that depicts logical relationships but implies no implementation technique. Data element segments and grouping are used but other logical relationships could also be used. In any case master tables hold the context insensitive data while the groupings of data elements deal with the context sensitive relationships that establish the observation’s meaning.

6.9.4 When selected few observations are gathered in a particular setting, a simpler structure can be employed. For example, if a diabetes clinic wished to capture only 20 variables (for example, diastolic and systolic blood pressure, blood glucose, hemoglobin Alc, weight, pulse, foot lesions (present/absent) etc.) one record per visit might be created and specific fields defined for just those specific observations. A master term table would not be needed. But if other requirements arise, this approach is very rigid, limited and does not work well in the general case. A EHR may have 10 000, or more kinds of observations (there may be 5000 different laboratory tests that could be recorded, for example). Further, observations may be recorded multiple times by different providers during the same visit. The rigid structure cannot accommodate that situation.

7. The Overall Structure of the Electronic Health Record

7.1 The discussion of the structure of the EHR must relate the major entities (objects) of the record to the identified record segments. The clinical heart of the EHR is the core of the entities: patient, provider, problem, encounters, orders, services and observations. The record segments that relate to these entities are shown in Fig. 1. The focus of these relationships is the RADT object model, dealt with in Practice E 1715, that provides the foundation for linking the entities in Fig. 1 to the detailed inventory of data elements given in Annex A1. Table 4 shows how the segments currently accommodate the entities.

7.1.1 Notice that most of the entities listed in Fig. 1 have their own attributes. For example, the patient has the attributes of sex, race, birthdate, etc. Each order includes attributes that identify the item(s) ordered, the date of the order, the quantity

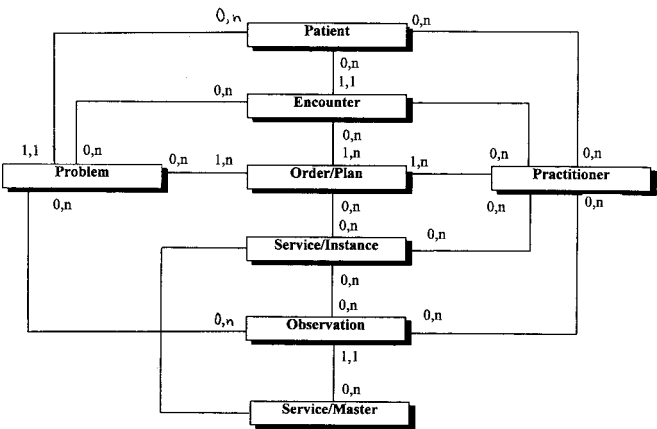


FIG. 1 Patient Record Object Model

7.2 *Perspective*—Representing the overall structure of the record is difficult since it is complex and has a number of dimensions. It also can be viewed from many perspectives. Four of these are: chronological, by encounter/episode, by problem, and by topic. Each of these views looks at the same stored data in a different way. There can be many perspectives and even more ways of displaying the same data. This guide must represent the complex storage structure in two dimensions. Therefore, in Appendix X1 several notational conventions are used. One of these is a “pointer” followed by a target segment or external master table. This allows data values in these tables to be referenced without clouding the basic structure being illustrated. These representations are not intended to imply implementation techniques but, rather, logical relationships. Another difficult task is that of representing the data needs of different settings in a manner that captures the diversity and complexity of the observations as they relate to service instances and requests. These aspects will be further expanded in the discussion of the appropriate segments.

TABLE 4 Patient Record Content Structure Data Categories, Segments and Entity Relationships

Data	Category and Segments	Entity
Administrative Data		
I	Demographics	Patient
II	Legal agreements	Patient
III	Financial information	Patient
IV	Provider/practitioner	Provider
Clinical Data: Problem/Diagnoses		
V	Problem list	Problem
Clinical Data: History		
VI	Immunization	Service instance
VII	Hazardous stressor exposure	Observation
VIII	Health history	Observation
Clinical Data: Assessments/Exams		
IX	Assessments	Observations
*	Patient reported data	Observation
Clinical Data: Care/Treatment Plans		
X	Clinical orders	Orders
Clinical Data: Services		
XI	Diagnostic tests	Observations
XII	Medications	Service instance
XIII	Scheduled appointment/ events	Encounter
Administrative Data: Encounters		
XIV	a	Patient
	f	Encounter
Clinical Data: Encounters		
	b	Observation
	c	Observation
	d	Service instance

^A These are new concepts or reordered data, or both. Note that the clinical heart of the EHR is the core of the entities (Objects). The record segments that relate to these are shown.

provider, the urgency of the order (stat, now, routine, etc.), the ordering instructions can be further broken down into amount, frequency, duration, special conditions for many orders. These will all be presented in detail in Section 9.

7.1.2 For some of these entities, the industry has enough experience with them that the overall structure is well understood and easy to describe. In some information areas, especially those that are represented by free text in the traditional record, much is yet to be learned.

7.3 *Segment Categories:*

7.3.1 In order to provide a comprehensive structure for the EHR record, it must be organized into major segments that are clearly identified and to which information can be consistently added from one setting and episode to another over time. The segments were identified through analysis of the content of the existing data sets and each segment describes and represents a category or type of information that can be seen in all patient care records.

7.3.2 As noted in Table 4, these segments have been regrouped for a more universal understanding of administrative and clinical. The following discussion deals with the essential data elements in each segment. The entire list is summarized in Appendix X1 and each element’s attributes are detailed in Annex A1, which gives a definition and form of representation. These elements may be utilized in different constellations in different settings, but each element’s meaning remains the same wherever it is used.

7.3.3 Segments 1 to 13 (see Table 4) contain elements that are widely used in all settings and apply to both patient record and the longitudinal precis regardless of setting. They are not specific to any one episode or encounter though they may be initiated or updated during an encounter. The way they reflect the relationships shown in Fig. 1 and Table 4 will be discussed in the following sections.

7.4 *Occurrence and Utilization of Record Segments in Different Settings*—Table 5 outlines the classes of settings that maintain a patient record of care which contains the identified segments to some degree.

7.5 *Segment 1, Demographics*—These are personal data elements, sufficient to identify the patient, collected from the patient or patient representative and not related to health status or services provided. Some of these elements may require updating at each encounter or episode and must satisfy various national standards and regulations such as a Joint Commission Standard, conditions of participation for medicare, uniform hospital discharge, ambulatory, and long term care data sets.

7.6 *Segment 2, Legal Agreements*—This includes data elements indicating legally binding directions or decisions.



TABLE 5 Sites of Care

Ambulance/aid-car	Hospital, government
Ambulatory surgery facility, free-standing	Hospital, outpatient department
Ambulatory surgery facility, hospital-based	Hospital, psychiatric
Birth center, free-standing	Hospital, rehabilitation
Birth center, hospital-based	Hospital, trauma center LVL 1
Clinic/health center, comp outpatient rehabilitation	Imaging services facility, free-standing
Clinic/health center, dental	Independent laboratory
Clinic/health center, free-standing	Industrial health/occupational health center
Clinic/health center, health maintenance organization	Intermediate care facility
Clinic/health center, outpatient mental health	Intermediate care facility-mentally retarded
Clinic/health center, pain	Mental health multiservice organization
Clinic/health center, rural	Mental health partial care organization
Clinic/health center, urgent care center, walk-in, free-standing	Private office, group, fee-for-service
Clinic/health center, vision	Private office, group, prepaid
Custodial care facility	Private office, solo practice
Day care center	Residential treatment center, emotionally
End-stage renal disease treatment facility	Disturbed children
Home health	Residential school
Hospice, free-standing	Retirement center
Hospital, acute care	School clinic/infirmary
Hospital, acute care with psychiatric services	Sheltered employment workshop
Hospital, burn center	Skilled nursing facility/nursing home
Hospital, cancer	Special education program
Hospital, children's	Substance abuse treatment facility, resident
Hospital, emergency room	Nursing center
	Vocational rehabilitation unit

patient healthcare, release of information and disposal of body or body parts, or both, after death.

7.7 Segment 3, Financial—This segment contains the references to the financial bodies that will cover the cost of care. This segment may be referred to from within the record, as during encounters/episodes. Such reference would obviate the need for a redundant collection of such data during the visit.

7.8 Segment 4, Provider/Practitioners:

7.8.1 This segment contains in one place the descriptive data about each provider/practitioner and may then be referenced when recording data about the events of healthcare. This includes the provider identifying data on the primary organization, or establishment responsible for the availability of healthcare services for a specific episode or encounter.

7.8.2 Practitioner identifying data elements are those associated with the individuals licensed or certified to deliver care to patients, who had face-to-face contact with the patient, and provided care based on independent judgment.

7.9 Segment 5, Problem List:

7.9.1 This includes specified clinical problems, a diagnosis summary and stressor exposure, an ongoing list of clinically significant health status events and factors, resolved and unresolved, in a patient's life. This list should contain all past and existing diagnoses, pathophysiological states, potentially significant abnormal physical signs and laboratory findings, disabilities, and unusual conditions. Other factors such as social problems, psychiatric problems, risk factors, allergies,

reactions to drugs or foods, behavioral problems or other health alerts may be included. The problem list is to be amended as more precise definitions of the problems become available. Controlled vocabulary for problem lists may be contained in a problem list directory master table.

7.9.2 This segment contains a master list of all of a patient's problems or diagnoses. It may be referenced, as noted in 7.18.2 in presenting the diagnostic summary beginning each encounter/episode. All problems or diagnoses initially recorded in a specific encounter/episode will also be entered in this master list.

7.9.3 Whenever possible, identification of risk factors (health alerts) that should be known prior to implementing any health services should be included in this section. They can be considered to be instances of a special type of patient problem and include allergies, contagious conditions, and adverse reaction to specified treatments.

7.10 Segment 6, Immunizations—Considered a component of patient health history, this segment contains, chronologically, all immunizations administered to the patient and their current status. This synopsis may also be copied to an emergency record to accompany medical alert data. Acquired (active or passive) or induced immunity or resistance to particular pathogens produced by deliberate exposure to antigens is included.

7.11 Segment 7, Exposure to Hazardous Substances:

7.11.1 The what, where, when, and how data on actual or potential exposure to all biological, physical or chemical agents that might be associated with adverse health effects are listed in this segment. This segment should provide data for epidemiological studies to determine correlation of disease with exposure to environmental stressors.

7.11.2 Because of the potentially long latency period in exposure to hazardous substances before the appearance of effects, the chronological record of exposure—both in the workplace and out, where appropriate—to hazardous chemical, physical, biological, or radiologic stressors to the body is contained in this segment. It has particular importance when accessed as part of the synoptic record because its completeness acts as a prompt to providers/practitioners long removed in time or space, or both, from the original entry that the signs and symptoms of health conditions may be due to previous exposure. Absence of such data does not rule out such exposure but presence provides direct clues needed to identify the possible causes of an observed condition.

7.12 Segment 8, Family/Prenatal/Cumulative Health/Medical/Dental Nursing History—The long term relevant natural family and patient history and signs which would aid practitioners in predicting or diagnosing illness, or actual or potential alterations in health, or predicting outcome of the patient's care are all the focus of this segment. The historic record of previous signs and symptoms complements the problem list in itemizing, in an integral way, the manifestations of prior disease, illness or health status not yet documented in the problem. It characterizes those already present in that list and it takes the form of a categorized list of questions of the form: "Have you ever_____? If so, when?" During each encounter/episode this list may be updated by the patient.

“Since the last visit have you ever _____? If so, when?” so that the most recent observations can be added to the growing list. This integral process then collects the most reliable observations from the patient, (historically categorized in patient records) review of systems, and nursing history or other method, and adds them to the historic body of (at the time) freshly collected data. Ideally, this process begins during gestation and the initial observations are transferred from the mother’s record to that of the newborn at birth. Fresh observations are added throughout the patient’s lifetime. If continuity can be maintained, the practitioner need not have to reconstitute the early record, at least not often, at each encounter. Recommended and optional attributes of patient history are included in a master table.

7.13 *Segment 9, Assessments/Exams:*

7.13.1 Assessments/exams characterizes the patient’s health status in tandem with the history. Depending upon the setting, this segment may include a general or specialty medical or dental exam or assessments by nursing, dietary, social service, therapy or dental hygiene specialists, or all of these. The assessments may be all-inclusive or may relate only to hands-on care of very special problems (that is, particular body systems, psychosocial assessment, dental, vision communication, etc.). All data pertinent to pre- and perinatal care including monitoring during delivery are also included in a post-delivery exam assessment. Details of the actual delivery for the newborn are to be entered in the specific section containing health factors of the neonate. Recommended attributes of assessments/exams are identified in master tables.

7.13.2 This segment records the observations of the practitioner during structured and systematic examinations of the patient’s body during encounters/episodes. It contains objective observations and measurements that quantify attributes of each body system. These are the same body systems about which patient questions are asked during the history. Such common categories allow characterization of expressed problems with observational evidence in explicit common terms and measures that, over time, allow practitioners to follow the course of illness and recovery. This focuses on the physical assessment of the patient and is combined with appropriate psychosocial assessment to compose overall patient assessment status. These observations complement the diagnostic terms described in 7.15. They also relate to the effects of therapeutic interventions, such as medications, as described in 7.16.

7.14 *Segment 10, Care/Treatment Plans and Orders:*

7.14.1 Data entries that direct a patient’s treatment includes detail data on deliverance of orders and compliance with any diagnostic or therapeutic treatment plans, whether written, oral or standing.

7.14.2 A care treatment plan may be a broad perspective program that identifies planned clinical encounters, education and scheduled events related to specific diagnosis or set of problems (for example, diabetes). It may also be a short term tool applied, for instance, in acute care or other setting that arranges interdisciplinary roles to carry out therapies, nursing services and other activities. While not always explicitly defined, care plans are typically based on protocols and guidelines. In some cases, they are developed via consensus.

7.14.3 A clinical order is an action-oriented message describing an intervention in the health of a specific patient originated by, or under the supervision of, a practitioner. A clinical order has legal implications regarding responsibilities for the ordered intervention as well as quality of care implications that may be assessed by supervisory bodies or clinical researchers, or both. It is therefore necessary to specify the logical structure of this message and to define the representations to be used for each constituent data element. The clinical order acts also as a communication and coordination mechanism for all of the practitioner and ancillary professionals who may participate in the actions set in motion by the order. The clinical order structure is complex and may be thought of as a network structure because of the complexity of relationships between specific data elements within the clinical order and other data elements located elsewhere in the care record. Because this complex structure is difficult, and perhaps practically impossible, to represent by means of two dimensional paper forms, there is no explicit manual-mode model for this kind of data structure. Paper records have relied on plain text representations in recording the order. In practice these relationships among the data elements have been implicit in the inculcated practices of professional training. This guide attempts to explicitly define this structure.

7.14.4 Since a clinical order is a message, it has a heading and a body. The heading specifies the originator, the object patient, the routing and the addressee(s). The body contains a structure that is greatly dependent upon the action addressee but does have a large degree of commonality across all types of orders. Since the message objective is a specific patient, a copy of all orders for that patient shall be filed in the patient’s care record. This follows current accountability practice regarding the manual record and its legal status as the record of care received by a patient. Other copies may be stored for use by the action or information addressees, as appropriate. A given clinical order may be more appropriately created by means of preexisting templates, or sets of templates, that contain preassigned data.

7.14.5 The data elements in each order are in the following functional groups:

7.14.5.1 Those that identify the patient,

7.14.5.2 Those that identify the action or ancillary service,

7.14.5.3 Those that identify the orderer(s),

7.14.5.4 Those that control the timing or delivery of services, or both,

7.14.5.5 Those that describe the requested service and conditions of delivery,

7.14.5.6 Those that document the delivery of results, and

7.14.5.7 Those that are used for quality assurance.

7.14.6 The logical structure in Appendix X1 lists these data elements showing their structural relationships within the message and the data elements to which they may be related in other segments of the clinical record.

7.14.7 *Orderer Group of Data Elements*—The elements in this group provide a means of tracking the initiation and responsibilities for each order. This group also helps ensure that various subordinate practitioners do not exceed the bounds of their training by ordering, unaided, procedures they claim to



yet been qualified to use. At the same time, these steps must, many times, be started in the absence of a practitioner having adequate authority to fully initiate the procedure or service ordered. In hospitals, the actions of the nursing staff and health practitioner students or those in training may require review and validation by co-signing for services having major health or cost implications from the aspect of accountability. Institutional policy must provide the criteria for expeditious action in identifying services needing higher permission levels from the responsible staff; this two-tier approach allows actions to be initiated in a timely fashion but yet rescinded, if appropriate. Therefore, the data elements in this group identify the needed information applying to a wide variety of situations. Nevertheless, not all elements may apply in a given situation.

7.14.8 Action/Ancillary Service Data Elements—The elements in this group identify the action performers and the type and priority of the order.

7.14.9 Order Content Data Elements—This group of data elements conveys the explicit service/actions desired for the patient. It may include patient data extracted from other segments of the record, as required to conduct the services or to carry out the action. Each ancillary service or treatment site must be able to define the data which will be required in this group in order to be able to carry out the ordered actions. Such data requirements will be found in appropriate subordinate files and will control, by prompting, the construction of the text of the order to meet these requirements. Modifications to the order shall be appended to the original text while other data elements shall document the course of each modification.

7.14.10 Result Group—This group of data elements documents the delivery of the result data from the service or action, as appropriate, while the results themselves are stored separately in the appropriate segments of the record.

7.14.11 Quality Assurance Group of Data Elements—This group of data elements documents the circumstances of actions that are exceptions to the routine process for each ordered action or service. They assume that a process is evaluating the specific criteria for each clinical order in order to establish the regular bounds. Because healthcare must deal with the unexpected and the unusual, recording of events that are unusual because they are outside the bounds of routine experience in no way implies that they are not required for treatment. Rather, these data elements flag such events so that they can be easily recognized for review. That they were reviewed is also documented in order to ensure that significant findings are not overlooked.

7.15 Segment 11, Diagnostic Tests—Significant details of tests performed aid the practitioner in the diagnosis, management and treatment of the patient. Documentation of the results from the clinical laboratory, radiology, nuclear medicine, pulmonary function and any other diagnostic examinations would be included. This segment contains the chronological list of all diagnostic tests ordered and conducted on the patient. The attribute data about each such test reference the order, problem list, appropriate physical exam or medication segments, or all of these, that may relate to the monitoring of therapeutic interventions to either measure therapeutic effects or detect adverse affects. It should be remembered that the

problem list, encounters and physical exam segments may, likewise, contain references to specific dates and types of tests that are associated with those problems, encounters or examinations and which help document the full implications of the meaning of such tests.

7.16 Segment 12, Medications:

7.16.1 A list of all long term medications and significant details on all medications prescribed or administered, or both, in the course of, or as a consequence of, an encounter or episode.

7.16.2 This segment contains data about the therapeutic chemical substances and treatments that have been prescribed as interventions in the disease process. All of the attributes of the order described in 7.14 are linked to this record by reference to the orders segment. Additional attributes provided by the pharmacist are also added to the record, including adverse affects reported in the history or the physical exam segments, or both. The problem list that identifies the problem being treated may also be referenced.

7.17 Segment 13, Scheduled Appointments/Events—This segment includes the list of planned or scheduled appointments that implement a treatment plan. It includes attributes that characterize the planned services, location and practitioners that constitute the plan.

7.18 Segment 14—Encounters/Episodes:

7.18.1 The concept of an encounter is usually defined to be a face-to-face session of the patient with a practitioner during which information about the patient's health status is exchanged. The encounter record should capture the facts relating to the events that took place—whether they occur in an inpatient setting or an ambulatory care environment. Certain information that characterizes the time, place and circumstances of the initiation of the encounter are first required. Then the information characterizing the patient's condition and reason for seeking care must be recorded. Next, the identification and characterization of the patient's problem(s), including referencing the encounter to the problem list must be included. Finally, the interventions ordered, the response to the actions performed, the departure condition and the required follow-up actions must be recorded, including a record of the services rendered. Because the circumstances leading to an encounter may be as direct as inpatient rounds by the attending physician to emergency room care (for example, traumatically injured patients), the data collected in the encounter may vary from brief to extensive. The collected data may not include all data elements identified, if these elements are not applicable to a given encounter. The logical structure shown in Appendix X1, however, identifies the minimal essential data elements that may comprise the ambulatory portion of the encounter record.

7.18.1.1 A discussion of this segment must first explain that the pointer arrows leading from the identified data elements to a logical file mnemonic is intended to portray that element is represented in a lexicon. The lexicon has associated attributes that are not dependent upon the context of the term in the encounter record, and the recorded element is the index into this lexicon. This notation enables discussion of the complexity of interrelationships among data elements of the record.



occur across and within segment boundaries. In order to reflect how the structure of the record parallels the practitioner's thought processes, these logical interrelations must be depicted using a generic convention and the data that are global to the individual encounter must be so identified in order to foster data independence wherever possible. This means avoidance of recording redundant data when that data are independent of the context. It also means using a key identifier or term to represent that invariant data which is stored in a logical list that can be referenced from within the context. This procedure avoids a common error in forms design in which specific instances, or data values, of a given data element are identified as separate data elements. A specific instance of a class name, for example, might be a specific drug or a unique lab test name. Use the above notation to convey membership in a lexicon name class.

7.18.2 *Segment 14A, Administrative/Diagnostic Summary:*

7.18.2.1 These are the data elements clarifying time/date, location, type and source of encounter or episode as they differ from information already contained in the related major segments (7.5-7.17). These should include the problems and the list of admitting and all other diagnoses which are a factor in the patients care during the specific episode or encounter and which should be added to the patient's problem list in 7.9.

7.18.2.2 This subsegment contains all of the data that characterizes the origin of the episode and the manner of arrival at the provider's facility, including the condition of the patient. It also summarizes the administrative conditions concerning the termination of treatment, excepting the disposition that is contained in 7.18.6.

7.18.3 *Segment 14B—Chief Complaint Present Illness/Trauma Care*—This contains health/medical/nursing dental history reference to Section 8 and history of chief complaint and reasons why the patient came in for care. This will include a review of systems as appropriate to the individual case and reference Section 9 as described in 7.13. It also includes reported pre-hospital care of emergency patients and assessment of the nature of traumatic injury and the results of stabilizing interventions.

7.18.4 *Segment 14C, Progress Notes/Clinical Course:*

7.18.4.1 This includes the components that form an ongoing chronological picture and analysis of the clinical course of the patient during an episode or encounter. This segment is applicable for any healthcare setting. These elements serve as a means of communication and interaction between members of the healthcare team. They may also occur as narrative or flow sheets. They constitute the record of patient response to therapies, procedures and other events.

7.18.4.2 This subsection contains all those data elements that characterize the clinical course of care and the condition of the patient. They will link to tests, therapies and procedures and will be represented by test or flow sheets.

7.18.5 *Segment 14D, Therapies:*

7.18.5.1 This includes significant details on all preventive or therapeutic, or both, services performed at the time of the episode or encounter or scheduled to be performed before the next episode or encounter. This subsection would not include any surgery performed in an operating room or that could be documented under either Segment 12 (7.16) or 7.18.6. Trans-

fusions, physical, occupational, nursing, respiratory, rehabilitative and mental health therapies would be included.

7.18.5.2 These elements are recorded to characterize all of the conditions of non-medication therapy, and they represent interdisciplinary therapy programs and results.

7.18.6 *Subsegment 14E, Procedures:*

7.18.6.1 This includes significant details on all procedures performed in an operating room for diagnostic, exploratory, or definitive treatment purposes.

7.18.6.2 This subsection contains data that characterizes those procedural events that accompany treatment of the patient, exclusive of laboratory phases of diagnostic procedures, which are recorded in Segment 11.

7.18.7 *Segment 14F, Disposition:*

7.18.7.1 This subsection identifies the circumstances under which the patient terminated the encounter or episode and includes data about the length of stay, condition of patient on disposition, recommended treatment and other information necessary for follow-up care.

7.18.7.2 This subsection contains that data that characterizes the conditions under which the encounter or episode was completed and the arrangements for appropriate follow-up either by the current or by other providers. It contains information needed to maintain continuity of care over several episodes or multiple encounters.

8. Alternative Views of the Logical Structure

8.1 The EHR requires content depth and retrieval flexibility. The proposed approach expands the idea of user specific data views to reflect the range of content from sparse to highly detailed. A data view is a specific collection of a set of data to meet user needs. This guide poses a minimum essential data view and a longitudinal precis view. The basic structure of this guide is expressed through the segments, now being adapted to the current perspective of objects. Content vocabulary is being assembled into master tables. Users are expected to begin with the standard as framework, build on the basic minimum data view and draw from the many master tables to specify their unique EHR requirements. As noted earlier in this guide, standard data views (such as uniform hospital discharge data, standard home health data set, etc.) were collected and incorporated into Annex A1. Additional views serve as ongoing resources to this work. Table 6 is a list of minimum essential data content or a minimum data view. It is organized according to currently proposed objects. Note that data items are intended for all EHR record sites unless marked as "conditional." This allows the variance between outpatient and inpatient as with a surgical procedure case. The "conditional" notation applies when the related events occur.

8.2 Just as master tables are a way in which to develop vocabulary depth within a framework, the data views provide the window for flexibility within a unified framework. This approach builds from the original work in this guide. Because the notation for conveying a common reference logical structure for the EHR depicts only a selected view of the complex interrelationships among the data elements, many readers may feel that their perspective is not represented. The selection of the notation used in Section 7 involved many compromises in selecting a reference representation. This section attempts to

rectify the omission of many other valid representations of the same elements and their relationships. Since it cannot be comprehensive, it fails in representing all views. It is intended as a guide to those whose view is not adequately depicted to provide an illustration that can be developed to represent their perspective. There are many aspects that are involved. One is selecting the grouping of data elements that captures the data about the care of a patient involved in the user's setting. Another is understanding how these data are used and whether there is colloquial vernacular involved and, if so, which data elements are affected. A third aspect is how these data are desired to be viewed. These views control how the index hierarchy represented in Section 7 would be transformed to logically represent the index priority desired. The notation of Section 7 groups certain elements together and links them together with pointer notation. A new view can represent these linkages differently by moving groupings and indexing using different key data elements that lead to the same logical outcome as Section 7. These new structures can be displayed differently but have the same logical implications.

8.3 Data views can represent unique care areas, subsets of the data to meet specific care needs and alternative displays of data. For instance, clinical flowsheets show the clinical results and treatments as a matrix (spreadsheet) in which the individual observations and treatment events are recorded in the bins of the matrix and the row and column labels identify the date-time and the variable.

8.3.1 The following are examples of alternative data views:

8.3.1.1 Clinical flowsheets,

8.3.1.2 Focused patient assessment/physical/mental exam data set by specialty/setting,

8.3.1.3 Prevention: risk factor data sets (pediatric, adolescent, adult, geriatric),

8.3.1.4 Healthcare outcomes data sets: diabetes care, obstetrical care, low back pain care, hypertension, benign prostatic hypertrophy,

8.3.1.5 Long term care data set,

8.3.1.6 Mental health data set,

8.3.1.7 Clinical program/clinical specialty data set (for example, breast cancer screening/monitoring),

8.3.1.8 Standard data elements for hospital drug surveillance,

8.3.1.9 Electronic health record for anesthesiology data set,

8.3.1.10 Electronic health record for emergency care data set,

8.3.1.11 National Committee on Quality Assurance patient record data set,

8.3.1.12 Longitudinal precis, and

8.3.1.13 Nursing minimum data set.

8.4 The EHR needs to be a reliable source of patient information in which a consistent base content can be found

regardless of care setting. Work has been done to reduce the initial minimum content data items to reflect the basic essential data that should be present in the EHR. In Table 6, the general list is noted. The proposed content reflects the minimum required to serve as a guide for developers and clinicians. This serves as a basic content foundation for EHRs.

8.5 *The Longitudinal Precis*—One common and important view of the EHR containing all data recorded about a patient is what has been termed the longitudinal precis, or, in other terms, the longitudinal health record or other synonyms. Management of chronic diseases; recognition of occupational illnesses; the outcome of traumatic injuries; the tracking of persons who have been exposed to environments later recognized as hazardous; and a ready synopsis of previous healthcare for each new practitioner who provides services to a patient, all are examples of the need for a longitudinal perspective. All of these uses require an accurate contiguous summary record of the significant events of care received by each individual. The goal of the longitudinal precis is to provide this integrated summary record. The first purpose of a longitudinal precis is to assist the clinical practitioner in assessment of the patient's past clinical problems by summarizing the documented primary data of the conditions that may be used in clinical judgments. It serves as a unified, coordinated, synopsis of the clinically significant genetic, environmental and clinical healthcare data and events aggregated over a person's lifetime.

8.5.1 *Properties of a Longitudinal Precis*—The salient facts from the original EHR should be assembled systematically, summarized, ordered by clinical importance and indexed to the original EHR. A longitudinal precis should be brief. Positive patient identification and significant sociodemographic data should begin the longitudinal precis. It should next summarize the patient's family history and genetic profile and should include hereditary and familial disorders potentially harmful family events such as childhood abuse, alcoholism and drug abuse. The patient's past health history should include past and current illnesses and surgeries, ranked by clinical significance as well as significant care problems experienced as a result of illness, injury or other health altering events. The genetic profile should name the finding(s) of specific laboratory studies and, if it represents an uncommon condition, an expanded description as part of the display of data. The longitudinal precis should link any past environmental exposure with potential or observed health problems. Exposure to environmental stressors should be named and followed briefly by quantitative details of the exposure and any suspected or clinical sequel. The longitudinal precis should next catalog past clinical episodes and diagnostic studies in order to facilitate retrieval of specific data such as EKG or laboratory tests.

TABLE 6 Minimum Essential Data Set—EHR Data View for All Settings

Entities	Data Elements	Segments	Conditional Status
Patient	Patient name Universal patient health number Record holding location ID	Segments I, II, III	Conditional (c) notation for designated items conditional to the event occurring



TABLE 6 *Continued*

Entities	Data Elements	Segments	Conditional Status
Encounter	Date of earliest held entry	Segments XIII, XIV	(c)
	Date of latest held entry		
	Date-time of birth		
	Birthplace		
	Sex (gender)		
	Race		
	Ethnic group		
	Religion		
	Marital status		
	Education level		
	Occupation		
	Family member name		
	Family member relationship		
	Patient permanent address		
	Consent signed/admit agreement		
	Patient rights acknowledgment		
	Directive to physician (primary healthcare practitioner)		
	Release of information action date		
	Type of record action		
	Person authorizing release		
Problem	Payment source	Segment V	(c)
	Payor group number		
	Payor ID number		
	Principal payment sponsor		
	Address of principal sponsor		
	Date time encounter/admission		
	Treatment facility name		
	Encounter type		
	Episode ID		
	Encounter diagnosis(es)		
Order-Care/treatment plan	Disposition date time	Segment IV	(c)
	Disposition type (master table)		
	Disposition destination		
	Disposition patient instructions		
	Text of note/report		
	Authentication/signature		
	Problem number(s)		
	Problem name		
	Problem date of onset		
	Problem current status		
Provider	Problem name @ encounter	Segment IV	(c)
	Problem name @ care/treatment or plan/order		
	Treatment Plan		
	Treatment Plan Id		
	Date-time		
	Care/treatment plan (text)		
	Clinical order(s) (full text)		
	Date-time of order		
	Provider/practitioner name		
	Provider address		
Observation—History	Provider type	Segments XIVA	(c)
	Provider ID number		
	Provider agency ID code		
	Practitioner name		
	Practitioner's universal ID number		
	Practitioner's profession		
	Practitioner's address		
	Practitioner's current role		
	Practitioner's authentication (signature)		
	Admission/encounter surgeon		
Observation—History	Admission/encounter surgeon role	Segment VIII	(c)
	Therapy perf practitioner		
	Anesthesiologist/Nurse anesthetist		
	Health history—previous illnesses		
	History taking event date		
	Source of history—contact name		
	History relationship source to patient		
	History—social (text)		
	Current habits/oral health practices (master table)		



Documents

Document Sharing Hub



TABLE 6 *Continued*

Entities	Data Elements	Segments	Conditional Status
Observation—Assessment/ Exams	Date-time of exam Health assessment/exam present illness/inj history Exam review of systems (Master table) Exam finding(s) Exam finding comment(s) Patient generated functional health status (Master table) Exam summary (text)	Segment IX	(c)
Observations—Diagnostic Tests	Test requested (Master table) Test/exam/spec-collection date-time Test request ordering treatment facility Test request performing facility Test date-time result reported Test report text Numeric measurement/analyte name Numeric measurement analyte value Numeric measure/analyze interpretation Test request microbial organism Microorg attribut Microbiol org resist patt Microbiol org spec comment Test comments	...	...
Observation—Encounter/ episode detail	Chief complaint (text) Reason for visit (Master table) Clinical progress note date-time (text) Clinical progress note (encounter) Authenticator/signature	Segment XI	...
Service Instance	Immunization name (Master table) Immunization date Medication pres/ord odate time Medication name (Master table) Medication prescriber Medication dose Medication vehicle/form (table) Medication route (table) Medication freq Medication instructions (text) Medication date of last refill Medication notes, for example, patient response (text) Name of therapy/service (Master table) Therapy start date-time Therapy finish date-time Therapists response assessment (text) Therapists recommendations Operation date-time Post-op diagnosis (Master table) Operative procedure name (Master table) Anesthetic agent (Master table) Post anesthesia assessment Operation complications	Segment XIV	...
		Segment VI, XII, XIVD/E	...

8.5.1.1 A longitudinal precis should be current, updated in a cost effective manner, and be an integral part of the EHR. Although it is a secondary record, it will require the same confidentiality and privacy protection as episodic patient records. Table 7 shows a sample general logical view of the precis according to the objects and segment's sources.

8.5.2 *Minimum Content and Data Categories*—The order of the categories of data utilized from the EHR by the longitudinal precis should begin with sociodemographic data and a list of long-term major health problems/risk factors which may then be directly accessed by practitioners to determine access to the remaining record. To provide a comprehensive structure for the

TABLE 7 *Content and Data Categories*

Object	Category	EHR Segment
Patient	Socio-demographic	I
Encounter	Episode/encounter index	XIV
Problem	Diagnoses/problems	V
Orders	Most recent treatment plan	X
Provider	Provider/practitioner	IV
Observation	(Health status and prevention risk)	IX
	Environmental exposures	VII
	Patient health history	VIII
	Diagnostic test results	XI
Medication profile	Immunizations	VI

longitudinal precis it must have access to all segments identified for the EHR in Section 7 and must organize that information in groupings optimized for its synoptic function. Table 7 summarizes these logical associations.

8.5.3 *Implementation*— A longitudinal precis could be a separate computer-based document or it could be the front part of the original source EHR. While the first level of presentation should be condensed and brief, an expanded presentation of selected data must be possible. Dates of service and clinical diagnoses/problems should serve as indexes to detailed data existing either in the longitudinal precis or the EHR itself.

9. Viewing the Overall Structure of the EHR from an Object Perspective

9.1 The purpose of this section is to initiate convergence and blending of data and terminology between the content and message standards for the EHR. Specific data item matches are noted where they occur with the specific originating standard codes. Section 9 organizes the basic information segments explained in Section 7 into major objects and defines direct mapping with the message standards data contained in Specification E 1238 and the comparable items contained in Health Level Seven Version 2.2. For example, 9.2.1.1, Name of patient P-6 (PN) from Specification E 1238 is matched to 01001 patient name from Annex A1 in this guide. Similarly, where term matches occur among this guide and HL7, the term is also labeled accordingly, for example, observation (OBR). This helps direct the users to see how this work is developing. It should be noted that many items directly relate to messages and not to content. Refer directly to the dictionary annex Annex A1 for the details for Specification E 1384. All tables contained in this section are illustrations from Specification E 1238 or are examples from HL7, or both. All tables will be reviewed for inclusion in Specification E 1633, which maps out the coded values and pointers to established code systems or related code tables, or both. Note also that in this section, the parent-child relationship refers to a process (parent) that generates a follow-on process (child.)

9.1.1 This section is still evolving, but it reorders and combines information to reflect another perspective.

9.1.1.1 The term electronic health record is used in this section to represent the specific content drawn from Specification E 1238.

9.1.1.2 The major entities (objects) of the EHR are shown listed in Table 8 and their interrelationships in Fig. 2.

9.1.1.3 The heart of the EHR is orders, encounters, services, and observations. Most of the other objects identify the persons (organizations) and places by whom, to whom and where care is given.

9.1.2 Major Objects Within the Patient Record:

9.1.2.1 The following subsections record the major “objects” that constitute a EHR and their principal attributes.

9.1.2.2 In the computer vernacular, entities with attributes can be represented as records where the set of entities correspond to the file. Each record represents a single entity, and the attributes of a single entity are stored in the fields of that record. A more general formulation is to consider the entity to be an object that accommodates more general data, structures and permits the bundling of behaviors (executable pro-

TABLE 8 Objects of EHR

1. Patient	9.2
2. Problem list	9.3
3. Orders (General)/Interventions/Treatment Plan	9.4
Treatment orders	9.4.2
Observation orders	9.4.3
Diet order specialization	9.4.4
4. Service instances	9.5
Specimen collection instances	9.5.2
Observation service instances	9.5.3
Observation battery instances	9.5.4
Treatment instances	9.5.5
5. Observations	9.6
6. Encounters	9.7
7. Appointments	9.8
8. Procedures	9.9
9. Legal agreements	9.10
10. Service order concept master	9.11
11. Provider master	9.12

TYPE	VALUE
EARLY	Early tray
LATE	Late tray
GUEST	Guest tray
NO	No tray
MSG	Tray message

FIG. 2 Values for Type

gramming code) with the data (13).

9.1.2.3 In the modeling context, consider the entities described above to be related globally as shown in Fig. 1.

9.1.2.4 The model in Fig. 1 is very global, a submodel of the MSDS JWG global model. It supplies a framework for the following paragraphs.

9.1.2.5 Notice that most of the entities listed in Table 8 have their own attributes. For example, the patient has the attributes of sex, race, birthdate, etc. Each order includes attributes that identify the item(s) ordered, the date of the order, the ordering provider, the urgency of the order (stat, now, routine, etc.), the ordering instructions (can be further broken down into amount, frequency, duration, special conditions for many orders. These will all be presented in detail in this section.

9.1.2.6 For some of these entities, the industry has enough experience with them that the overall structure is well understood and easy to describe. In some information areas, especially those that are represented by free text in the traditional record, much is yet to be learned.

9.1.3 *Data Types*—In the model that we describe, we are very explicit about an attribute’s data type, and these are precisely defined. (See Table 2 for a brief description. See Specification E 1238 and the MSDS JWG common data types document for full details.)

9.1.3.1 Three of the data types require special attention. The coded entry (CE) is a data type used to report coded entities (for example, ICD-9 diagnoses or NDC drug codes). However, a coded entry contains up to three pieces of information: the code, a text description (optional if the code is also stored) and a code that identifies the source book for the code (that is, it identifies the code as an ICD-CM or an ICD-10 or a CPT4 code). This ensures that a code will never be misinterpreted when code systems are replaced (for example, ICD-9 to ICD-10). The date-time data type permits varying degrees of granularity, from days down to hours, minutes or even seconds.



seconds; it can also specify the offset from Greenwich Mean Time when the time is not local time. A person's name is recorded as a five part data type (last or family name, first or given name, etc.).

9.1.3.2 Though the data types are precisely defined, this does not mean that a real implementation of an EHR would, for example, use strings to represent dates, or would have to provide a field for recording the offset Greenwich Mean Time. For the date/time an implementor might have one integer field for date and another for time, and always translate any time zone offsets into the local time for storage. But an implementor's storage structures should be able to represent the same information recorded in the model data type and be able to import and export data in these prescribed data types.

9.1.4 A number of devices have been employed to ease reader assimilation of the model shown in Fig. 1. The use of complex data types (for example, person's name) is one, because it reduces the number of atomic attributes that readers have to absorb and ensures that person's names will be treated uniformly throughout the model. The model allows repeating values for some attributes when they are appropriate (following CEN TC251 and the ASN.1's lead). Finally, most entities (for example, patients, providers, or services) can have many identifiers. For example, a patient might be identified by his state driver's license number (fifty possibilities), a credit card number (many people possess a great number of these) and so forth. So most of these objects will have an attribute for the preferred EHR identifier and a CE attribute with a variable number of values, each of which will include the identifier and the producer of the identifier. However, such simplifying approaches should not be interpreted as prescriptions for the implementation of real world systems.

9.1.4.1 In 9.2, Specification E 1238 and HL7 message segment cross-references are detailed. The alphanumeric (Line 1) catalogue number for the 1384 matched item is listed in Line 2. For example, HL7 objects are designated "observation (OBR), observation order (OBR), Patient (PID ...) etc."

9.2 Patient (Identifying and Contact Information):

9.2.1 These are personal data elements, sufficient to identify the patient, collected from the patient or patient representative, and not related to health status or services provided. More information on incorporating demographic information into an EHR can be found in Guide E 1239:

9.2.1.1 Name of Patient:

P-6 (PN)
01001. PATIENT NAME

Person receiving healthcare services and about whom records containing data about those services are collected. The patient's name shall be presented as last name, first name, middle name or initial, suffix, prefix, and degree, and each of these six components shall be separated by a component delimiter as defined in Specification E 1238 and the MSDS task group on data types.

9.2.1.2 Multiple Birth Indicator:

PV2-11 (ID)
01035. MULTIPLE BIRTH MARKER

Multiple birth marker (a term to distinguish identical individuals produced in the same gestation period.

9.2.1.3 Patient Health Identifier:

01016. UNIVERSAL PATIENT HEALTH IDENTIFIER

Unique personal identifier (unique number used by all providers/practitioners and third party payers in conjunction with establishing and using the longitudinal record. It will link services for the individual across care systems).

9.2.1.4 Other Patient Identifying Numbers—A multi-valued field that would accommodate any other identifiers. SSAN could be one voluntary option if privacy act notification is provided.

Social security number
01020. SSAN

Social Security Account Number—A pseudo social security number may be assigned if patient does not have an SSAN.

9.2.1.5 Date of Birth:

P-8 (DT)
01032. DATE-TIME OF BIRTH

Patient's birthdate shall be presented in the standard date format (YYYYMMDD). In the case of neonates, for whom the age in hours might be relevant, the birth can be recorded with the time of birth YYYYMMDDHHMM. Age can be generated from date of birth (DOB) if needed.

9.2.1.6 Place of Birth:

01033. BIRTHPLACE

The city, state, nation where the patient's birth records may be found.

9.2.1.7 Sex:

P-9 (ID)
01040. SEX

(As recorded at the start of care.) Distinction of gender. Field shall be represented by M for males, F for female patients. Record U when the gender is unknown.

9.2.1.8 Race:

P-10 (ID)
01042. RACE

The major biologic class to which the patient belongs as a result of a pedigree analysis or with which the patient identifies him/herself in cases where the data are not conclusive. Codes are W (White); B (Black); NA (Native American); O (Oriental or Asian); H (Hispanic); OTH (Other).

9.2.1.9 Ethnic Group:

(TX)
01045. ETHNIC GROUP

That cultural group with which the patient identifies him/herself either by means of recorded family data or personal preference. A patient may belong to several such groups depending upon heritage, language, nationality or social association. Full text names may be entered, and multiple entries are allowed, separated by repeat delimiters.

9.2.1.10 Religion:

P-28 (ID)
01047. RELIGION

Current religious affiliation of the patient at the start of care. A particular system of faith or worship. Codes or names may be sent; full names of religions may also be sent as needed.



Examples of religious codes and abbreviations are: P (Protestant); C (Catholic); M (Church of Latter Day Saints); J (Judaism); H (Hinduism); A (Atheist). When a full name is sent it should be preceded by a component delimiter, for example, Methodist or C (Coptic Rite).

9.2.1.11 Marital Status:

P-29 (ID)
01052. MARITAL STATUS

Marital status of patient at start of care. NEVER MARRIED (S): includes annulment of only marriage. MARRIED (M): includes common law. SEPARATED (A): married persons living apart except institutionalized. WIDOWED (W): spouse died and not remarried. DIVORCED (D): legally divorced and not remarried. Undetermined (U): status unknown.

9.2.1.12 Educational Level:

01060. EDUCATIONAL LEVEL

The highest level, in years, within each major (primary, secondary, college, post-baccalaureate) educational system, irrespective of any certifications achieved.

9.2.1.13 Occupation:

01065. CURRENT OCCUPATION

Employment, business, or a course of action in which one is engaged (that is, "student").

9.2.1.14 Mother's Full Name at Birth:

P-7 (PN)
01090.07. FAMILY MEMBER FEMALE PARENT

This is the biologic female parent of the patient to be used for family pedigrees. It is the full birth name of a newborn infant's mother, recorded as described in 6.5.3.

9.2.1.15 Father's Full Name:

01090.05. FAMILY MEMBER MALE PARENT

This is the biologic male parent of the patient to be used for family pedigrees. (Universal parent identifiers will be added when they are available.)

9.2.1.16 Patient's Permanent Address:

P-11 (AD)
01095. PATIENT PERMANENT ADDRESS

Usual residence or address of the patient, or both. May be referred to as the mailing address. Shall include the patient's city, state, province, country and zip or postal code of the patient's mailing address separated by component delimiters (see address data type in Specification E 1238).

9.2.1.17 Patient's Telephone Number:

P-13 (TN)
01100. HOME PHONE

This text value shall record the patient's day telephone and optionally the patient's night telephone, using the standard telephone number specification (see 6.6.18, TN Telephone and Beeper Number, of Specification E 1238), that includes options for area code, extensions, and beeper codes. The first telephone number will be the number at which the patient can be reached during the day. The second number (if required) is the number where the patient can be reached at night. When both are sent they should be separated by repeat delimiters.

9.2.1.18 Date/Time of Registration/Reservation:

P-33 (TS)
01197. REGISTRATION REVIEW DATE

This is the date when the registration record was reviewed by a responsible official for its accuracy. (In Specification E 1238, this field contains the date-time when the patient registration data being transmitted was last changed. This value is of use to peer-to-peer systems where both may register patients. When the registry data delivered by the sending system differs from that in such a receiving system, this field can help the receiving system decide when to overwrite its existing patient data with the newly received registry data. This is not the same as this field.)

9.2.1.19 Patient's Language:

P-31 (ST)

The value of this field indicates the patient's primary language. This may be needed when the patient is not fluent in the local language.

9.2.1.20 Confidentiality Class:

P-32 (ID)

This field indicates the degree to which special confidentiality protection should be applied to the patient.

V	—	Very restricted
R	—	Restricted
U	—	Usual control

9.2.1.21 Death Date/Time:

P-34 (TS)

When applicable, record the date (and the time, if known) of the patient's death in this field. The addition of this field to the patient segment provides a mechanism for communicating the date-time of death to various clinical systems. It is a critical piece of information when the data is being requested for clinical research as well as for many administrative and operational purposes, for example, appointment reminders.

9.3 Problem List:

9.3.1 This set constitutes a master list of all of a patient's problems or diagnoses. It may be referenced by many of the other objects: orders, encounters, and so on, as noted in ***6.16.1 in presenting the diagnostic summary beginning each encounter/episode. All problems or diagnoses initially recorded in a specific encounter/episode will also be entered in this master list.

9.3.1.1 A problem such as "cough" can be recorded as the value of a simple observation or as a formal problem. In the first case it is an observation: someone observed that the patient coughed. When recorded as a problem, it is a conclusion: the cough is an important issue in this patient and needs to be followed, diagnosed, or treated, or all of these. This distinction is subtle but important.

9.3.1.2 The problems within the problem list are broken down as separate objects, both because they have so much significance in the traditional patient record and because many events in the care process can (or must) be labeled by problem. Making the problem list a separate object class (table) facilitates such labeling.

9.3.1.3 The problem list (stressor exposure), as discussed in Section 7, is an ongoing, up-to-date list of clinically significant health status events and factors, resolved and in a well-defined



patient's past and existing life. The list should contain all past and existing diagnoses, pathophysiological states, potentially significant abnormal physical signs and laboratory findings, disabilities, and unusual conditions. Other factors such as social problems, psychiatric problems, risk factors, allergies, reactions to drugs or foods, behavioral problems or other medical alerts may be included. The problem list is amended as more precise definitions of the problems become available.

9.3.2 *Attributes of a Problem:*

9.3.2.1 *Problems Number:*

(ST)
05001.PROBLEM NO.

This is the practitioner assigned sequence number for a particular problem. For the present it is simply for the convenience of the problem recorder and is used to define the order in which the problems are ranked. The number can be written as a hierarchy (for example, 1.1, 1.2, 1.3 ...) to provide a hierarchical structure to the problem list. A systematic procedure for assigning these numbers across all practitioners has not been agreed upon.

9.3.2.2 *Problem Indication:*

(CE)
05001.01. CLINICAL PROBLEM INDICATION

This is the name or ID of the reason for establishing a separate problem, or both. The reason may be either a diagnosis, a finding, or a symptom. The identity can be recorded as free text, as ID (code) or both. Where the code is included the code source should also be identified in the third component of the CE data type. See 6.6.4, Test/Observation Identifiers, in Specification E 1238.

9.3.2.3 *Diagnosis Onset Date/Time:*

DG1-5 (TS (optional))
05001.03. EST DATE OF PROBLEM ONSET

This is the estimated date that the problem first occurred.

9.3.2.4 *Date of Problem Resolution:*

(TS (optional))
05001.15. DATE PROBLEM RESOLVED

This is the date that this particular problem is considered resolved and no longer needs active consideration.

9.3.2.5 *Current Status (Active, Resolved):*

(ID (optional))
05001.20 PROBLEM CURRENT STATUS

Active versus inactive.

9.4 *General Orders:*

9.4.1 Orders are requests for a particular service to be performed once, repeatedly, or continuously on a patient. They are usually written by health care professionals and include the name of a service (for example, glucose test, vital signs, penicillin) that can be an observation (glucose test), a medication (penicillin), a nursing treatment (wet to dry dressings), a consultation, a patient amenity (stationery), and instructions that specify the amount of the service, the frequency, the duration, and the urgency of the service, and special circumstances that should control the dispensing of the service.

9.4.1.1 A single order may request the performance of a package of predefined services. Orders for "routines stat" in many emergency rooms implies the performance of many

separate tests (for example, CBC, electrolytes, glucose, and blood urea nitrogen). Orders often ask that a service be repeated many times at intervals, for example, "vitals TID" asks for blood pressure, pulse, and respiratory rate to be observed and recorded three times a day indefinitely.

9.4.1.2 Thus one order can spawn many service instances (for example, a particular point in time when a specific service is performed). We define the service instance as a separate object because a place is often needed to record specific information about that instance. For example, when a practitioner in a hospital orders ampicillin 250 mg three times a day, a service instance is needed to record the time each dose is dispensed, the person who dispensed, etc. (The paper equivalent for drug dispensing is the MAR.) Service instances are not required for all ongoing orders, however.

9.4.1.3 Another complexity of orders is that the service requested may not be the service provided. A practitioner may order drug A, but because of formulary policies, patient wishes, etc., a related but different drug may be dispensed. Many other examples exist. The EHR has to have a place to record both what is requested when the order is first written and what is delivered by the service provider.

9.4.1.4 Finally, orders come in many types: orders for observations, for treatments, for teaching, etc. These subtypes have different attributes that are accommodated by different subobjects.

9.4.1.5 An order as recorded in the EHR is not the same as a message required to transmit that order to an independent computer. The message will often have to contain much of the information in the patient object, information about other encounters (if needed for billing purposes), or information about past observations (if needed to interpret the results of a test order). These do not become part of the order as it resides in the EHR because they are already recorded elsewhere in the EHR.

9.4.2 *Attributes of All Orders:*

9.4.2.1 *Place Order Number:*

Placer Order Number
ORC-2 (CM)

This field holds the unique identification number for the order.

9.4.2.2 *Universal Service ID:*

OBR-5 (CE)
Ordered Item

This field should contain an identifier code for the requested observation/test battery. This can be based on local or "universal" codes, or both. The "universal" procedure identifier is recommended. The structure of this CE data type is described in HL7 Page II-10 (<identifier>^ <text>^ <name of coding system>).

9.4.2.3 *Text Comment:*

C-4 (TX)
10001.100. CLINIC ORDER FULL TEXT

The textual content of the order detailing what action is to be taken and the means to go about it.

9.4.2.4 *Order Status:*

ORC-5 (ST)
10001.055 ORDER CONFIRMATION REQUEST





This field describes the status of an order. Refer to Table 9 for valid entries. The purpose of this field is to report the status of an order either upon request (solicited), or when the status changes (unsolicited). It does not initiate action. It is assumed that the order status always reflects the status as it is known to the EHR.

9.4.2.5 Response Flag:

ORC-6 (ST)

This field allows the placer (sending) application to determine the amount of information to be requested from the filler. Sometimes the requested level of response may not be possible immediately, but when it is possible, the filler (receiving) application must send the information. When the field is null, D is the default value of the field. Refer to Table 10 for valid entries.

9.4.2.6 Quantity/Timing Fields—A quantity/timing field provides a means of specifying when the service described by the order segment is to be performed and how frequently. Nine separate quantity/timing fields are required to fully specify some complex orders. More than one quantity-timing specification, separated by repeat delimiters, may appear. It should be considered a subrecord of sorts and a distinct data type. The components of a single quantity-timing specification are described in 9.4.2.7.

9.4.2.7 Quantity Component:

ORC-7.1 (CQ)

Indicates the quantity of the service that should be provided at each service interval. For example, if 2 blood cultures are to be obtained every 4 h, the quantity would be 2. If 3 units of blood are to be typed and cross-matched, the quantity would be 3. The default value is one. When units are required, they can be added, specified by a subcomponent delimiter.

NOTE 1—The component delimiter in this CQ is demoted to a subcomponent delimiter.

9.4.2.8 Interval Component:

ORC-7.2 (CM)
10001.067 CLIN ORDER EXECUTION FRE-
QUENCY

Determines the interval between repeated services. The default is one time only, the first subcomponent is the repeat pattern, and the second subcomponent is the explicit time at which pattern is to be executed:

Repeat Pattern

NOTE 2—Alternative settings may differ on standard intervals. Hospitals, hospices, and home care programs determine specific times to best meet their patient needs.

Here are some suggested codes:

TABLE 9 Order Status

Value	Description
CA	Order was canceled
CM	Order is completed
DC	Order was discontinued
ER	Error, order not found
HD	Order is on hold
IP	In process, unspecified
RP	Order has been replaced
SC	In process, scheduled

TABLE 10 Response Flag

Value	Description
E	Report exceptions only
R	Same as E, also replacement and parent-child
D	Same as R, also other associated segments
F	Same as D, plus confirmations explicitly
N	Only the MSA segment is returned

Q<integer>S	every <integer> seconds
Q<integer>M	every <integer> minutes
Q<integer>H	every <integer> hours
Q<integer>D	every <integer> days
Q<integer>W	every <integer> weeks
Q<integer>L	every <integer> months (lunar cycle)
Q<integer>J<day#>	repeats on a particular day of the week, from the French jour (day). If <integer> is missing, the repeat rate is assumed to be 1. Day #'s are counted from 1 = Monday to 7 = Sunday. So Q2J2 means every second Tuesday; Q1J6 means every Saturday.
BID	twice a day at standard-specified times (for example, 9 am to 4 pm)
TID	three times a day at standard-specified times (for example, 9 am to 4 pm to 9 pm)
QID	four times a day at standard-specified times (for example, 9 am to 11 am to 4 pm to 9 pm)
(Note that none of the above three specifications are equivalent to their Q <integer> H counterpart. QUID is not Q6H. The former is unequally spaced; the latter is equally spaced.)	
QAM	in the morning at specified time
QSHIFT	during each of three eight-hour shifts at institution-specified times
QOD	every other day (same as Q2D)
QHS	every day before the hour of sleep
QPM	in the evening at standard-specified time
C	service is provided continuously between start time and stop time
U <spec>	for future use, where <spec> is an interval specification as defined by the
Once	one time only. This is also the default when this component is null

9.4.2.9 Explicit Time Interval Subcomponent—This subcomponent will explicitly list the actual times referenced by the code in the first subcomponent, in the following format: HHMM,HHMM,HHMM, ... This second component will be used to clarify the first component in cases where the actual administration times vary within an institution. If the time of the order spans more than a single day, this new component is only practical if the same times of administration occur for each day of the order. If the actual start time of the order (as given by the fourth component of the QT field) is after the first explicit time, the first administration is taken to be the first explicit time after the start time. In the case where the patient moves to a location having a different set of explicit times, the existing order may be updated with a new QT field showing the changed explicit times:

Ex: 2nd component of QT field:
...^ QID&0230,0830,1430,2030^ ...

9.4.2.10 Duration Component :

ORC-7.3
10001.069 DURATION OF SERVICE

Indicates how long the service should continue after it is started. The default is INDEF (do indefinitely). This component is coded as follows:



Documents

Document Sharing Hub



S<integer> = <integer> seconds
M<integer> = <integer> minutes
H<integer> = <integer> hours
D<integer> = <integer> days
W<integer> = <integer> weeks
L<integer> = <integer> months
X<integer> = <integer> times at interval specified in the order. A request for 2 blood cultures Q2H X3 would imply obtaining 2 blood cultures 3 different times at 2-h intervals for a total of 6 blood cultures.
T<integer> = at the interval and amount stated until a total of <integer> "DOSAGE" is accumulated. Units would be assumed to be the same as in the QUANTITY field.
INDEF = do indefinitely—also the default.

9.4.2.11 Start Date-Time Component:

ORC-7.4 (TS)
Date/Time of treatment plan execution
10001.23 CLINIC ORDERS RELATED ORDERS

This may be specified by the orderer, in which case it indicates the earliest D/T at which the services should be started. In many cases, however, the start date time will be implied or will be defined by other fields in the order record (for example, urgency—STAT). In such a case, this field will be empty. The filling service will often record a value in this field after receipt of the order, however, and compute an end time on the basis of the start date-time for the filling service's internal use.

9.4.2.12 End Date-Time Component:

ORC-7.5 (TS)

When filled in by the requester of the service, this field should be the latest date-time that the service should be performed. If it has not been performed by the specified time, it should not be performed at all. The requester may not fill in this value, yet the filling service may fill it in on the basis of the instruction it receives and the actual start time. Regardless of the value of the end date-time, the service should be stopped at the earliest of the date-times specified by either the duration or the end date-time.

9.4.2.13 Priority Component:

ORC-7.6

Describes the urgency of the request. Five values are suggested (the default for priority is R):

S = Stat. With highest priority.
A = ASAP. Fill after S orders.
R = Routine.
P = Preop.
T = Timing critical. A request implying that it is critical to come as close as possible to the requested time, for example, for a trough antibiotic level.

If using the value "T" (timing critical), the degree of criticality can be specified thus:

Format:
TS<integer> = Timing Critical within <integer> seconds
TM<integer> = Timing Critical within <integer> minutes
TH<integer> = Timing Critical within <integer> hours
TD<integer> = Timing Critical within <integer> days
TW<integer> = Timing Critical within <integer> weeks
TL<integer> = Timing Critical within <integer> months

For the sequential orders specification, these values specify the time criticality with which the predecessor order must be followed by the given order.

9.4.2.14 Condition Component:

ORC-7.7 (ST)

Free text description of conditions under which the service should be done, for example, "PRN pain" or "as needed to control blood pressure."

9.4.2.15 Text Component:

ORC-7.8 (TX)

Full text version of the instruction (optional).

9.4.2.16 Conjunction Component:

ORC-7.9

A non-null component indicates that a second timing specification is to follow using the repeat delimiter. This field can take three values:

S = Synchronous do the next specification after this one (unless otherwise constrained by the START D/T and END D/T). An "S" specification implies that the second timing sequence follows the first, for example, when an order is written to measure blood pressure Q15 min for the first hour, then every 2 h for the next day.

A = Asynchronous do the next specification in parallel with this one (unless otherwise constrained by the START D/T and END D/T). The conjunction of "A" specifies two parallel instructions, as are sometimes used in medication, for example, Prednisone given at one tab on Mon, Wed, Fri, and at one-half tab on Tues, Thurs, Sat, Sun.

C = Actuation time it will be followed by a completion time for the service. This code allows one to distinguish between the time and priority at which a service should be actuated (for example, blood should be drawn) and the time and priority at which a service should be completed (for example, results should be reported).

For continuous or periodic services, the point at which the service is actually stopped is determined by the components END D/T, DURATION, whichever indicates an earlier stopping time. Ordinarily, only one of these components would be present, but if one requested an EKG with the specification:

^ 1^ QAM^ X3^ D10

then the EKG would be done for only three days since the number of repeats (three) defined the earlier stopping time.

9.4.2.17 Examples of Quantity/Timing Usage:

(1) 3^ once

Perform the service at one point in time, for example, order three units of blood to be given once.

(2) 1^ QHS^ X2

Perform the service twice at bedtime, for example, give a unit of blood at bedtime on two sequential nights.

(3) 1^ C^ 3D

Do a service continuously for three days.

(4) 1^ Q1H^ X4^ ^ ^ PVCs>10/min

Perform an EKG every hour up to a maximum of four EKGs, if patient is having more than ten PVCs per minute.

(5) 1^ Q2J^ ^ 1432

Perform a service every Tuesday at 2:32 p.m.

(6) 1^ ^ ^ ^ 198911210800

Perform a test before 11/21/89 0800, for example, some preop laboratory tests.

(7) 1^ Q3600S^ X5^ 198911051030

Perform a service every hour for 5 h starting at 10:30 a.m. 11/5/89, for example, draw a blood glucose





(8) 1^ QAM^ X3^ ^^^^ S\1^ QOD^ 4D^ ^^^ if K + > 5.5.

Perform a service every morning for three days and then do it every other morning for four days (that is, max twice) if the serum potassium is greater than 5.5.

(9) ^^^ 198812120800^ ^ T^ ^ Trough specimen for MIC^ C\^ ^^^^ R

Draw a blood specimen exactly at 8:00 a.m. on 12/12/1988 and report results routinely.

9.4.2.18 *Parent:*

ORC-8 (CM)

Parent's placer order identification. This field relates a child to its parent when a parent-child relationship exists (for example, when one order spawns another). (See Specification E 1238.)

9.4.2.19 *Date/Time of Transaction:*

ORC-9 (TS)

This field contains the date and time the current order was completed. For other messages, this is the date and time the current transaction (for example, cancellation) enters the sending application. This date and time is for the current transaction and is not a "replacement" time for a correction to the original order. Similarly, the Entered By, Verified By, and Enterer's Location fields of this segment relate to the current transaction, not the original order.

9.4.2.20 *Entered By:*

ORC-10 (CNA)

ID number and Name (PNA). This field contains the identity of the person who actually keyed the order into the application. It provides an audit trail in case the order is entered incorrectly and the ancillary department needs to clarify the request. By local agreement, either the ID number or name component may be omitted.

9.4.2.21 *Verified By:*

ORC-11 (CNA)

ID number and name (PNA). This field contains the identity of the person (CNA data type) who verified the accuracy of the entered order. It is used in cases where the order is entered by a technician and needs to be verified by a higher authority (for example, a nurse). By local agreement, either the ID number or name component may be omitted.

9.4.2.22 *Ordering Practitioner:*

ORC-12 (CN)
Name/credentials of practitioner ordering Tx
or authorizing the treatment plan.
10001.033 CLIN ORDER ORDERING PRAC-
TITIONER NAME

This field contains the identity of the person who is responsible for creating the order (for example, ordering physician).

9.4.2.23 *Enterer's Location:*

ORC-13 (CM)

This field contains the location (for example, department, floor) of the person who entered the order. It is a composite field that may be used on a site-specific basis to include some subcategory of department. For example, ICU4 might be the designation for a fourth-floor ICU location.

9.4.2.24 *Order Effective Date/Time:*

ORC-15 (TS)

The order effective date/time field contains the date/time that the changes to the order took effect or are supposed to take effect.

(1) If the transaction date/time (ORC;9) is after or equal to the order effective date/time (ORC;16), the data values in the ORC and its subordinate segments took effect on the order effective date/time.

(2) If the transaction date/time (ORC;9) is before the order effective date/time, the data values in ORC and its subordinate segments are planned to take effect on the order effective date/time.

(3) If the order effective date/time is left blank, its value is assumed to be equal to the transaction date/time or the message date/time (MSH;7) if the transaction date/time is blank.

(4) In the case where the order effective date/time (for order control code event in the same ORC segment) is different from the corresponding date/time in the quantity-timing field, the order effective date/time takes precedence. Thus if the ORC event is a discontinue request to the filler for a continuing order, and the order-effective date/time is prior to the end date/time of the quantity timing field, the order effective date-time should take precedence. If the order identified in the ORC has children, the children which have not started should be canceled; if there is a child in process, it should be discontinued; if a child has progressed beyond the point where it can be discontinued, its status is unaffected.

9.4.2.25 *Entering Organization:*

ORC-17 (CE)

This field contains the organization that the enterer represents at the time he/she enters/maintains the order.

9.4.2.26 *Entering Device:*

ORC-18 (CE)

This field shall contain the identifier of the physical device (terminal, PC) used to enter the order.

9.4.2.27 *Call-Back Phone Number:*

ORC-21 (TN)

This field contains the telephone number to call for clarification of an order or other information regarding the order.

9.4.2.28 *Relevant Clinical Information:*

OBR-14 (ST)
Plan of action (text)
10001.099. ORDER PRINCIPAL PROBLEM

The main problem that occasioned this order. This will include the rationale and plan of action that lead to this order, including clinical goals and objectives. (From HL7: Additional clinical information about the patient or specimen.)



provided here. This field is used to report the suspected diagnosis and clinical findings on requests for interpreted diagnostic studies.)

9.4.2.29 Serv Sect ID 00548:

OBR-25 (ID)
Order Text

This optional identifier shall denote the section of the diagnostic service where the observation was performed. If the study was performed by an outside service, the identification of that service should be recorded here. Refer to Table 11 for valid entries.

9.4.2.30 Result Copies to (CNA) 00551:

4.2.1.2.28, Specification E 1238
OBR-29

In case a report is produced as a result of the order, this field identifies the people who are to receive copies of the report. The individuals are identified through code or by name.

9.4.2.31 Transportation Mode (ID) 00625:

4.2.1.2.30, Specification E 1238
OBR-31

When a service requires transportation, this attribute indicates how (or whether) that transportation should take place. Refer to Table 12 for appropriate values.

9.4.2.32 Reason for Study (CE) 00626:

4.2.1.2.31, Specification E 1238
OBR-32

Required for some studies to receive reimbursement.

9.4.2.33 Sender Name or ID:

[6.14.1.3
H-5 (ST)

9.4.2.34 Source Facility Identification:

11001.01.06. TEST REQ ORDERING TREAT
FAC

The name or identifier of the facility from which the test was requested in a clinical order.

9.4.3 Treatment Orders—Extra attributes required when the order is for a drug or treatment:

TABLE 11 Diagnostic Service Section ID

Code	Description	Code	Description
AU	Audiology	OUS	OB ultrasound
BG	Blood gasses	OT	Occupational therapy
BLB	Blood bank	OTH	Other
CUS	Cardiac ultrasound	OSL	Outside lab
CTH	Cardiac catheterization	PHR	Pharmacy
CT	CAT scan	PT	Physical therapy
CH	Chemistry	PHY	Physician (Hx, Dx, admission note, etc.)
CP	Cytopathology	PF	Pulmonary function
EC	Electrocardiac (for example, EKG EEC Holter)	RX	Radiograph
EN	Electroneuro (EEG EMG)	RUS	Radiology ultrasound
HM	Hematology	RC	Respiratory care (therapy)
IMM	Immunology	RT	Radiation therapy
MB	Microbiology	SR	Serology
MCB	Mycobacteriology	SP	Surgical pathology
MYC	Mycology	TX	Toxicology
NMS	Nuclear medicine scan	VUS	Vascular ultrasound
NMR	Nuclear magnetic resonance	VR	Virology
NRS	Nursing service measure	XRC	Cineradiograph

TABLE 12 Transportation Mode

Value	Description
CART	Cart—patient travels on cart or gurney
PORT	The examining device goes to patient's location
WALK	Patient walks to diagnostic service
WHLC	Wheelchair

4.5.3.1.1 Requested Give Code, Specification E 1238
RXO-1 (CE)

9.4.3.1 Medication (Generic or Brand Name):

12001.06. MEDICATION NAME

Description of the current product. This is the identifier of the medical substance ordered to be given to the patient; it is equivalent to the Universal Service ID code of the OBR in function. The request-to-dispense fields, which define the type and amount of what is to be issued to the patient (see Fields 10 to 12 below) do not necessarily correlate with the instructions of what amount is to be “given” or administered with each dose, and may or may not be specified with the order. For example, the “give” part of the order may convey the field-representation of *give 15 mg of Librium* every 6 h, while the request to dispense part of the order may convey *issue 30 tablets of 10 MG generic equivalent for this outpatient prescription*. When the give code does not include the dosage form, use the requested dosage form field.

9.4.3.2 Requested Give Amount—Minimum:

4.5.3.1.2, Specification E 1238
RXO-2 (NM)
[6.15.1.5
12001.30. MEDICATION DOSE

Strength, dosage, concentration. The ordered amount. In a variable dose order, this is the minimum ordered amount. In a nonvarying dose order, this is the exact amount of the order.

NOTE 3—This field is not a duplication of the first component of the quantity/timing field, since in non-pharmacy orders, that component can be used to specify multiples of an ordered amount.

Another way to say this is that, for pharmacy orders, the quantity component of the quantity/timing field refers to what is to be given out at each service interval; thus, in terms of the RX order, that first component always defaults to one. Hence, in the actual execution of the order, the value of one in the first component of the quantity/timing field always refers to one administration of the amount specified in this field (the requested give amount field).

9.4.3.3 Requested Give Amount—Maximum:

4.5.3.1.3, Specification E 1238
RXO-3 (NM)

In a variable dose order, this is the maximum ordered amount. In a nonvarying dose order, this field is not used.

9.4.3.4 Requested Give Units:

4.5.3.1.4, Specification E 1238
RXO-4 (CE)

The units for the given amount.

NOTE 4—These units can be a “compound quantity”; that is, the units may contain the word “per.” For example, micrograms per kg (mcg/kg) is an acceptable value, which means that the units are micrograms per kg (of body weight). See Section 7 for full definition of units.



9.4.3.5 Requested Dosage Form:

4.5.3.1.5, Specification E 1238
RXO-5 (CE)
[6.15.1.6 Dosage form
12001.36. MEDICATION VEHICLE/FORM

The form of the medication including vehicle (for example, syrup). Use the requested dosage form field when both the give codes and the dispense code do not specify the drug form.

9.4.3.6 Practitioner's Pharmacy Instructions:

4.5.3.1.6, Specification E 1238
RXO-6 (ST)
[6.15.1.12 Text Instruction
12001.45. MEDICATION INSTRUCTIONS

The ordering provider's instructions to the pharmacy as a free text field.

9.4.3.7 Practitioner's Administration Instructions:

4.5.3.1.7, Specification E 1238
RXO-7 (ST)

The ordering provider's instructions "sig" to the patient or to the provider administering the drug as a free text field, that is, in a form understandable to the patient.

9.4.3.8 Deliver-to Location:

4.5.3.1.8, Specification E 1238
RXO-8 (ID)

This is a two-component field:

Nurse__Unit&Room&Bed&Facility__ID
Street__Address&Other__Designation&
City&State<or>Province&ZIP Code&Country

The first component contains the inpatient or outpatient location to which the pharmacy is to deliver the drug (if applicable). The default (null) value is the current census location for the patient. Site specific table. This field has the same form as PV1;3, "assigned patient location."

NOTE 5—The facility ID subcomponent is under current discussion for inclusion as part of the various location fields. It is optional.

The second component can be used to specify an address. This could be used to fill mail orders to a patient or provider, or to account for home health care.

9.4.3.9 Substitution Flag:

4.5.3.1.9, Specification E 1238
RXO-9 (ID)

Values are the following:

N	Substitutions are NOT authorized. (This is the default—null.)
G	Allow generic substitutions.
T	Allow therapeutic substitutions.

9.4.3.10 Requested Dispense Code:

4.5.3.1.10, Specification E 1238
RXO-10 (CE)

This is what is to be/was dispensed; it is equivalent to the universal service ID code of the OBR in function. It may be present in the order or not, depending on the application. If not present, and values are given for Fields 10 and 11 (requested dispense amount and units), the requested give code (Field 1) is assumed. If the dispense code does not include the dosage form, use the requested dosage form field.

9.4.3.11 Requested Dispense Amount:

4.5.3.1.11, Specification E 1238

RXO-11 (NM)

The amount to be dispensed.

9.4.3.12 Requested Dispense Units:

4.5.3.1.12, Specification E 1238
RXO-12 (CE)

The units for the dispense amount (for example, tabs, suppositories). This must be in simple units that reflect the actual quantity of the substance to be dispensed. It does not include compound units.

NOTE 6—On request-to-dispense fields, sometimes an order will be written in which the total amount of the drug requested to be dispensed has no direct relationship with the give amounts and schedule. For example, an outpatient pharmacy order might be *take four pills a day of <drug name, value>, O6H (every 6 h)—dispense 30 tablets*. An inpatient order might be *NS/D5W (normal saline with 5 % dextrose) at 1000 cc/hour—dispense three 1-L bottles of NSD5W solution*. The request-to-dispense fields support this common style of ordering.

9.4.3.13 Number of Refills:

4.5.3.1.13, Specification E 1238
RXO-13 (NM)
[6.15.1.10 Number of refills authorized
12001.51. MEDICATION NO OF REFILLS

Number of times the prescription is authorized to be refilled. Outpatient only.

9.4.3.14 Pharmacist Verifier ID:

4.5.3.1.15, Specification E 1238
RXO-15 (CN)
[6.15.1.11 Dispensing person's name
12001.54.01. MEDICATION REFILL DISP
FACIL

Practitioner ID of pharmacist verifier. Use if required by the pharmacy application or site on orders (or some subgroup of orders), in addition to the "verified by" practitioner in the ORC. Each facility dispensing a refill of a specific prescription must be uniquely identified. Example: The site requires a "verified by" practitioner (such as a nurse) and a "verifying pharmacist" on the order. In this case the first field, "verified by," is already present in the ORC segment, but the second field, "verifying pharmacist," is needed on the RXO.

9.4.3.15 Needs Human Review:

4.5.3.1.16, Specification E 1238
RXO-16 (ID)

This field has the following values:

Y	Indicates that the pharmacist filling the order needs to pay special attention to the text in the provider's pharmacy instructions field. A warning is present.
N	No warning is present. This is the equivalent default (null) value.

An example of the use of this field is given by the following case:

A *smart* order entry application knows of a possible drug interaction on a certain order, but the provider issuing the order wants to override the condition. In this case, the pharmacy application receiving the order will want to have a staff pharmacist review the interaction and contact the ordering physician. A value of "Y" in the needs human review field serves to signal the need for such a review, as described in the practitioner's pharmacy instructions field.

9.4.3.16 Requested Give Per (Time Unit):

4.5.3.1.17, Specification E 1238



E 1384

RXO-17 (ST)
Frequency of Administration
12001.32 MEDICATION FREQ

The time unit to use to calculate the rate at which the pharmaceutical is to be administered or the interval between doses:

Format:
S<integer> = <integer> seconds
M<integer> = <integer> minutes
H<integer> = <integer> hours
D<integer> = <integer> days
W<integer> = <integer> weeks
L<integer> = <integer> months

Note that this is the same as the format specified for the DURATION component of the quantity/timing field, excluding the “X” specification. This field is required when relevant (for example, certain IVs). For example, if the “give amount/units” are 300 mL and the “give per” time unit is H1, the rate is 300 mL/h and the duration of this dose is 1 h. Thus the give amount and give per time unit define the duration of the service. This field is distinct from the “interval” component of the quantity/timing field, but it could be used in conjunction with it, as in give 300 mL of NS per hour for 1 h, repeat twice a day.

9.4.3.17 Route:

4.5.3.2.1, Specification E 1238
RXR-1 (CE)
[6.15.1.7 Route of administration
12001.39. MEDICATION ROUTE

A term identifying the route of administration. Refer to Table 13 for appropriate values. Some current “route codes” such as some of the NDC-derived codes include the site already. In such cases, the entire code can be included in this field as a “locally defined code” for the CE data type.

9.4.3.18 Administrative Site:

4.5.3.2.2, Specification E 1238
RXR-2 (CE)

The site of the administration route. Refer to Table 14 for appropriate values. As a CE data type, this field may be extended to cover a wide variety of body site codes (for example, when SNOMED is used as the table source).

9.4.3.19 Administration Device:

4.5.3.2.3, Specification E 1238
RXR-3 (CE)

Mechanical device used to aid in the administration of the

TABLE 13 Route

Code	Description	Code	Description
AP	Apply externally	IV	Intravenous
B	Buccal	NS	Nasal
DT	Dental	NG	Nasogastric
GTT	Gastrostomy tube	OP	Ophthalmic
GU	GU irrigant	OT	Otic
IA	Intra-arterial	PO	Oral
IC	Intracardiac	PR	Rectal
ID	Intradermal	SC	Subcutaneous
IH	Inhalation	SL	Sublingual
IM	Intramuscular	TP	Topical
IN	Intranasal	TD	Transdermal
IO	Intraocular	TL	Translingual
IP	Intraperitoneal	UR	Urethral
IS	Intrasynovial	VG	Vaginal
IT	Intrathecal		

TABLE 14 Site

Code	Description	Code	Description
BE	Bilateral ears	LVL	Left vestus lateralis
OU	Bilateral eyes	NB	Nebulized
BN	Bilateral nares	PA	Perianal
BU	Buttock	PERIN	Perineal
CT	Chest tube	RA	Right arm
LA	Left arm	RAC	Right anterior chest
LAC	Left anterior chest	RACF	Right antecubital fossa
LACF	Left antecubital fossa	RD	Right deltoid
LD	Left deltoid	RE	Right ear
LE	Left ear	REJ	Right external jugular
LEJ	Left external jugular	OD	Right eye
OS	Left eye	RF	Right foot
LF	Left foot	RG	Right gluteus medius
LG	Left gluteus medius	RH	Right hand
LH	Left hand	RIJ	Right internal jugular
LIJ	Left internal jugular	RLAQ	Right lower abd. quadrant
LLAQ	Left lower abd. quadrant	RLFA	Right lower forearm
LLFA	Left lower forearm	RMFA	Right mid forearm
LMFA	Left mid forearm	RN	Right naris
LN	Left naris	RPC	Right posterior chest
LPC	Left posterior chest	RSC	Right subclavian
LSC	Left subclavian	RT	Right thigh
LT	Left thigh	RUA	Right upper arm
LUA	Left upper arm	RUAQ	Right upper abd. quadrant
LUAQ	Left upper abd. quadrant	RUFA	Right upper forearm
LUFA	Left upper forearm	RVL	Right vastus lateralis
LVG	Left ventragluteal	RVG	Right ventragluteal

drug. Common examples are IV-sets of different types. Refer to Table 15 for values.

9.4.3.20 Administration Method:

4.5.3.2.4, Specification E 1238
RXR-4 (CE)

The administration method identifies the specific method requested for the administration of the drug to the patient. Refer to Table 16 for values.

9.4.4 *Observation Orders*—Attributes needed for observation orders. To be added in the revision of this guide.

9.4.5 *Diet Orders*— This section is still being developed and will be added to the next revision of this guide. Attributes needed for diet orders. This needs to be better harmonized with the treatment orders.

9.4.5.1 Type—Diet, Supplement, or Preference:

ODS-1 (ID)

This ID tells whether the segment specifies a diet, nourishment, or supplement (D, S, or P).

9.4.5.2 Service Period:

ODS-2 (CE)

When blank, the modifier applies to all service periods. Diet orders, for example, typically apply to all service periods. This field will usually be specified for nourishments and supplements. This field allows you to designate a modification for one

TABLE 15 Administration Device

Code	Description	Code	Description
AP	Applicator	IVS	IV solution
BT	Buretrol	MI	Metered inhaler
HL	Heparin lock	NEB	Nebulizer
IPPB	IPPB	PCA	PCA pump
IVP	IV pump		



Documents

Document Sharing Hub

TABLE 16 Administration Method

Code	Description	Code	Description
CH	Chew	NB	Nebulized
DI	Dissolve	PT	Pain
DU	Dust	PF	Perfuse
IF	Infiltrate	SH	Shampoo
IS	Insert	SO	Soak
IR	Irrigate	WA	Wash
IVPS	IV piggyback	WI	Wipe
IVP	IV push		

or more of the service periods during a day by combining service specifications as needed. The service periods will be local CEs, normally numbers. Typically, Service 1 is breakfast, Service 2 is mid-a.m. snack, Service 3 is lunch, Service 4 is mid-afternoon snack, Service 5 is dinner, and Service 6 is bedtime snack. Ex: |1 ~ 5| means Service 1 and Service 5, whatever these are locally defined to be.

9.4.5.3 Diet, Supplement or Preference Codes:

ODS-3 (CE)

This is the identifier of the ordered item for a patient; it is equivalent to the universal service ID code of the OBR in function. Since ODS is a repeating segment, multiple entities get multiple segments. For example: |↑ REG^ L&FD7|, |023^ L&FD6|, |↑ NOLACT^ L&FD5|, |↑ TUBEFD^ L&FD4|, and |009^ ADA20^ L&FD3|. In the case of supplements (S), it is a specification for a particular item or class of items. If institutional codes for patient food preferences (P) have been codified, they are also expressed as coded segments; otherwise, the information is passed as a text string in the fourth component of the ODS segment, described below.

9.4.5.4 Text Instruction:

ODS-4

This allows specific instructions for dietary. These instructions may address specific patient needs, such as isolation.

9.4.5.5 Tray Type:

ODT-1 (CE)

The type field says what kind of information follows in this particular segment. The defined values for type are given in Fig. 2. Tray specifications are useful for early and late tray delivery in cases where a patient undergoes a procedure during normal feeding times. Tray specifications can also be used for guest trays, no trays, and messages.

9.4.5.6 Service Period:

ODT-2 (CE)

When blank, the modifier applies to all service periods. This field allows you to designate one or more of the feeding periods during a day by combining the codes as needed. It can also combine with quantity/timing to give such information as which service period the order belongs to.

9.4.5.7 Text Instructions:

ODT-3 (CE)

Instructions associated with the tray. For example, plastic silverware.

9.5 Service Instances:

9.5.1 This object represents the specific service performed at a specific time. An order often is associated with one or more

service instance. When, for example, penicillin is ordered as 250 mg every 6 h, a service instance is generated four times a day, one for each dispensing of the 250 mg pill. When a glucose test is ordered every morning for three days, three separate service instances occur. The service instance carries information about what was done by whom. The service instance documents that a service was performed and by whom. Orders for tests that require specimens to be drawn almost always generate a service instance related to the specimen (separate from the observation service instance). This contains information about the specimen and who drew it. The relation between an order and its service instance may vary with the setting. Continuing inpatient medication orders generate service instances. Outpatient prescriptions usually do not.

9.5.1.1 The attributes that apply to a service instance depend upon the kind of order. From the perspective of the EHR, the service instances that require specimens will have attributes related to the specimen. Drug orders (in the inpatient area) will have attributes related to the drug dispensed and by whom. These attributes are presented for the two subobjects of treatment service and test services in two separate sections.

9.5.2 *Specimen Collection Instances*—Providers write orders for observations in order to obtain information to diagnose, treat and manage their patients. This includes orders for pathology and clinical laboratory, radiology, nuclear medicine, respiratory therapy studies, for vital signs, special measurements, etc. An observation order can request a single measurement (for example, glucose), or a battery of measurements (for example, CBC, vital signs). An observation can request such a measure at a point in time (for example, glucose—stat), at intervals over time (for example, vital signs three times a day) or continuously (for example, cardiac monitoring).

9.5.2.1 *EHR Order Number*—Link to the order (see 5.1) that triggered this specimen collection. (One order may trigger many separate collections.)

9.5.2.2 *Specimen Identifier Number*—Unique identifier for each specimen.

9.5.2.3 *Date/Time Specimen Collection Planned*—Time when collection was requested or specified.

9.5.2.4 Observation Date/Time:

4.2.1.2.7
OBR-8 (TS)
11001.01. DATE OF SPECIMEN COLLECT

In the case of a specimen-associated study, this field shall represent the date and time the specimen was collected or obtained.

9.5.2.5 Observation End Date/Time:

OBR-9 (TS)

This field shall contain the end date and time of a study or timed specimen collection. If an observation takes place over a substantial period of time, it will indicate when the observation period ended. For observations made at a point in time, it will be null. This is a results field except when the placer or a party has already drawn the specimen.

9.5.2.6 Collection Volume 00532:

4.2.1.2.9, Specification E 1238
OBR-10 (CQ)



The volume of a specimen. The default unit is ML. Specifically, units should be expressed in the ISO standard unit abbreviations (see the table on Single Case ISO Units Abbreviations in Specification E 1238 or ISO 2955-1983a). This is a results-only field except when the placer or a party has already drawn the specimen. (See Section 7 for full details about units.)

9.5.2.7 Collector Identifier 00533:

4.2.1.2.10, Specification E 1238
OBR-11 (CN)

This field identifies the person, department, or facility that collected the specimen. Either name or ID code, or both, may be present.

9.5.2.8 Specimen Action Code 00534:

4.2.1.2.11, Specification E 1238
OBR-12 (ID)

Indicates the action to be taken with respect to the specimen. The purpose of this field is to further qualify (when appropriate) the general action indicated by the order control code contained in the order segment which triggered the specimen collection. For example, when a new order (ORC—"NW") is sent to the lab, this field would be used to tell the lab whether or not to collect the specimen ("L" or "O"). Refer to Table 17 for valid entries.

9.5.2.9 Danger Code 00535:

4.2.1.2.12, Specification E 1238
OBR-13 (CM)

This field shall contain a code or text, or both, indicating any known or suspected patient or specimen hazards, for example, patient with active tuberculosis or blood from a hepatitis patient. Either code or text, or both, may be absent. However, the code is always placed in the first component position and any free text in the second component. Thus, free text without a code must be preceded by a component delimiter.

9.5.2.10 Specimen Received Date/Time 00537:

4.2.1.2.14, Specification E 1238
OBR-15 (TX)

For observations requiring a specimen, the actual login time at the diagnostic service. (This is a results-only field.)

9.5.2.11 Specimen Source— The source of the specimen (the site where the specimen should be obtained or where the service should be performed) is transmitted in five fields:

9.5.2.12 Specimen Source Name or Code:

OBR-16.1 (CE)

Contains the specimen source name or code (as a CE data type component). (Even in the case of observations whose name implies the source, a source may be required, for example, blood culture-heart blood.)

9.5.2.13 Additives:

OBR-16.2 (ST)

Additives to the specimen such as Heparin, EDTA, or Oxlate, when applicable.

9.5.2.14 Method of Collection:

OBR-16.3 (TX)

A free text component describing the method of collection when that information is a part of the order.

9.5.2.15 Body Site:

OBR-16.4 (CE)

The body site from which the specimen was obtained.

9.5.2.16 Site Modifier:

OBR-16.5 (CE)

The site modifier. For example, the site could be antecubital fossa, and the site modifier "right." Refer to Table 18 for valid entries.

9.5.3 Observation Service Instances:

9.5.3.1 Observation Service Instance ID:

OBR-5 (CE)

The identity of the requested diagnostic test, represented as a code, a text name, or both. See definition of CE data type. This field should contain an identifier code for the requested observation battery. An observation battery may represent a set of observations (test) or a single observation; for example, vital signs, or serum potassium. This can be based on local or "universal" codes, or both.

9.5.3.2 Results Report/Status Change—Date/Time:

OBR-23 (TS)

Date-time results reported or status changed. This field is used to indicate the date and time that the results are composed into a report and released, or that a status, as defined in order status, is entered or changed. (This is a results field only.) When other applications (such as office or clinical database applications) query the laboratory application for untransmitted results, the information in this field may be used to control processing on the communications link. Usually, the ordering service would want only those results for which the reporting date/time is greater than the date/time the inquiring application last received results.

9.5.4 Observation Battery Instances:

9.5.4.1 Result Status 00734:

4.2.1.2.25, Specification E 1238
OBR-26 (ID)

The purpose of this field is to report the status of results for this order. The status applies to ALL results associated with the order. This field would typically be used in a response to an order status query where the level of detail requested does not include the OBX segments. This field can only be valued by the filler. When the individual status of each result is necessary, the observe result status field in the OBX segment may be used. Refer to Table 19 for valid entries.

9.5.4.2 Parent Results 00550:

4.2.1.2.26, Specification E 1238
OBR-27 (CM)

TABLE 17 Specimen Action Code

Value	Description
A	Add ordered tests to the existing specimen
G	Generated order; reflex order
L	Lab to obtain specimen from patient
O	Specimen obtained by service other than lab
P	Pending specimen (order sent prior to delivery)
R	Revised order
S	Schedule the tests specified below

TABLE 18 Source of Specimen

Code	Description	Code	Description
ABS	Abcess	MILK	Breast milk
AMN	Amniotic fluid	NAIL	Nail
ASP	Aspirate	NOS	Nose (nasal passage)
BPH	Basophils	OTH	Other
ABLD	Blood arterial	PRT	Peritoneal fluid ascites
BBL	Blood bag	PER	Peritoneum
BON	Bone	PLC	Placenta
BRTH	Breath	PLAS	Plasma
BRO	Bronchial	PLB	Plasma bag
BRN	Burn	PLR	Pleural fluid (thoracentesis flu)
CALC	Calculus	PMN	Polymorphonuclear neutrophils
CDM	Cardiac muscle	PUS	Pus
CNL	Cannula	SAL	Saliva
CTP	Catheter tip	SEM	Seminal fluid
CSF	Cerebral spinal fluid	SER	Serum
CVM	Cervical mucus	SKN	Skin
CVX	Cervix	SKM	Skeletal muscle
COL	Colostrum	SPRM	Spermatozoa
CBLD	Cord blood	SPT	Sputum
CNJT	Conjunctiva	SPTC	Sputum coughed
CUR	Curettage	SPTT	Sputum tracheal aspirate
CYST	Cyst	STON	Stone
DRN	Drain	STL	Stool = Fecal
EAR	Ear	SWT	Sweat
ELT	Electrode	SNV	Synovial fluid = Joint fluid
ENDC	Endocardium	TEAR	Tears
ENDM	Endometrium	THRT	Throat
EOS	Eosinophils	THRB	Thrombocyte (platelet)
RBC	Erythrocytes	TISS	Tissue
FIB	Fibroblasts	TISB	Tissue bone marrow
FLT	Filter	TISG	Tissue gall bladder
FIST	Fistula	TISL	Tissue lung
FLU	Body fluid—unspecified	TISP	Tissue peritoneum
GAST	Gastric fluid	TISU	Tissue ulcer
GEN	Genital	TISC	Tissue curettage
GENC	Genital—cervix	TISPL	Tissue placenta
GENL	Genital lochia	ULC	Ulcer
GENV	Genital vaginal	UMB	Umbilical blood
HAR	Hair	URTH	Urethra
IT	Intubation tube	UR	Urine
LAM	Lamella	URC	Urine clean catch
WBC	Leucocytes	URT	Urine catheter
LN	Line	VOM	Vomit
LNA	Line arterial	BLD	Whole blood
LNV	Line venous	BDY	Whole body
LYM	Lymphocytes	WICK	Wick
MAC	Macrophages	WND	Wound
MAR	Marrow	WNDA	Wound abscess
MEC	Meconium	WNDE	Wound exudate
MBLD	Menstrual blood	WNDD	Wound drainage

TABLE 19 Result Status Codes (OBR;25)

Code	Description
O	Order received; specimen not yet received
I	No results available; specimen received, procedure incomplete
S	No results available; procedure scheduled, but not done
P	Preliminary; A verified early result is available, final results not yet obtained
R	Results stored; not yet verified
F	Final results; order is complete and verified
X	No results available; order canceled (used only on queries)
Y	No order on record for this test (used only on queries)
Z	No record of this patient (used only on queries)

is identified by Field 29, parent accession number. (See Section 7 for more details about this linkage.) A second mode of conveying this information is to use a standard observation result segment (OBX). If more than one organism is present the sub ID field is used to distinguish them. In this case, the first OBX with subid *N* will contain a value identifying the *N*th microorganism, and each additional OBX with subid *N* will contain sensitivity values for a given antibiotic test on this organism.

9.5.4.3 Parent Identifier Number 00737:

4.2.1.2.29
OBR-30 (CM)

This field is identical to the parent number of the ORC segment. This field relates a child to its parent when a parent-child relationship exists. For example, observations that are spawned by previous observations, for example, antibiotic susceptibilities spawned by blood cultures, need to record the parent (blood culture) Filler Order Number here. The parent-child mechanism is described under the order Control field notes (see Segment ORC field notes in 4.1.4.2.1). It is required when the order is a child. Parent is a two-component field. The first component contains the placer order number of the parent order. The second component is optional and contains the filler order number of the parent. The components of the placer order number and the filler order number are transmitted in subcomponents of the two components of this field.

9.5.4.4 Other Participating Persons:

OBR-33 (CN)

The identity of the other clinician who interpreted the observation and is responsible for the report content. Include the identity and the role of the persons in the observation production (OBR33, OBR34, and OBR35 in the observation order section).

9.5.4.5 Assistant Result Interpreter 00628:

4.2.1.2.33, Specification E 1238
OBR-34

When applicable, record the clinical observer who assisted with the interpretation of this study.

9.5.4.6 Technician 00630:

4.2.1.2.34, Specification E 1238
OBR-35

When applicable, record the performing technician.

9.5.4.7 Transcriptionist 00629:

toxicology) this field is defined as coded observation ID Sub-ID of parent. This important information, together with the information in OBR:29 (parent access number) uniquely identifies the parent result's OBX segment related to this service instance order. The value of this OBX segment in the parent result is the organism or chemical species about which this battery reports. For example, if the current battery is an antimicrobial sensitivity, the parent result's identified OBX contains a result which identifies the organism on which the sensitivities were run. This indirect linkage is preferred because the name of the organism in the parent result may undergo several preliminary values prior to finalization. The third component may be used to record the name of the microorganism identified by the parent result directly. The organism in this case should be identified exactly as it is in the parent culture. This field is present only when the parent result



4.2.1.2.35, Specification E 1238
OBR-36

When applicable, record the report transcriber.
9.5.4.8 *Scheduled—Date/Time 00736:*

4.2.1.2.36, Specification E 1238
OBR-37

When applicable (for example, action code in field 11 = “S”), record the date/time the filler scheduled an observation. This is a result of a request to schedule a particular test and provides a way to inform the placer of the date/time a study is scheduled (result only).

9.5.5 *Treatment Instances:*

9.5.5.1 *Treatment Instances Unique ID:*

Prescription Number
RXD-7 (NM)
[6.15.1.3 Prescription number
12001.12. MEDICATION PRESCRIPTION NO.

Unique number assigned to identify each prescription.

9.5.5.2 *Administration Sub-ID Counter:*

4.5.11.1.2, Specification E 1238
RXA-2 (NM)xxxxx

Starts with “1” the first time that medication is administered for this order. Increments by one with each additional administration of medication. Note that more than one RXA segment can be “matched” to a single RXG segment, as is the case when recording a change of the rate of administration of an IV solution.

9.5.5.3 *Administered Code:*

4.5.11.1.5, Specification E 1238
RXA-5 (CE)xxxxx

This is the identifier of the medical substance administered. It is equivalent to the Universal Service ID code and links to the master service catalogue.

9.5.5.4 *Administered Amount:*

4.5.11.1.6, Specification E 1238
RXA-6 (NM)xxxxx

The amount administered.

9.5.5.5 *Administered Units:*

4.5.11.1.7, Specification E 1238
RXA-7 (CE)xxxxx

This must be in simple units that reflect the actual quantity of the substance administered. It does not include compound units.

9.5.5.6 *Administered Dosage Form:*

4.5.11.1.8, Specification E 1238
RXA-8 (CE)xxxxx

Use this field when the administered code does not specify the dosage form.

9.5.5.7 *Administration Notes:*

4.5.11.1.9, Specification E 1238
RXA-9 (ST)xxxxx
[6.15.1.13 Medication notes
12001.63. MEDICATION NOTES

Free text notes from the provider administering the medication. This may contain free text describing a custom IV, mixture, or salve.

9.5.5.8 *Administering Provider:*

4.5.11.1.10, Specification E 1238
RXA-10 (CN)xxxxx

Provider ID of the person administering the pharmaceutical.
9.5.5.9 *Administered at Location:*

4.5.11.1.11, Specification E 1238
RXA-11 (ID)xxxxx

This is a two-component field:

Nurse__Unit&Room&Bed&Facility__ID
Street__Address&Ot__Designation&
City&State<or>Province&ZIP Code&Country

(1) The first component contains the inpatient or outpatient location at which the drug was administered (if applicable). The default (null) value is the current census location for the patient. Site specific table.

(2) The second component can be used to specify an address. This could be used to fill mail orders to a patient or provider, or to account for home health care.

9.5.5.10 *Administered Per (Time Unit):*

4.5.11.1.12, Specification E 1238
RXA-12 (ST)xxxxx

Rate at which this medication was administered as calculated by using the administered amount and the administered units fields.

9.6 *Observations:*

9.6.1 We use the notion of observations in its most general sense to mean any aspect of a patient that can be described at a point in time. It follows exactly Allen Rector’s idea of an observation (14). A serum glucose result, a chest X-ray impression, a Glasgow coma score, each of the questions in the SF-36, a history of present illness, urine output, and nurses’ note are each observations. An observation is an attribute of a patient at a point in time. An observation is the atomic unit or “chunk” in which clinical information is recorded. When a report is divided into well defined sections or variables, each section or variable should be reported as a separate observation, so the computer can manipulate it individually.

9.6.2 The observation object cannot stand alone. General attributes (those that are independent of a particular patient’s observation), such as: the units in which a numeric object is reported; the name and synonyms for the observation; information about how the observation is grouped and sequenced in reports with other observations; the class of the observation (for example, laboratory test, X-ray report), and so forth are associated with a master file or service catalogue. Most laboratory systems, pharmacy systems, billing systems, inventory systems and other systems that must deal with large numbers of discrete items use a general object (file) to carry all patient observations with a “pointer” to master tables (a service master table, a term dictionary, a table of detailed provider information) that identifies the observation. It is also the approach used by all long surviving medical record systems.

9.6.3 Using a master dictionary makes it possible to accommodate different degrees of granularity; it also easily accommodates change. As new variables are invented they can be added to the master table without requiring any restructuring of the objects contained in the data base. The observation object has provisions for storing free text comments (paragraphs), as well as for storing more specific data types (numbers, dates, etc.).



provisions for linking to more complex objects (for example, images, tracings, etc.).

9.6.4 When a selected few observations are recorded in a data base, a simpler structure can be employed. If a diabetes clinic, for example, wanted to capture 20 variables (for example, diastolic blood pressure, systolic blood pressure, blood glucose, hemoglobin A1c, weight, pulse, foot lesions (yes/no), etc.), they could create one record per visit, and define specific fields for each of those twenty variables. A master term dictionary would not be needed. However, this approach does not work well in the more general case. An EHR may have 10 000 or more different kinds of observations. (Laboratory results alone can account for 5000 different variables.) Further, an observation may be recorded more than once during the visit by different providers. The flat structure, with fields corresponding to different observation, cannot accommodate the volume or the complexity of such data.

9.6.5 The master term dictionary is defined for the objects contained in the orders, procedures, and problems object classes in the same general manner.

9.6.6 These components form an ongoing chronological picture and analysis of the clinical course of the patient during an episode or encounter. This segment is applicable for any health care setting. These elements serve as a means of communication and interaction between members of a health care team. They may also occur as narrative or flow sheets.

9.6.7 Observation Record ID:

Link to Order Instance

9.6.8 Observation Identifier:

OBX-4 (CE)

Unique identifier for the observation. The format is that of the coded element (CE). Example: 93000.3 P-R interval. The identifier will “point” to a master observation table that will provide other attributes of the observation that may be used to define the possible orders and groupings of observations from “fixed” “?” “?” “?” “?” to problem lists. The relation of an observation ID to a master observation table is analogous to the relationship between a charge code (in a billing record) and the charge master.

9.6.9 Observation Sub-ID (Repeat Identifiers):

OBX-5 (ST)

This field is also used to distinguish between multiple observations with the same observation ID and observation timing, for example, repeat measurements on one sample.

9.6.9.1 The sub-identifier is also used to group related components in reports such as surgical pathology. It is traditional for surgical pathology reports to include all the tissues taken from one surgical procedure in one report.

9.6.10 Observation Date/Time:

OBX-15 (TS)

11001.01.45 DATE-TIME RESULT REPTD

9.6.10.1 This field is required in two circumstances. The first is when the observations reported beneath one report header (OBR) have different dates. This could occur in the case of queries, timed test sequences, or clearance studies where one measurement within a battery may have a different time than

another measurement.

9.6.10.2 It is also needed in the case of OBX segments that are being sent by the placer to the filler, in which case the date of the observation being transmitted is likely to have no relation to the date of the requested observation. In France, requesting services routinely send a set of the last observations along with the request for a new set of observations. The date of these observations is important to the filler laboratories.

9.6.10.3 In all cases, the observation date-time is the physiologically relevant date-time or the closest approximation to that date-time. In the case of tests performed in specimens that the relevant date-time is the specimen’s collection date-time. In the case of observations taken directly on the patient (for example, X-ray images, history and physical), the observation date-time is the date-time that the observation was performed.

9.6.11 Observation Data-Type:

OBX-3 (ID)

The value type field defines the format of the observation value in OBX. If the value is CE then the result must be a coded entry. If the value type is TX then the results will be bulk text. The valid values for the value type of an observation are listed in Table 4.

9.6.11.1 The observation value must be represented according to the format for the data type defined in Chapter II, Control Section. For example, a PN consists of six components, separated by component delimiters.

9.6.11.2 Although NM is a valid type, observations which are usually reported as numbers will often have the string (ST) data type because non-numeric characters are often reported as part of the result, for example, >300 to indicate the result was off-scale for the instrument. In the example, “>300,” “>” is a symbol and the digits are considered a numeric value.

9.6.11.3 All HL7 data types are valid except CM, because it is not a specific data type, CQ, because units for the value (OBX;5) are always specified explicitly in an OBX segment (in OBX;6), and sequence ID, because it only applies to segments.

9.6.12 Observation Value:

OBX-6 (Data type depends upon the observation data type)

This field contains the value observed by the observation producer. The value type field (OBX;2) contains the data type according to which observation value is formatted. It is a required field in the OBX segment.

9.6.13 Representation— This field contains the value of observations identified in the observation identifier field. Depending upon the observation, the data type may be a number (for example, a respiratory rate), a coded answer (for example, a pathology impression recorded as SNOMED), or a date-time (the date-time that a unit of blood is sent to the ward). An observation value is always represented as the data type specified in the observation field of the same segment. Whether numeric or short text, the answer shall be recorded in ASCII text.

9.6.13.1 Producer ID:

OBX-16 (CNA)

Observation performance site

This field contains a unique identifier of the responsible producing service. It should be reported explicitly when