



Standard Specification for Transferring Clinical Observations Between Independent Computer Systems¹

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1. Scope

1.1 *General Approach*—This specification covers the two-way digital transmission of requests for, and results of, tests, diagnostic studies, and care-provider observations between requestors (for example, hospital information systems, clinical workstations, office practice computers) and producers (for example, clinical laboratory systems, radiology systems, EKG machines, nursing care systems). It specifies the logical format and encoding rules for messages needed to interchange any clinical information that can be reported in a textual form. It enables any two systems to establish a link for communicating text to send result or request information in a standard and interpretable form. It deals not only with general information about diagnostic testing, but specific details useful for clinical practice, administration, and research in a comprehensive, but flexible, convention.

1.2 The major topics are found in the following sections:

	Section
Information Requirements in Diagnostic Studies and Clinical Observations	5

Distinction Between the Logical Contents and the Encoding Rules in This Specification	5.1
General Approach	5.2
Maximum Line Length	5.3
Network Protocols and Transmission Media	5.4
Relation to Specifications E 1394 and E 1381E 1394E 1381	5.5
Negotiating Required and Optional Fields in Segments	5.6
Acknowledgment of Messages	5.7
Message General Content Considerations	6
Character Representation	6.1
Standard Character Set	6.1.1
Range and Case Insensitivity	6.1.2
Segment and Field Lengths	6.2
Maximum Line Length	6.3
Delimiters	6.4
Segment Delimiter	6.4.1
Field Delimiter	6.4.2
Repeat (subfield) Delimiter	6.4.3
Component (sub-subfield) Delimiter	6.4.4
Specification of Delimiters	6.4.5
Delimiters for Null Fields	6.4.6
Fields of No Concern to the Receiving System	6.4.7
Changing Fields to Null Values	6.4.8
Segment Types	6.5
Message Header Segment (H)	6.5.1
Patient Identifying Segment (P)	6.5.2
Observation Order Segment (OBR)	6.5.3
Observation Segment (OBX)	6.5.4
Comment Segment (C)	6.5.5
Error Checking Segment (E)	6.5.6
Request Results Segment (Q)	6.5.7
Scientific Segment (S)	6.5.8
Addendum Segment (A)	6.5.9
Field Data Types	6.6

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AD Addresses	6.6.1	Sequence Number	9.10
CE Coded Entry	6.6.2	Observation Requestor Accession or Specimen ID	9.11
CK Composite ID With Check Digit	6.6.7	Observation Producer Accession ID	9.12
CM Composite Miscellaneous	6.6.8	Producer ID for Generated or Exploded Orders	9.13
CNA Provider and User IDs	6.6.9	Observation Battery ID	9.14
CQ Fixed Measurements and Units	6.6.10	Priority	9.15
Reserved for Future Use	6.6.11	Requested Date and Time	9.16
Reserved for Future Use	6.6.12	Observation Date-Time/Specimen Collection Date-Time	9.17
Reserved for Future Use	6.6.13	Collection End Time	9.18
ID String that Represents an ID	6.6.14	Collection Volume	9.19
NM Numeric	6.6.15	Collector ID	9.20
PN Person Name	6.6.16	Action Code	9.21
ST String	6.6.17	Danger Code	9.22
TN Telephone and Beeper Number	6.6.18	Relevant Clinical Information	9.23
TS (Time Stamp)—Previously Date-Time	6.6.19	Date and Time of Specimen Receipt in the Laboratory	9.24
TX Bulk Text	6.6.20	Source of Specimen	9.25
Examples of Messages Using This System	6.7	Ordering Physician	9.26
Rules About Retransmission of Results	6.8	Physician's Telephone Number	9.27
Orders that Spawn Multiple Orders	6.9	Requestor Field 1	9.28
Producer Generated Orders	6.10	Requestor Field 2	9.29
DETAILED STRUCTURE OF EACH SEGMENT TYPE		Producer (Diagnostic Service) Field 1	9.30
Message Header	7	Producer (Diagnostic Service) Field 2	9.31
General Approach	7.1	Date-Time Observations Reported or Order Status Changed	9.32
Segment Type ID	7.2	Producer's Charge	9.33
Delimiter Definition	7.3	Producer's Section ID	9.34
Message Control ID	7.4	Order Result Status (previously report type)	9.35
Security (previously Access Password)	7.5	Link to "Parent" Result	9.36
Sender Name or ID	7.6	Quantity/Timing (previously Frequency)	9.37
Sender Street Address	7.7	Send Copies to (new)	9.38
Message Type (new)	7.8	Link to Parent Order (new)	9.39
Sender Telephone Number	7.9	Transportation Mode (new)	9.40
Characteristics of Sender	7.10	Reason for Study (new)	9.41
Receiver ID	7.11	Principal Interpreter of Study (new)	9.42
Comment or Special Instructions	7.12	Assisting Interpreter of Study (Resident) (new)	9.43
Processing ID	7.13	Observer/Technician (new)	9.44
Version	7.14	Transcriptionist Identity (new)	9.45
Date and Time of Message	7.15	Date-Time Scheduled (new)	9.46
Patient Identifying Segment	8	Observation Segment	10
General Approach	8.1	Background	10.1
Segment Type ID	8.2	Changes	10.2
Transmission Sequence Number	8.3	Each Component of a Narrative Report Is Sent as a Separate	10.3
Requestor (Practice) Assigned Patient ID	8.4	OBX	
Producer (Diagnostic Service) Assigned Patient ID	8.5	Diagnostic Impressions (IMP)	10.4
Alternate Patient ID	8.6	Recommendations (REC)	10.5
Patient Name	8.7	Confirming Procedure (CNP)	10.6
Mother's Maiden Name	8.8	Procedure Medication (MED)	10.7
Birthdate	8.9	Anatomic Site (ANT)	10.8
Patient Sex	8.10	Devices (DEV)	10.9
Patient Race or Ethnic Origin	8.11	Gross or General Description (GDT)	10.10
Patient Street Address, City, State, Country, and Zip/Postal Code	8.12	Secondary or Microscopic Description (MDT)	10.11
Not used	8.13	Procedure Comment (TCM)	10.12
Patient Telephone Number	8.14	Addendum Note (ADT)	10.13
Attending Physician ID	8.15	Diagnosis (problem) Onset Date-Time (IMT)	10.14
Special Field 1	8.16	Diagnosis (problem) Resolution Date-Time (RMT)	10.15
Special Field 2	8.17	Comparison study (CMS)	10.16
Patient Height	8.18	Comparison Date-time (CMT)	10.17
Patient Weight	8.19	Comparison Results (CMR)	10.18
Patient's Known or Suspected Diagnosis	8.20	Comparison Change (CMC)	10.19
Patient Active Medications, or Medications Suspected in Overdose Situations	8.21	Predicted (PRD)	10.20
Patient's Diet	8.22	Percent of Predicted (PPR)	10.21
Practice Field 1	8.23	After Drug Observed (AFD)	10.22
Practice Field 2	8.24	Predicted Value After Drug (ADP)	10.23
Admission Date/Time and Discharge Date/Time	8.25	Percent Predicted After Drug (APP)	10.24
Admission Status	8.26	Expanded AS4 Codes	10.25
Location	8.27	Segment Type ID	10.26
Diagnostic Classification	8.28	Sequence Number	10.27
Patient Religion	8.29	Value Type (new)	10.28
Marital Status	8.30	Observation Identifier	10.29
Isolation Status	8.31	Observation SubID	10.30
Language	8.32	Observation Value	10.31
Confidentiality Status (new)	8.33	Representation	10.32
Date and Time Registration Changed	8.34	Reporting Logically Independent Observations	10.33
Death date/time	8.35	Multiple OBX Segments With The Same Observation ID and Sub ID	10.34
Observation Order Segment (OBR)	9	Coded Values	10.35
General Approach	9.1	Bacterial Names as Values	10.36
Segment Type ID	9.9	Units of Measure	10.37
		ISO and ANSI Customary Units Abbreviations	10.38





Local Codes	10.39	Guarantor Phone Number—Work	17.9
Reference Ranges	10.40	Guarantor Date of Birth	17.10
Upper and Lower Limits	10.40.1	Guarantor Sex	17.11
Physiologic and Therapeutic Range	10.40.2	Guarantor Type	17.12
Abnormal Flags	10.41	Guarantor Relationship to Patient	17.13
Probability (new)	10.42	Guarantor Universal ID Number	17.14
Nature of Abnormal Checking	10.43	Guarantor Date/Time—Begin	17.15
Observation Result Status	10.44	Guarantor Date/Time—End	17.16
Date/Time of Last Change in Normal Values or Units	10.45	Guarantor Priority	17.17
Interpretive Report Segment	10.46	Guarantor's Employer Name	17.18
Error Checking Segment	11	Guarantor's Employer Address	17.19
General Approach	11.1	Guarantor's Employer Telephone Number	17.20
Segment Type ID	11.1.5.1	Guarantor Employee ID Number	17.21
Sequence Number	11.1.5.2	Guarantor Employment Status	17.22
Error Check, Byte Count	11.1.5.3	HL7 Insurance Segment for Billing	18
Check Code	11.1.5.4	Background	18.1
Comment Segment	12	Segment Type ID	18.2
General Approach	12.1	Sequence Number	18.3
Segment Type ID	12.1.1	Insurance Plan ID	18.4
Sequence Number	12.1.2	Insurance Company	18.5
Comment Source	12.1.3	Insurance Company Name	18.6
Comment Text	12.1.4	Insurance Company Address	18.7
Request Results Segment	13	Insurance Company Contact Person	18.8
General Approach	13.1	Insurance Company Phone Number	18.9
Segment Type ID	13.1.1	Group Number	18.10
Sequence Number	13.1.2	Group Name	18.11
Practice (Requester) Assigned Patient ID	13.1.3	Insured's Group Employer ID	18.12
Observation Producer Assigned Patient ID	13.1.4	Insured's Group Employer Name	18.13
Observation Battery ID	13.1.5	Plan Effective Date/Time	18.14
Nature of Request Time Limits	13.1.6	Plan Expiration Date/Time	18.15
Beginning Request Results Date and Time	13.1.7	Authorization Information	18.16
Ending Request Results Date and Time	13.1.8	Plan Type	18.17
Requesting Physician	13.1.9	Name of Insured	18.18
Requesting Physician Telephone Number	13.1.10	Insured's Relationship to Patient	18.19
User Field 1	13.1.11	Insured's Date/Time of Birth	18.20
User Field 2	13.1.12	Insured's Address	18.21
Message Terminator	14	Assignment of Benefits	18.22
General Approach	14.1	Coordination of Benefits	18.23
Segment Type ID	14.1.1	Primary Payer	18.24
Sequence Number	14.1.2	Notice of Admission Code	18.25
Not used (for compatibility with Specification E 1394E 1394)	14.1.3	Notice of Admission Date/Time	18.26
Patient Count (NM)	14.1.4	Report of Eligibility Code	18.27
Line Count (NM)	14.1.5	Report of Eligibility Date/Time	18.28
Batch Number	14.1.6	Release Information Code	18.29
Scientific Segment	15	Preadmit Certification	18.30
General Approach	15.1	Verification Date/Time	18.31
Segment Type ID	15.1.1	Verification By	18.32
Sequence Number	15.1.2	Type of Agreement	18.33
Analytical Method	15.1.3	Billing Status	18.34
Instrumentation	15.1.4	Lifetime Reserve Days	18.35
Reagents	15.1.5	Delay Before Lifetime Reserve Days	18.36
Units of Measure	15.1.6	Company Plan Code	18.37
Quality Control	15.1.7	Policy Number	18.38
Specimen Source	15.1.8	Policy Deductible	18.39
Body Site	15.1.9	Policy Limit—Amount	18.40
Container	15.1.10	Policy Limit—Days	18.41
Specimen ID	15.1.11	Room Rate—Semiprivate	18.42
Analyte	15.1.12	Room Rate—Private	18.43
Result	15.1.13	Insured's Employment Status	18.44
Result Units	15.1.14	Insured's Sex	18.45
Collection Date and Time	15.1.15	Insured's Employer Address	18.46
Result Date and Time	15.1.16	Insured's Telephone Number—Home	18.47
Analytical Preprocessing Steps	15.1.17	Insured's Telephone Number—Work	18.48
Patient Diagnosis	15.1.18	Insured's Universal ID Number	18.49
Patient Birthdate	15.1.19	Test/Observation Master Segments	19
Patient Sex	15.1.20	General Approach	19.1
Patient Race	15.1.21	General Test Observation Master Segment	19.2
HL7 Patient Visit Segment	16	Segment Type ID	19.2.1
HL7 Guarantor Segment	17	Sequence Number	19.2.2
Background	17.1	Producer's Test/Observation ID	19.2.3
Billing Information	17.1.1	Permitted Data Types	19.2.4
Segment Type ID	17.2	Specimen Required	19.2.5
Sequence Number	17.3	Producer ID	19.2.6
Guarantor Number	17.4	Observation Description	19.2.7
Guarantor Name	17.5	Other Test/Observation IDs for the Observation	19.2.8
Guarantor Spouse Name	17.6	Other Names	19.2.9
Guarantor Address	17.7	Preferred Report Name for the Observation	19.2.10
Guarantor Phone Number—Home	17.8	Preferred Short Name or Mnemonic for the Observation	19.2.11





Preferred Long Name for the Observation	19.2.12	Observation ID Suffixes	19.6.4
Orderability	19.2.13	Test/Observation Master Segment for Calculated	19.7
Identity of Instrument Used to Perform This Study	19.2.14	Observations	
Coded Representation of Method	19.2.15	Segment Type ID	19.7.1
Portable Device	19.2.16	Sequence Number	19.7.2
Observation Producing Department/Section	19.2.17	Derivation Rule	19.7.3
Telephone Number of Department/Section	19.2.18	Observations Used to Compute Value	19.7.4
Nature of Test/Observation	19.2.19		
Report Subheader	19.2.20		
Report Display Order	19.2.21		
Date-Time Stamp for Any Change in Definition Attribute for the Observation	19.2.22		
Effective Date-Time of Change in Test Procedure That Makes Results Noncomparable	19.2.23		
Typical Turn-Around Time from Receipt of Specimen/Subject to Result Produced	19.2.24		
Processing Time	19.2.25		
Processing Priority	19.2.26		
Reporting Priority	19.2.27		
Outside Site(s) Where Observation May be Performed	19.2.28		
Address of Outside Site(s)	19.2.29		
Phone Number of Outside Site(s)	19.2.30		
Confidentiality Code	19.2.31		
Observations Required to Interpret This Observation	19.2.32		
Interpretation of Observations	19.2.33		
Contraindications to Observations	19.2.34		
Reflex Tests/Observations	19.2.35		
Rules That Trigger Reflex Testing	19.2.36		
Fixed Canned Message	19.2.37		
Patient Preparation	19.2.38		
Procedure Medication	19.2.39		
Factors That May Affect the Observation	19.2.40		
Test/Observation Performance Schedule	19.2.41		
Description of Test Methods	19.2.42		
Charge by Producing Service	19.2.43		
Price Modifiers	19.2.44		
Numeric Test/Observation Segment	19.3		
Segment Type ID	19.3.1		
Sequence Number	19.3.2		
Units of Measure	19.3.3		
Range and Decimal Precision	19.3.4		
Corresponding SI Units of Measure	19.3.5		
SI Conversion Factor or Formula	19.3.6		
Reference (Normal) Range for Ordinal and Continuous Observations	19.3.7		
Critical Range for Ordinal and Continuous Observations	19.3.8		
Absolute Range for Ordinal and Continuous Observations	19.3.9		
Delta Check Criteria	19.3.10		
Minimum Meaningful Increments	19.3.11		
Categorical Test/Observation Master Segment	19.4		
Segment Type ID	19.4.1		
Sequence Number	19.4.2		
Preferred Coding System	19.4.3		
Text/Codes for Categorical Observations	19.4.4		
Normal Text/Codes for Categorical Observations	19.4.5		
Abnormal Text/Codes for Categorical Observations	19.4.6		
Critical Abnormal Text/Codes for Categorical Observations	19.4.7		
Data Type	19.4.8		
Observations That Require Specimens	19.5		
Segment Type ID	19.5.1		
Sequence Number	19.5.2		
Derived Specimen	19.5.3		
Container Description	19.5.4		
Container Volume	19.5.5		
Container Units	19.5.6		
Specimen	19.5.7		
Additive	19.5.8		
Preparation	19.5.9		
Special Handling Requirements	19.5.10		
Normal Collection Volume	19.5.11		
Minimum Collection Volume	19.5.12		
Specimen Requirements	19.5.13		
Specimen Priorities	19.5.14		
Specimen Retention Time	19.5.15		
Test/Observation Master Segment for Observation Batteries	19.6		
Segment Type ID	19.6.1		
Sequence Number	19.6.2		
Tests/Observations Included Within an Ordered Test Battery	19.6.3		

2. Referenced Documents

2.1 ASTM Standards:

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

E 1384 Guide for Content and Structure of the Computer-Based Patient Record²

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 Coded Values Used in Computer-Based Patient Record²

2.2 ANSI Standards:³

ANSI X3.4 1986 Coded Character Sets—American National Standard Code for Information Interchange (7-bit ASCII)

ANSI X3.50 1986 Representations for U.S. Customary, SI, and Other Units to be Used in Systems with Limited Character Sets

ANSI X3.51 1986 Representations of Universal Time, Local Time Differentials, and United States Time Zone References for Information Interchange

2.3 ISO Standards:⁴

ISO 2022 1986 ISO 7-bit and 8-bit Character Sets—With Code Extension Techniques

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

ISO 4217 1990 Currency and Funds Codes

ISO 8072 1986 Network Standards

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

ISO 8859 1988 Information Processing—8-Bit Single-Byte Coded Graphic Character Sets

ISO 10646 UCS2 Information Technology—Universal Multiple-octet coded Character Set (UCS)—Part I: Architecture and Basic Multilingual Plane

2.4 Other Documents:

HL7 Health Industry Level 7 Interface Standards⁵

² Annual Book of ASTM Standards, Vol 14.01.

³ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁴ Available from ISO, 1 Rue de Varembe, Case Postale 56, CH 1211, Geneve, Switzerland.

⁵ Health Level 7, Mark McDougall, Executive Director, 900 Victors Way, Suite 122, Ann Arbor, MI 48108.





NCCLS Document H1-A3 Evacuated Tubes for Blood Specimen Collection⁶

Unicode: The Unicode Worldwide Character Set Standard, Version 1.0.1 (1992)⁷

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *battery*—a set of one or more observations identified by a single name and code number, and treated as a shorthand unit for ordering or retrieving results of the constituent observations.

3.1.1.1 *Discussion*—Vital signs, electrolytes, routine admission tests, and obstetrical ultrasound are all examples. Vital signs (conventionally) consist of diastolic and systolic blood pressure, pulse, and respiratory rate. Electrolytes usually consist of Na⁺, K⁺, Cl⁻, HCO₃⁻. Routine admission tests might contain CBC, electrolytes, SMA12, and urinalysis. For our purposes the elements of a battery may also be batteries. Obstetrical ultrasound is a battery made up of traditional component measurements and the impression, all of which would be returned as separate observations when returned to the requestor. In keeping with the mathematical conventions about sets a battery can be a single observation.

3.1.1.2 *Discussion*—The word battery is used in this specification synonymously with the word profile or panel. The individual observation elements within a battery may be characteristic of a physiologic system (for example, liver function tests), or many different physiologic systems.

3.1.2 *field*—one specific attribute of a segment.

3.1.2.1 *Discussion*—For example, patient diagnosis, which may contain aggregates of data elements further refining the basic attribute.

3.1.2.2 *Discussion*—This document often refers to fields by name, the field mnemonic, or both, just to avoid any ambiguity. The mnemonic for a field is constructed from the segment ID and the field's numeric position in the segment. The patient's name is stored in the seventh field of the patient (P) segment; so the mnemonic is P-7. The observation value field is in the sixth field in the observation (OBX) segment; so its mnemonic is OBX-6.

3.1.3 *field components*—a field entry may also have discernible parts or components.

3.1.3.1 *Discussion*—For example, the patient's name is recorded as last name, first name, and middle initial, each of which is a distinct entity separated by a component delimiter (sub subfield in Specification E 1238-88).

3.1.4 *message*—the body of text information concerning orders for, or results of, diagnostic studies, tests, or clinical observations transmitted at one session between two systems.

3.1.5 *observation*—a measurement of a single variable or a single value derived logically or algebraically, or both, from other measured or derived values (a test result, a diastolic blood pressure, and a single chest X-ray impression are all observations).

3.1.6 *producer*—the person, or service, who produces the observations requested by the requestor. (Syn. *filler*).

3.1.6.1 *Discussion*—This includes diagnostic services and clinical services and care providers who report observations about their patients. The clinical laboratory is a producer of lab test results (filler of a lab order), the nursing service is the producer of vital signs observations (the filler of orders to measure vital signs), and so on.

3.1.7 *repeated value*—some fields may contain many repeat data elements.

3.1.7.1 *Discussion*—For example, the diagnoses field may contain many different diagnoses.

3.1.8 *requestor*—the person or service that requests (orders) an observation battery, for example, the physician, the practice, clinic, or ward service, that orders a lab test, X ray, vital signs, etc. (Syn. *placer*).

3.1.9 *segment (previously record)*—A typed aggregate of data elements (fields) describing one complete aspect of a message.

3.1.9.1 *Discussion*—For example, the information about one order is sent as one type of segment (OBR), the information related to an observation is sent as another segment (OBX).

3.1.9.2 *Discussion*—The segment in a message is analogous to a record in a database, and in previous versions of the standard we used record in place of the word segment. We have changed the nomenclature to be consistent with HL7 and other standards organizations in this version.

3.2 Symbols:

3.2.1 *null fields (" ")*—used in this specification to signify a null or empty field.

3.2.1.1 *Discussion*—In an actual record, a null field will be represented by two field delimiters with nothing between. When a double quote is sent as a field's value, it has a special meaning as described in 6.4.8.2.

4. Significance and Use

4.1 *Rationale*—A brief analysis of the problems involved in entry and capture of computer-stored medical records in a timely and error-free format suggested that physicians would find it very difficult to operate a computer-stored record without standard formats for transmitting laboratory and other externally produced data to the physician's office practice computer (see 1, 2).⁸ Without such formats, practitioners could not hope to develop the many specialized programs needed to translate the data obtained from many external sources, for example, local hospital laboratories and commercial laboratories.

4.2 Hospitals, commercial laboratories, and other observation producers also need standardized formats. Hospitals need them so that they can more easily interconnect independent computer modules within their units, for example, laboratory, pharmacy, and medical records. Because of the cost pressures of Diagnoses Related Groups (DRG), hospitals may begin to bid diagnostic and clinical services to outside vendors and thereby need standard formats for linking to the computers of these reporting services.

⁶ Available from NCCLS.

⁷ Available from Addison Wesley, Inc.

⁸ The boldface numbers in parentheses refer to the list of references at the end of this standard.



4.3 Current trends will require efficient computer links among hospitals, HMOs, physicians' offices, nursing homes, hospital nursing stations, emergency rooms, clinical laboratories (physician-owned, commercial, and hospital), and other observation producers. The use of the standard format prescribed in this specification should benefit patient care institutions, whether large or small, by making it easier for them to interface their existing information systems with sources of clinical information such as the clinical lab, radiology, nursing care systems, and the like (on-site or off-site).

4.4 Clinical laboratories and other diagnostic services will also gain from this specification because of demands from large volume customers for electronic transmission of requests and results and the cost of writing special programs to deal with the unique file structures of each of their customers.

4.4.1 The standards will help office practitioners by permitting them to gather laboratory and other clinical observations into their office computer systems without the expense, delays, and potential errors associated with manual transcription.

4.4.2 These standards will facilitate the collection of large administrative and clinical data bases and, as such, should facilitate clinical and health policy research. They should be particularly useful to health outcomes research because they will make raw clinical data more available to researchers.

4.5 This specification applies to two-way transmission. It is intended for sending requests for diagnostic studies to, and receiving results from, observation producers and for transmitting provider-gathered patient observations.

4.6 Specification E 1238 was initially developed for clinical laboratory results. In this revision, the scope has been extended to most kinds of clinical data, including nursing data, physician notes, imaging results, blood pressures, etc. This specification has sufficient flexibility to permit the addition of fields to existing segment types or the creation of new segment types to accommodate future extensions. It has been developed in cooperation with HL7, an organization whose scope is all information services within a hospital network.⁵

4.7 The purpose of this specification is to facilitate the general use of computerized medical records, as well as to facilitate exchange of patient-specific clinical observational data, and to thereby increase the availability of patient data for clinical care and research. The rationale and need for such standards is further explained in two published papers (1, 2).

5. Information Requirements in Diagnostic Studies and Clinical Observations

5.1 *Distinction Between the Logical Contents and the Encoding Rules in This Specification*—This specification defines both the logical content of a data interchange message and the encoding rules for representing that content in a particular message. By *logical content* we mean the specification of the data elements (fields), their logical representation (for example, a date is recorded as YYYYMMDD), their aggregation into segments, and the aggregation of segments into messages. By *encoding rules* we mean the rules that now specify that messages be represented as ASCII (American Standard Code for Information Interchange) characters, that fields be identified by their position in a segment, and that delimiters separate the data elements within segments. The distinction between

logical content and encoding rules is important because the two should be independent. With the exception of the data types, Sections 5 and 6 deal mostly with encoding rule issues; Sections 7-15 deal mostly with logical content. Future versions of this specification will make these distinctions more formal to permit the use of alternative encoding rules to represent the specification's logical content.

5.2 General Approach:

5.2.1 The blocked stream of data sent to or from a diagnostic service or other clinical results processor at a given time is referred to as a message. Messages may contain one or more requests/clinical observations for one or more patients. These observations are often requested and returned as batteries that include many individual observations, for example, vital signs include pulse, diastolic and systolic blood pressure, temperature, and respiration rate; electrolytes include Na, K, Cl, and CO₂. Other examples of batteries are multi-channel analyzer batteries, such as a CHEM12, or physiological groupings of tests (such as liver function tests), or both. The EKG can be considered a battery that includes a set of measurements (for example, PR-interval, QRS axis) and a diagnostic impression. For laboratory tests, the fact that a series of observations are contained in a battery does not necessarily imply that they are all on the same analytic instrument, though that is often the case. The history and physical can also be considered a battery, consisting of the traditional components, for example, heart exam, lung examination, abdomen examination, present illness, and review of systems, just to name a few.

5.2.2 Messages consist of a hierarchy of segments of various types. Segments at the first level of the hierarchy contain information about individual patients. Segments at the second level contain information about a diagnostic study or specimen (observation order segment), or both. Segments at the third level contain details about an individual observation or test result. Observation segments may be sent by the requestor to the producer (to convey needed interpretive information) or vice versa (to convey all results).

5.2.3 Three other segment types may be inserted at any level: (1) the free text comment segment (C) which may follow a patient, order, request-result, or scientific segment, (2) the addendum segment (A) which is used to carry the overflow of an immediately preceding segment that exceeds the maximum allowable line size of 220 characters and (3) the error check segment (E).

5.2.4 Additional segment types are the guarantor segments, available for passing information about the associated visit guarantor (GT1); the insurance segment, available for passing associated insurance information (IN1); the query segment, which provides for requesting results from the observation producers for specified patients, observations, or dates, or combination thereof; the scientific segment; and the message trailer segment, which must be the very last segment in the overall transmission.

5.2.5 The basic element of information in any segment is the field: a single item of information, such as a date, a patient name, or a numeric test result.

5.2.5.1 The logical structure of the message is shown in Fig. 1.



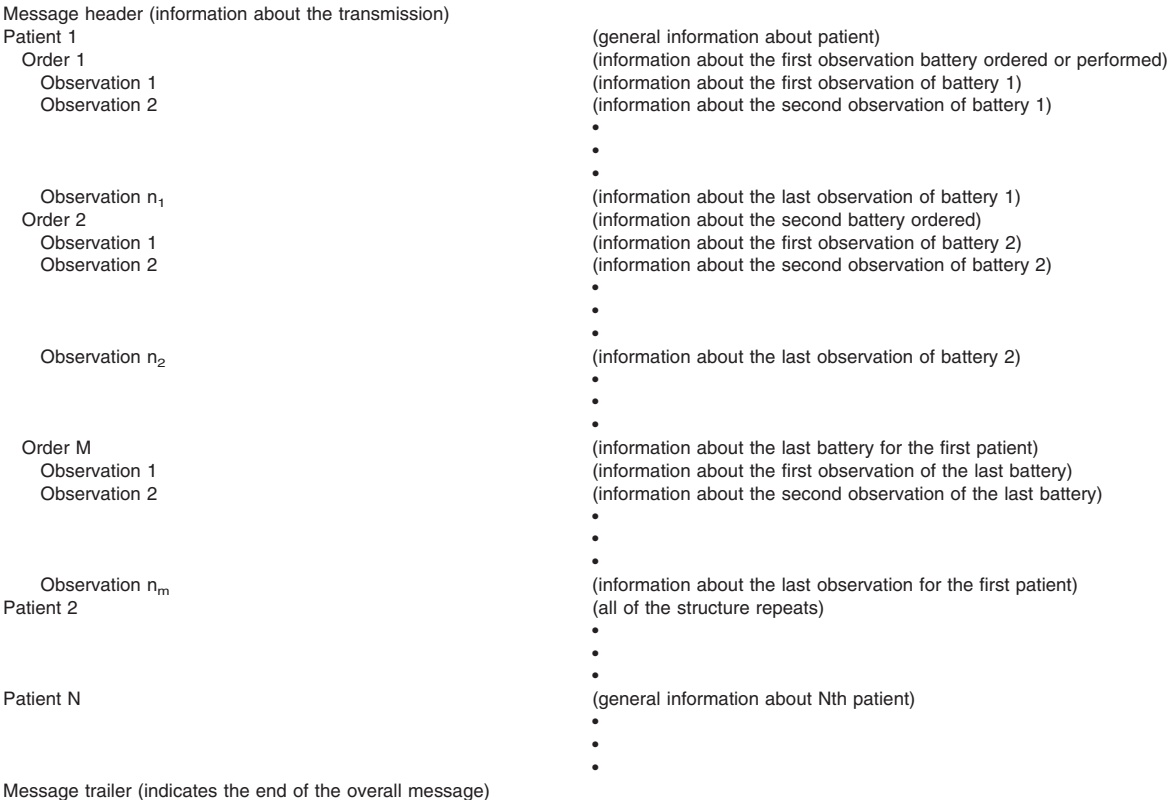


FIG. 1 Logical Structure of Message

5.2.6 The observation order segment (previously test order record) contains information about ordering a single observation, diagnostic study or battery, as discussed in 6.5.3 and Section 9.

5.2.7 Comment segments may appear at any point in the hierarchy. The comment segment always relates to the immediately preceding patient, order, result, or scientific segment. Error segments may also appear anywhere within the hierarchy. Error segments apply to the preceding characters up to the beginning of the message or the preceding error segment, as defined in 6.5.6.

5.2.8 Most of the various segment types are related to each other in a definite hierarchy. At the highest level, designated zero, is the message header and message trailer. At level one is the patient segment, the request-result segment, and the scientific segment. At level two is the observation order segment. At level three are the segments that contain the observation values. The error checking segment and comment segment do not have assigned levels.

5.2.9 A sequence of patient segments, order segments, or observation segments at one level is terminated by the appearance of a segment type of the same or higher level. Thus, a sequence of result segments (OBX) for one battery of observations is terminated by the next order, patient, scientific, request result, or message terminator segment.

5.2.10 When an order is transmitted to an observation producer, it must be preceded by a patient segment. All orders that follow apply to the patient in the preceding patient segment. When a set of observations is transmitted back from

an observation producer, they must be preceded by an order segment and a patient segment to maintain the prescribed hierarchy. In this case, order segment is best thought of as a header for the battery of observations. It contains information that applies to all of the following observations.

5.2.11 Though many fields are defined in this specification, all defined fields are not transmitted in every message. For example, if this specification was being used in a closed hospital system, most of the information in the patient segment would be sent only once, upon admission. The patient segment transmitted with each order would contain only the few defined fields. Similarly, when results are being returned to the ordering service, all that is absolutely required are the first few fields that identify the segment and the patient. Moreover, some fields in the order segment are only relevant after the order has reached the observation producer. Thus, the need to send the hierarchy of segments will not always generate large messages.

5.2.12 The logical relation of these segments is shown in the schematic of Fig. 2, using the HL7 message syntax. In this figure, curly braces identify the repeating segment patterns, and square brackets identify the optional single components. Segments that are not surrounded by brackets are required.

5.2.12.1 In most systems the observation ID in the OBX segment will point to a master observation table that will provide other attributes of the observation that may be used by the receiving system to process the observations it receives. The relation of an observation ID to a master observation table is analogous to the relationship between a document ID and a

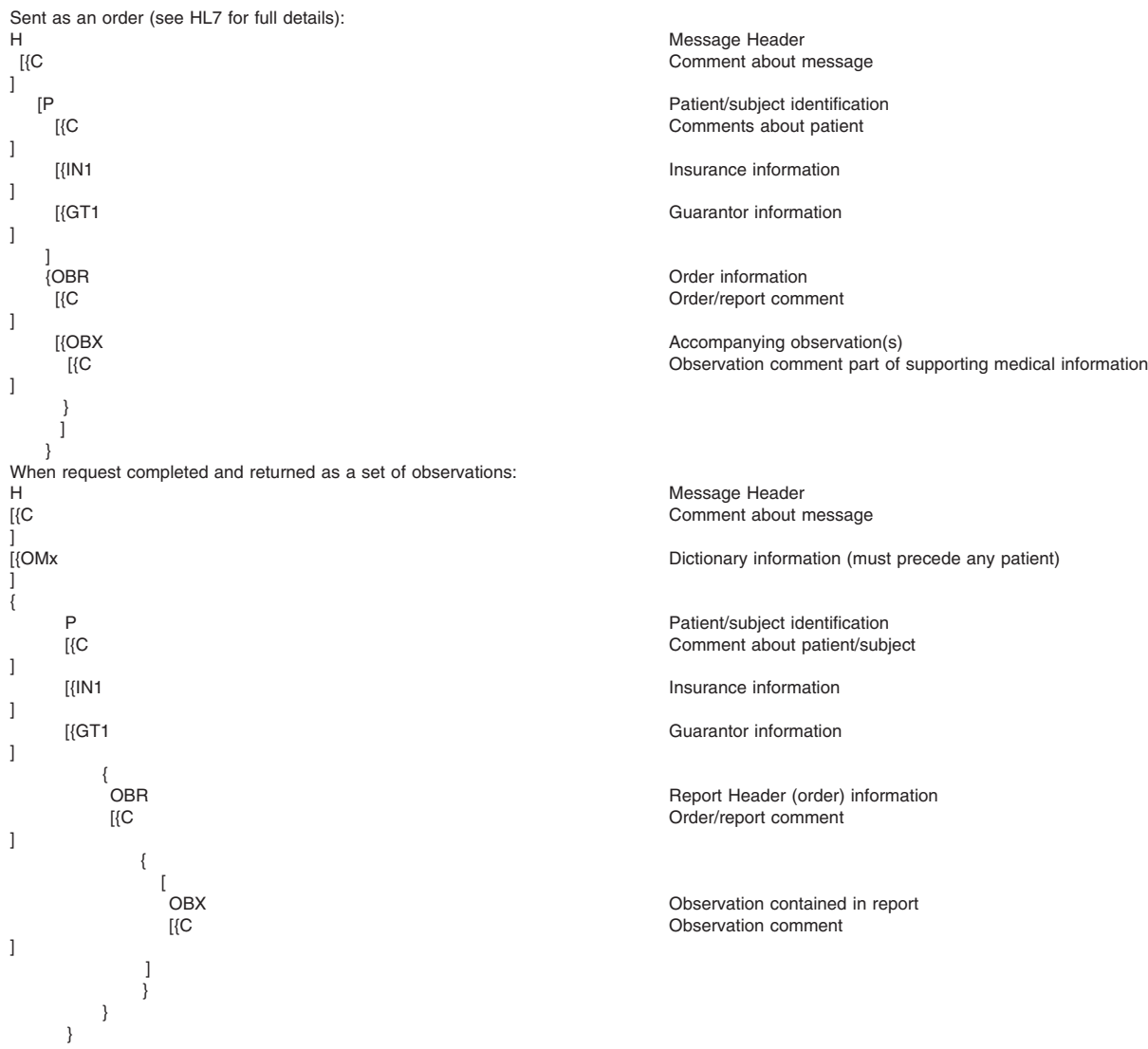


FIG. 2 Logical Relation of Segments

billing record) and the charge master. A proposed set of message segments for transmitting such master observation tables appears in Chapter 19.

5.3 *Maximum Line Length*—Because some operating systems limit the maximum number of characters that can be transmitted between carriage returns, this specification limits a single line of text to 220 characters, including the carriage returns. Some of the segment types can contain more than 220 characters. To accommodate such long segments, this specification defines an addendum segment (see 6.5.9). This represents the logical continuation of a segment larger than the maximum line length.

5.4 *Network Protocols and Transmission Media*—The message body may be preceded and followed by communication headers and trailers produced by the communications method or data compression techniques used during transmission. This specification, however, does not address the nature of the hardware or software network protocols (see ISO Network Standards 8072). It is presumed that the network protocol

sends error-free messages or indicates that there is an error in the message. This specification deals with ISO/OSI (open systems interconnect) Level 7, the message content level, and assumes the existence of an underlying protocol to handle errors. It does define a simple error check segment as data. This error check segment is included so that this specification can be employed to transmit request or result information across channels, such as commercial electronic mail services, or simple computer to computer links, that do not guarantee error-free transmission. This error check is sent only for the convenience of the receivers.

5.4.1 This specification defines no rules for handling the errors, nor what to do when the error is detected. The simple error check is not meant to replace the network error checking protocols which, in most circumstances, will be available to support the communication.

5.4.2 Likewise, media other than telecommunication, which may be employed to exchange laboratory data, are not dealt with in this specification.

5.5 Relation to Specifications E 1394 and E 1381E 1394E 1381 on Data Interchange Between Laboratory Instruments and Computer Systems:

5.5.1 Subcommittee E31.14 has published two standard specifications for the electronic exchange of data between laboratory instruments and laboratory systems. The first, Specification E 1381E 1381, defines standards at the hardware level for linkage between instruments and laboratory systems. The second is Specification E 1394, the message specification.

5.5.2 In designing the order and result segments of Specification E 1394E 1394, the subcommittee closely followed the specification of the O and R records of Specification E 1238 – 88. In the current version of Specification E 1238, these segments have evolved into OBR and OBX segments, respectively.

5.5.3 Subcommittee E31.14 permits each instrument vendor to define its own test codes, which are inferred by the receiving application. Moreover, some instruments will need the defined low level protocol (Specification E 1381E 1381). Thus, it is unlikely that the same application would process messages from instruments and from other computer systems. But, in the case that an office practice system, for example, wants to process laboratory instrument data intermingled with messages from other systems, the R and the O designation will identify segments from an instrument, as specified by Specification E 1394E 1394.

NOTE 1—These are not identical to the O and R record of Specification E 1238 – 88. Subcommittee E31.14 has added three fields to the end of Specification E 1394E 1394.

5.5.4 The O and R segments are permitted when the system receiving the data and the systems sending the data agree to do so. It will be up to the receiver and sender to negotiate how they will identify observation IDs in the O and R segments. On the other hand, vendors who support Specification E 1238 – 91 are not obliged to support the O and R segments.

5.6 Negotiating Required and Optional Fields in Segments:

5.6.1 Which fields should be optional and which required in a standard message is a question that cannot be answered simply because the needs, information availability, and tightness of coupling among observation requestors and producers varies so much across potential users of the standards. In the tightly coupled hospital setting, where the laboratory always receives all patient registration information as it becomes available, the only required field in the patient segment might be the patient’s hospital number. A commercial laboratory, on the other hand, would require many more patient fields to properly report a result back to the requesting practice.

5.6.2 Moreover, what fields are required is conditional on the value of other fields in the message. There are many examples, especially within the OBR segment. Information

about the specimen source (field number 16) is not required for X rays or other observations taken directly from a patient. Nor is it needed in the case that the source is implicit to the test name, for example, CSF culture. The collection volume (field OBR-10) is only required when the test requires a large volume collection (for example, 24 h urines, pleural fluid) and an aliquot is forwarded to the laboratory. If all of the collected specimen is sent, the laboratory can measure the volume itself. The specimen collection time should be entered into the order segment when the ordering service obtained the specimen. But if the lab is to obtain the specimen, this information would not be available to the ordering service and would have to be entered by the lab.

5.6.3 X-ray studies have an interpreter (field OBR-34). In the past most laboratory tests did not. Today, however, because of tightening third party policies about what pathologists can charge for, many laboratory procedures do have an explicit pathologist’s interpretation. In the OBX segment, units and normal ranges are required for numeric results. They are not required for most categorical answers. In short, many and subtle dependencies exist between the observation ID (OBX-4) and the requirement for other fields in the OBX segments.

5.6.4 Difficult operational realities and special cases further complicate attempts to set ironclad policies about required fields. Requesting services do not always have the information that they should have. For example, when registering a patient by telephone, registry clerks are notoriously reluctant to ask the patient to report their race. So a variable, important for interpreting many results, will be missing. In emergency situations, orders may be transmitted before the patient is fully registered. Or worse, the patient is unconscious and no patient identifying information is available—a John Doe. There are also special cases: specimens that are being submitted incognito (blinded) to protect patient confidentiality or scientific policy, and specimens that are submitted as pseudo patients. A hospital may define a patient called Airvent B4 and submit monthly infection control cultures under that patient identifier. Of course, such a patient will not have demographic information.

5.6.5 There are also differences that depend upon the direction of transmission of some segments. More information might be required in the patient segment when sent to the lab as part of a request than when being sent back from the lab as part of a report.

5.6.6 Because of these dependencies, and the incompleteness of our collective understanding about the requirements and limitations across all of the institutions that will employ these standards, we provide guidelines (not ironclad rules) about required fields, in Table 1.

TABLE 1 Synopsis of Field Names and Their Maximum Lengths

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
7 Message Header (H) (both requester and filler)					
7.2	Segment type ID	H-1	ST	R1	3
7.3	Delimiter definition	H-2	ST	R1	5
7.4	Message control ID	H-3	ST	R1	3

TABLE 1 *Continued*

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
7.5	Security	H-4	ST	R2	12
7.6	Sender name or ID	H-5	ST	R1	40
7.7	Sender street address, city, state and zip code	H-6	AD		100
7.8	Message type	H-7	CM		7
7.9	Sender telephone number	H-8	TN		40
7.10	Characteristics of sender	H-9	ST		40
7.11	Receiver ID	H-10	ST	R1	40
7.12	Comment or special instructions	H-11	ST		80
7.13	Processing ID	H-12	ID	R1	20
7.14	Version	H-13	ST	R1	5
7.15	Date and time of message	H-14	TS	R1	26
8 Patient Segment (P) (requester and filler)					
8.2	Segment type ID	P-1	ST	R1	3
8.3	Transmission sequence number	P-2	NM	R1	4
8.4	Practice assigned patient ID	P-3	CK	R1	16
8.5	Diagnostic service assigned patient ID	P-4	CK	R3	16
8.6	Alternative patient ID	P-5	ST		16
8.7	Patient name	P-6	PN	R3	48
8.8	Mother's maiden name	P-7	ST	R3	24
8.9	Birth date/time	P-8	TS	R3	26
8.10	Patient sex	P-9	ID	R3	1
8.11	Patient race or ethnic origin	P-10	ID		40
8.12	Patient street address	P-11	AD		200
8.13	City, state, country, and zip postal code				
8.13	Not used				
8.14	Patient telephone number	P-13	TN		40
8.15	Attending physician ID	P-14	CNA		60
8.16	Special field 1	P-15	ST		60
8.17	Special field 2	P-16	ST		60
8.18	Patient height	P-17	CQ		10
8.19	Patient weight	P-18	CQ		10
8.20	Patient's known or suspected diagnosis	P-19	CE		200
8.21	Patient's medications	P-20	ST		200
8.22	Patient's diet	P-21	ST		200
8.23	Practice field 1	P-22	ST	R2	60
8.24	Practice field 2	P-23	ST	R2	60
8.25	Admission date/time and discharge date/time	P-24	TS		53
8.26	Admission status	P-25	ID		2
8.27	Location	P-26	ST		25
8.28	Diagnostic classification	P-27	CE		100
8.29	Patient religion	P-28	ID		30
8.30	Marital status	P-29	ID		2
8.31	Isolation status	P-30	ID		20
8.32	Language	P-31	ST		20
8.33	Confidentiality status	P-32	ID		20
8.34	Date/time registered	P-33	TS		26
8.35	Death date/time	P-34	TS		26
9 Observation Order Segment (OBR) (requester or filler)					
9.9	Segment type ID	OBR-1	ST	R1	3
9.10	Sequence number	OBR-2	NM	R1	4
9.11	Requestor (placer) specimen ID or accession number	OBR-3	CM	R1	75
9.12	Producer's (filler) specimen ID or accession number	OBR-4	CM	R2	75
9.13	Observation battery ID	OBR-5	CE	R1	200
9.14	Unused	OBR-6			
9.15	Requested date-time	OBR-7	TS		26
9.16	Specimen collection or observation date-time	OBR-8	TS	R2	26
9.17	Collection/observation end time	OBR-9	TS		26
9.18	Collection volume	OBR-10	CQ		20
9.19	Collector ID	OBR-11	CNA		60
9.20	Action code	OBR-12	ID	R1	1
9.21	Danger code	OBR-13	CM		60
9.22	Relevant clinical information	OBR-14	ST		300
9.23	Date and time of specimen receipt	OBR-15	TS		26
9.24	Source of specimen	OBR-16	CM		300
9.25	Ordering provider	OBR-17	CNA		60
9.26	Order callback telephone number	OBR-18	TN		40
9.27	Requestor (placer) field 1	OBR-19	ST	R2	60
9.28	Requestor (placer) field 2	OBR-20	ST	R2	60
9.29	Producer's (filler) field 1	OBR-21	ST		60

TABLE 1 *Continued*

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
9.30	Producer's (filler) field 2	OBR-22	ST		60
9.31	Date and time observation reported or status changed	OBR-23	TS	R2	26
9.32	Producer's charge	OBR-24	CM		60
9.33	Producer's section ID	OBR-25	ID		10
9.34	Order result status code	OBR-26	ID	R2	1
9.35	Link to parent result	OBR-27	CM		200
9.36	Quantity—Timing	OBR-28	CM	R2	200
9.37	Send copies to	OBR-29	CNA		150
9.38	Link to parent order	OBR-30	CM	R2	150
9.39	Transportation mode	OBR-31	ID		20
9.40	Reason for study	OBR-32	CE		300
9.41	Principle interpreter of study	OBR-33	CNA		60
9.42	Assisting interpreter of study (resident)	OBR-34	CNA		60
9.43	Technician identity	OBR-35	CNA		60
9.44	Transcriptionist identity	OBR-36	CNA		60
9.45	Date-time scheduled	OBR-37	TS		26
10 Result Observation Segment (OBX) (requester or filler)					
10.26	Segment type ID	OBX-1	ST	R1	3
10.27	Sequence number	OBX-2	NM	R1	10
10.28	Value type	OBX-3	ID	R1	2
10.29	Observation identifier	OBX-4	CE	R1	80
10.30	Observation Sub-ID	OBX-5	ST	R2	20
10.31	Observation value	OBX-6	(Variable)	R3	64K
10.32	Units	OBX-7	CE	R3	20
10.40	Reference range	OBX-8	ST	R3	60
10.41	Abnormal flags	OBX-9	ID	R3	10
10.42	Probability	OBX-10	NM		5
10.43	Nature of abnormal checking	OBX-11	ID		5
10.44	Observation result status	OBX-12	ID	R3	2
10.45	Date/time of last change in normal values or units	OBX-13	TS	R3	26
10.46	User-defined access checks	OBX-14	ST		20
10.47	Physiologic date/time of observation	OBX-15	TS		26
10.48	Producer ID	OBX-16	CNA		200
10.49	Responsible observer	OBX-17	CNA		60
11 Error Checking Segment (E) (requester or filler)					
11.1.5.1	Segment type ID	E-1	ST	R1	3
11.1.5.2	Sequence number	E-2	NM	R1	4
11.1.5.3	Error check, byte count	E-3	NM	R1	10
11.1.5.4	Check code	E-4	NM	R1	3
12 Comment Segment (C) (requester or filler)					
12.1.1	Segment type ID	C-1	ST	R1	3
12.1.2	Sequence number	C-2	NM	R1	4
12.1.3	Comment source	C-3	ID	R1	8
12.1.4	Comment text	C-4	TX	R1	64K
13 Request Results Segment (Q) (requester or filler)					
13.1.1	Segment type ID	Q-1	ST	R1	3
13.1.2	Sequence number	Q-2	NM	R1	6
13.1.3	Practice (requestor) assigned patient ID	Q-3	CK	R2	200
13.1.4	Diagnostic service (producer) assigned patient ID	Q-4	CK	R2	200
13.1.5	Observation battery ID(s)	Q-5	CE	R2	200
13.1.6	Nature of request time limits	Q-6	ID		10
13.1.7	Beginning request results date and time	Q-7	TS		100
13.1.8	Ending request results date and time	Q-8	TS		100
13.1.9	Requesting physician	Q-9	CNA	R2	60
13.1.10	Requesting physician telephone number	Q-10	TN		40
13.1.11	User field 1	Q-11	ST		80
13.1.12	User field 2	Q-12	ST		80
14 Message Terminator (L) (both requester and filler)					
14.1.1	Segment type ID	L-1	ST	R1	3
14.1.2	Sequence number	L-2	NM	R1	1
14.1.3	Not used	L-3			
14.1.4	Patient count	L-4	NM		4
14.1.5	Line count	L-5	NM		10
14.1.6	Batch number	L-6	ST		12
15 Scientific Segment (S) (filler)					
15.1.1	Segment type ID	S-1	ST	R1	3

TABLE 1 *Continued*

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
15.1.2	Sequence number	S-2	NM	R1	4
15.1.3	Analytical method	S-3	ST		10
15.1.4	Instrumentation	S-4	ST		10
15.1.5	Reagents	S-5	ST		40
15.1.6	Units of measure	S-6	CE		8
15.1.7	Quality control	S-7	ST		2
15.1.8	Specimen type	S-8	ST		10
15.1.9	Body site	S-9	ST		10
15.1.10	Container	S-10	ST		10
15.1.11	Specimen ID	S-11	ST		10
15.1.12	Analyte	S-12	ST		10
15.1.13	Result	S-13	ST		60
15.1.14	Result units	S-14	CE		8
15.1.15	Collection date and time	S-15	TS		26
15.1.16	Analysis date and time	S-16	TS		26
15.1.17	Analytic preprocessing steps	S-17	ST		60
15.1.18	Patient diagnosis	S-18	CE		40
15.1.19	Patient birth date/time	S-19	TS		26
15.1.20	Patient sex	S-20	ST		1
15.1.21	Patient race	S-21	ST		1
16 HL7 Patient Visit Segment (PV1)^A					
17 HL7 Guarantor Segment (GT1)					
17.2	Segment type ID	GT1-1	ST	R1	3
17.3	Sequence number	GT1-2	NM	R1	4
17.4	Guarantor number	GT1-3	ST	R1	20
17.5	Guarantor name	GT1-4	PN	R3	48
17.6	Guarantor spouse name	GT1-5	PN		48
17.7	Guarantor address	GT1-6	AD		100
17.8	Guarantor phone number—Home	GT1-7	TN		40
17.9	Guarantor phone number—Work	GT1-8	TN		40
17.10	Guarantor date of birth	GT1-9	TS	R3	26
17.11	Guarantor sex	GT1-10	ID	R3	1
17.12	Guarantor type	GT1-11	ID		20
17.13	Guarantor relationship to patient	GT1-12	ST		20
17.14	Guarantor universal ID number	GT1-13	ST		11
17.15	Guarantor date/time—Begin	GT1-14	TS		26
17.16	Guarantor date/time—End	GT1-15	TS		26
17.17	Guarantor priority	GT1-16	NM		2
17.18	Guarantor employer name	GT1-17	ST		45
17.19	Guarantor employer address	GT1-18	AD		100
17.20	Guarantor employer telephone number	GT1-19	TN		40
17.21	Guarantor employee ID number	GT1-20	ST		20
17.22	Guarantor employment status	GT1-21	ID		2
18 HL7 Insurance Segment (IN1)					
18.2	Segment type ID	IN1-1	ST	R1	3
18.3	Sequence number	IN1-2	NM	R1	4
18.4	Insurance plan ID	IN1-3	ST	R1	8
18.5	Insurance company ID	IN1-4	ST		8
18.6	Insurance company name	IN1-5	ST		45
18.7	Insurance company address	IN1-6	AD		100
18.8	Insurance company contact person	IN1-7	PN		48
18.9	Insurance company phone number	IN1-8	TN		40
18.10	Group number	IN1-9	ST		12
18.11	Group name	IN1-10	ST		35
18.12	Insured's group employer ID	IN1-11	ST		12
18.13	Insured's group employer name	IN1-12	ST		45
18.14	Plan effective date/time	IN1-13	TS		26
18.15	Plan expiration date/time	IN1-14	TS		26
18.16	Authorization information	IN1-15	CM		55
18.17	Plan type	IN1-16	ID	R3	2
18.18	Name of insured	IN1-17	PN		48
18.19	Insured's relationship to patient	IN1-18	ID		20
18.20	Insured's date/time of birth	IN1-19	TS	R3	26
18.21	Insured's address	IN1-20	AD		100
18.22	Assignment of benefits	IN1-21	ID		2
18.23	Coordination of benefits	IN1-22	ID		2
18.24	Primary payer	IN1-23	ID		2
18.25	Notice of admission code	IN1-24	ID		2
18.26	Notice of admission date/time	IN1-25	TS		26
18.27	Report of eligibility code	IN1-26	ID		2

TABLE 1 *Continued*

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
18.28	Report of eligibility date/time	IN1-27	TS		26
18.29	Release information code	IN1-28	ID		20
18.30	Pre-admit certification	IN1-29	ST		15
18.31	Verification date/time	IN1-30	TS		26
18.32	Verification by	IN1-31	PN		48
18.33	Type of agreement	IN1-32	ST		20
18.34	Billing status	IN1-33	ST		20
18.35	Lifetime reserve days	IN1-34	NM		4
18.36	Delay before lifetime reserve days	IN1-35	NM		4
18.37	Company plan code	IN1-36	ST		8
18.38	Policy number	IN1-37	ST		15
18.39	Policy deductible	IN1-38	MO		20
18.40	Policy limit—Amount	IN1-39	MO		20
18.41	Policy limit—Days	IN1-40	NM		4
18.42	Room rate—Semiprivate	IN1-41	MO		20
18.43	Room rate—Private	IN1-42	MO		20
18.44	Insured's employment status	IN1-43	ID		2
18.45	Insured's sex	IN1-44	ID		1
18.46	Insured's employer address	IN1-45	AD		100
18.47	Insured's telephone number—Home	IN1-46	TN		40
18.48	Insured's telephone number—Business	IN1-47	TN		40
18.49	Insured's universal ID number	IN1-48	ST		11
19.2 General Test/Observation Master Segment (OM1)					
19.2.1	Segment type ID	OM1-1	ST	R1	3
19.2.2	Sequence number	OM1-2	NM	R1	4
19.2.3	Producer's test/observation ID	OM1-3	CE	R1	200
19.2.4	Permitted data types	OM1-4	ID		12
19.2.5	Specimen required	OM1-5	ID	R1	1
19.2.6	Producer ID	OM1-6	CE	R1	200
19.2.7	Observation description	OM1-7	TX		64K
19.2.8	Other test/observation IDs for the observation	OM1-8	CE		200
19.2.9	Other names (recognized by the producer for the observation)	OM1-9	ST		200
19.2.10	Preferred report name for the observation	OM1-10	ST		30
19.2.11	Preferred short name or mnemonic for the observation	OM1-11	ST		8
19.2.12	Preferred long name for the observation	OM1-12	ST		200
19.2.13	Orderability	OM1-13	ID	R1	1
19.2.14	Identity of instrument used to perform this study	OM1-14	CE		200
19.2.15	Coded representation of method	OM1-15	CE		200
19.2.16	Portable device	OM1-16	ID		1
19.2.17	Observation producing department/section	OM1-17	ID		20
19.2.18	Telephone number of department/section	OM1-18	TN		40
19.2.19	Nature of test/observation	OM1-19	ID	R1	1
19.2.20	Report subheader	OM1-20	CE		200
19.2.21	Report display order	OM1-21	ST		20
19.2.22	Date-time stamp for any change in definition for the observation	OM1-22	TS	R1	26
19.2.23	Effective date-time of change in test procedure that makes results noncomparable	OM1-23	TS		26
19.2.24	Typical turn-around time from receipt of specimen/subject to result produced	OM1-24	NM		20
19.2.25	Processing time	OM1-25	NM		20
19.2.26	Processing priority	OM1-26	ID		40
19.2.27	Reporting priority	OM1-27	ID		5
19.2.28	Outside site(s) where observation may be performed	OM1-28	CE		200
19.2.29	Address of outside site(s)	OM1-29	AD		1000
19.2.30	Phone number of outside site(s)	OM1-30	TN		400
19.2.31	Confidentiality code	OM1-31	ID		20
19.2.32	Observations required to interpret this observation	OM1-32	CE		200
19.2.33	Interpretation of observations	OM1-33	TX		64K
19.2.34	Contraindications to observations	OM1-34	TX		64K
19.2.35	Reflex tests/observations	OM1-35	CE		200
19.2.36	Rules that trigger reflex testing	OM1-36	TX		64K
19.2.37	Fixed canned message	OM1-37	TX		64K
19.2.38	Patient preparation	OM1-38	TX		64K
19.2.39	Procedure medication	OM1-39	CE		200
19.2.40	Factors that may affect the observation	OM1-40	TX		64K
19.2.41	Test/observation performance schedule	OM1-41	ST		60
19.2.42	Description of test methods	OM1-42	TX		64K
19.2.43	Charge by producing service	OM1-43	CM		60

TABLE 1 *Continued*

Section	Field Name	Field Mnemonic	Type (See Table 2)	Required Code	Maximum Length
19.2.44	Price modifiers	OM1-44	CM		60
19.3 Numeric Test/Observation Segment (OM2)					
19.3.1	Segment type ID	OM2-1	ST	R1	3
19.3.2	Sequence number	OM2-2	NM	R1	4
19.3.3	Units of measure	OM2-3	CE		20
19.3.4	Range and decimal precision	OM2-4	NM		10
19.3.5	Corresponding SI units of measure	OM2-5	CE		20
19.3.6	SI conversion factor or formula	OM2-6	ST		80
19.3.7	Reference (normal) range for ordinal and continuous observations	OM2-7	CM		200
19.3.8	Critical range for ordinal and continuous observations	OM2-8	CM		200
19.3.9	Absolute range for ordinal and continuous observations	OM2-9	CM		200
19.3.10	Delta check criteria	OM2-10	CM		200
19.3.11	Minimum meaningful increments	OM2-11	NM		20
19.4 Categorical Test/Observation Master Segment (OM3)					
19.4.1	Segment type ID	OM3-1	ST	R1	3
19.4.2	Sequence number	OM3-2	NM	R1	4
19.4.3	Preferred coding system	OM3-3	ID		8
19.4.4	Text/codes for categorical observations	OM3-4	CE		400
19.4.5	Normal text/codes for categorical observations	OM3-5	CE		200
19.4.6	Abnormal text/codes for categorical observations	OM3-6	CE		200
19.4.7	Critical abnormal text/codes for categorical observations	OM3-7	CE		200
19.4.8	Data type	OM3-8	ID		2
19.5 Observations That Require Specimens (OM4)					
19.5.1	Segment type ID	OM4-1	ST	R1	3
19.5.2	Sequence number	OM4-2	NM	R1	4
19.5.3	Derived specimen	OM4-3	ID		1
19.5.4	Container description	OM4-4	TX		64K
19.5.5	Container volume	OM4-5	NM		20
19.5.6	Container units	OM4-6	CE		60
19.5.7	Specimen	OM4-7	CE		200
19.5.8	Additive	OM4-8	CE		200
19.5.9	Preparation	OM4-9	TX		64K
19.5.10	Special handling requirements	OM4-10	TX		64K
19.5.11	Normal collection volume	OM4-11	CQ		20
19.5.12	Minimum collection volume	OM4-12	CQ		20
19.5.13	Specimen requirements	OM4-13	TX		64K
19.5.14	Specimen priorities	OM4-14	ID		60
19.5.15	Specimen retention time	OM4-15	CQ		20
19.6 Test/Observation Segment for Observation Batteries (OM5)					
19.6.1	Segment type ID	OM5-1	ST	R1	3
19.6.2	Sequence number	OM5-2	NM	R1	4
19.6.3	Tests/observations included within an ordered test battery	OM5-3	CE		5000
19.6.4	Observation ID suffixes	OM5-4	ST		200
19.7 Test/Observation Master Segment for Calculated Observations (OM6)					
19.7.1	Segment type ID	OM6-1	ST	R1	3
19.7.2	Sequence number	OM6-2	NM	R1	4
19.7.3	Derivation rule	OM6-3	TX	R1	64K
19.7.4	Observations used to compute value	OM6-4	CE		5000

^A Further information will be added to E 1238 in this position in a future revision.

5.6.7 As a guideline, the standard identifies some fields that should always be included in a segment. It distinguishes three levels of inclusion requirement. The R1 level implies that the field be transmitted and its value be non-null. The segment ID, sequence number, and principle identifier fields of each segment are examples.

5.6.8 A field required at the R2 level can contain null values, but only when the value of the field is not known by the sender (or the field does not apply). The date-time of specimen (field

OBR-8) is required at level R2. When a requestor orders a test that is to be drawn by the laboratory (as indicated by the status flag of L in the “Action Code” (OBR-12) in Table 1 and Section 9.2.1 and Table 3), the requestor does not know the date-time of the specimen. The requestor will record a null value in the date-time field. On the other hand, if the requestor had drawn the specimen, the date-time would have to be included in that, and all subsequent transmissions of the date-time field. Once a value is known to the sender, the test

TABLE 2 Data Types

Code	Description	Reference
AD	Address	6.6.1
CE	Coded entry (for example Test IDs, Dx codes)	6.6.2
CK	Composite ID with check digit	6.6.7
CM	Composite miscellaneous	6.6.8
CNA	Composite ID and person name	6.6.9
CQ	Composite quantity with units <number> ^ <units>	6.6.10
ID	Identifier	6.6.14
MO	Money	6.6.21
NM	Numeric	6.6.15
PN	Person name	6.6.16
RP	Reference Pointer	6.6.22
ST	String for short text and numerics	6.6.17
TN	Telephone number	6.6.18
TS	Time stamp (date and time)	6.6.19
TX	Bulk text	6.6.20

TABLE 3 Codes for Order Actions

Code	Meaning
A	Add the ordered tests or batteries to an existing specimen with the patient identifiers and date-time given in this record.
C	Cancel order for the battery or tests named
G	Generated order. This study was initiated by diagnostic service; for example, (one or more) orders for antibiotic sensitivity can be initiated by the lab when organisms grow out of a bold culture.
H	Hold order until time specified by the quantity-timing field
L	Laboratory to obtain a specimen instead of receiving one from the practice
N	New orders accompanying a new specimen
P	Pending specimen. Order has been sent prior to delivery of needed specimen. Practice will provide specimen.
R	Revised order
S	Schedule the tests specified below

always be included in a message. A null cannot be sent to indicate there has been no change, as is true of the required level R3 (to follow).

5.6.9 A field at the R3 level is required, but can be sent as a null in two cases: (1) when the value is not known by the sender, or (2) when the sender wants to indicate that there has been no change in the value already available to the receiver (see 6.4.8.1). A long X-ray narrative description, for example, might be transmitted from the producer to the requestor with a result status flag of preliminary, because the transcription has not yet been reviewed by the interpreting radiologist. If the reading radiologist found the report to be perfect, the report could be resent, with a status of final and a null observation value to indicate that it had no changes. The same would apply to demographic information in the case of tightly coupled systems. However, the sending and receiving applications would have to know when the values they had were the same as those of the receiving system before they could employ this option. This use of a null value to indicate no change in R3 field value should be used with great caution.

5.6.10 This specification defines optional fields in a very limited way. Optional fields, designated O in Table 1, are those that a sender may or may not include, but that the receiving system must interpret. The only example specified in the standard is in the query segment. The sender may or may not want to specify a date range in a query, for example.

5.6.11 Communicants can negotiate the requirement level for fields that do not have a requirement class specified in Table

1. They can negotiate the level to be N—not transmitted, O—optional in the above sense, or required at the R1, R2, or R3 level. We suggest the following rules be used to negotiate the requirement status of such fields. Whether a value for a field is included or not, the field’s place must be held with a delimiter, however.

5.6.11.1 Rule 1—If the sending application carries information that is defined in the Specification E 1238 message that it will be sending, and the receiving system wants that information, the sender should send it.

5.6.11.2 Rule 2—If the receiving system does not want to get all of the data in the Specification E 1238 message, the sending service is not required to eliminate those values before sending the message (except by mutual agreement). It is usually up to the receiving service to discard information that it does not want.

5.6.11.3 Rule 3—The components of an observation, for example, the value, normal range, and abnormal flags should always be stored in their respective OBX fields. They should not be lumped as one string within the value field. Moreover, observation values should never be stored as a comment in the comment field.

5.7 Acknowledgment of Messages—This standard does not specify how receiving systems report acknowledgment of their receipt of a message nor how to report application level errors. How this shall be done depends strongly on the communication systems and the services available within that system. For users who require an acknowledgment message for each transmitted message, we recommend the use of a message containing a message header and a message acknowledgment segment (MSA) as described in section 2.5.7 of HL7 version 2.1, and a trailer segment.

6. Message General Content Considerations

6.1 Character Representation:

6.1.1 Standard Character Set—Some existing operating systems can only send and receive printable seven bit ASCII characters. Some communication systems use the eighth bit or the non-printable characters, or both, to control message flow, but they use them in nonstandard ways. In order to ensure that the largest class of existing applications and communication links can employ this specification, we have restricted the allowable characters to the printable seven bit ASCII characters and a few special seven bit characters as described below.

6.1.1.1 Representation—All data shall be sent as a restricted set of ASCII characters in accordance with ANSI X3.4; for example, the number 13.5 would be sent as four characters. The only characters permitted in the message body are ASCII characters 32 through 126, ASCII 9 (tab), ASCII 10 (linefeed), ASCII 11 (vertical tab), ASCII 12 (formfeed), and ASCII 7 (bell). ASCII 13 (carriage return) is reserved for use as a segment terminator.

6.1.1.2 European Community and Extended Data Sets—(1) There is nothing intrinsic to Specification E 1238 (or HL7, its sister standard) that restricts the legal data set to the printable ASCII characters. The above restriction was imposed to accommodate the limitations of many existing communication systems. Some existing systems would not be able to



eight-bit characters as flow control characters instead of data. Others would strip off the eighth bit.

(2) The European community (EC) has a need for printable characters (for example, the German ö, the French accent grave) that are not within the above defined restricted data set. The personal computer market accommodates these alphabetic characters by assigning them to codes between 128 and 256, but it does this in many different ways. ISO 8859 is a 256-character set that does include all of the needed European letters and is a candidate for the European standards group. When the Europeans define an eight-bit character set specification, Specification E 1238 will accept this data set in environments that require it, and can use it without complications. The French consortium, H.P.R.I.M., is using ISO-latin (ISO 8859-1) in their implementation of this specification.

6.1.1.3 Multicharacter Codes:

(1) *UNICODE*—When communicants use UNICODE, and all characters are represented by the same number of bytes, all delimiters will be single characters of the specified bytes length, and the standard applies just as it does for single-byte characters except that the length of the characters may be greater than one byte.

(2) *JIS X 0202*—ISO 2022 provides an escape sequence for switching among different character sets and among single-byte and multi-byte character representations. Japan has adopted ISO 2022 and its escape sequences as JIS X 0202 in order to mix Kanji and ASCII characters in the same message. Both the single and multiple byte characters use only the low order 7 bits in JIS Kanji code with JIS X 0202 in order to ensure transparency over all standard communication systems. When ASTM messages are sent as JIS X 0202 all Specification E 1238 delimiters must be sent as single-byte ASCII characters, and the escape sequence from ASCII to Kanji and back again must occur within delimiters. In most cases the use of Kanji will be restricted to text fields.

(3) In the case that a single country uses conflicting rules for representing multi-byte characters, it is up to the communicants to ensure that they are using the same set of rules.

6.1.2 Range and Case Insensitivity—Excluding the exceptions for European Community, extended data sets, and multicharacter codes noted in 6.1.1.2 and 6.1.1.3, only the ASCII characters 32 through 126 are permitted within text data fields. Furthermore, all characters used as delimiters in a particular transmission are excluded from the permitted range. The sender is responsible for screening all text data fields to ensure that the text does not contain those delimiters. The codes and names specified in this standard are *case insensitive*.

6.2 Segment and Field Lengths—This specification assumes that all fields are variable in length. No storage is allocated (except for the delimiter) when no data are entered within a field. When, for example, ten characters of data are entered within a field, only ten characters will be occupied. However, this specification does define a maximum length for each field and forbids the inclusion of more characters than specified by the maximum. **Table 1** lists the maximum length for each field within each segment type.

6.3 Maximum Line Length—See 5.3.

6.4 Delimiters—Alphanumeric characters should not be used as delimiters because they are likely to appear within field content. The examples in this specification use the following recommended delimiters:

Field delimiter	= vertical bar ()
Repeat (subfield) delimiter	= tilde (~)
Component (sub-subfield) delimiter	= caret (^)
Subcomponent delimiter	= ampersand (&)
Escape character	= backslash (\)

6.4.1 Segment Delimiter—Carriage return (ASCII 13) shall be the delimiter that marks the end of all defined segment types. Any nonprintable characters (ASCII 0 through 31) immediately following this carriage return and up to the next printable character will be ignored by the receiving station. Thus the standard can regard either <CR> or <CR><LF> as the line terminator.

6.4.2 Field Delimiter—A single ASCII printable character (ASCII 32 through 126) or one of the five control characters defined in 6.1.1 excluding ASCII 13 (carriage return), shall separate adjacent fields, for example, the date of the specimen and the comment code, and shall be defined in the message header. The same delimiter must be used in all segments within a message. Subcommittee E31.11 recommends the vertical bar (|) as the field delimiter.

6.4.3 Repeat (Subfield) Delimiter:

6.4.3.1 A repeat delimiter must be defined in the message header and is used to separate variable numbers of repeat values within a field. Examples are the results of blood cultures which may include many organisms or the diagnoses field which may contain multiple active diagnoses. This repeat delimiter might be any of the ASCII characters defined in 6.1.2 but must not be the same as the field delimiter. We suggest the use of tilde (~) as the repeat delimiter.

6.4.3.2 The repeat delimiter cannot be used to report multiple observations within one observation segment (OBX). For example, the eight different results composing a typical minimal inhibitory concentration (MIC) sensitivity battery or the twelve results in a CHEM12 would be sent as eight and twelve separate observation segments, respectively.

6.4.3.3 For fields with data type TX (bulk text; see 6.6.20), the repeat delimiter has a more specialized meaning. Within TX fields, it means a hard carriage return. Two repeat delimiters in a row would imply a paragraph in a word processing context. Because the only repeats that exist within bulk text are lines or paragraphs, this is a natural deployment of the repeat delimiter.

6.4.4 Component (Sub-Subfield) Delimiter—A component delimiter is used to separate distinct parts of a field entry. The patient name field is composed of last name, first name, and middle initial, separated by component delimiters. It is single ASCII character, as described in 6.4.1 and it must be different from both the field and repeat delimiter. We suggest the use of the caret (^).

6.4.4.1 Subcomponent Delimiter—The subcomponent delimiter is used to distinguish parts of a component. We suggest the use of ampersand (&) as the subcomponent delimiter.

6.4.4.2 *Escape Character*—For compatibility with HL7, we define the escape character and suggest the use of backslash (\). This is only used in fields of text (TX) data types (see 6.6.20).

6.4.5 *Specification of Delimiters*—The actual delimiters to be employed in a given transmission shall be specified in the header message. It is the responsibility of the sender to avoid the inclusion of any delimiter characters within the field contents. The receiving computer will determine what characters to use by reading the specifications of the header it receives. In the examples used for this document, the vertical bar (|) will be employed as the field delimiter, the tilde (~) as the repeat delimiter, the caret (^) as the component delimiter, the ampersand (&) as the subcomponent delimiter, and backslash (\) as the escape character. (This is a change from \$, |, \, respectively, in the previous version.)

6.4.6 *Delimiters for Null Fields*—Fields shall be identified by their position, obtained by counting field delimiters from the beginning of the segment. This position-sensitive identification procedure requires that when the contents of the field are null, its corresponding field delimiter must be included in the segment to ensure that the *i*th field can be found by counting (*i*-1) delimiters. Delimiters are not included for trailing null fields; that is, if the tenth field was the last field containing data, the segment would contain nothing after the tenth field, and it would contain only nine delimiters.

6.4.7 *Fields of No Concern to the Receiving System*—Transmitted segments may include more fields than are required by a receiving system. When processing a message, the receiving system may ignore any field it does not require. Fields must always be transmitted, however, in the order designated by this specification.

6.4.8 *Changing Fields to Null Values:*

6.4.8.1 A system may transmit a null value for a field because (1) it does not know the value, (2) it knows the value is irrelevant to the receiving system, or (3) the value has not changed since the last transmission, or any combination thereof. To exemplify case number three, a lab within a tightly linked hospital network may never transmit the patient's birthdate, sex, or race in the patient segment when transmitting the order and result segments to the requesting system because it knows that the hospital registry system always broadcasts new or changed patient data to the receiving system.

6.4.8.2 Because the sending system can use nulls to indicate no change, a null value does not overwrite existing data in the receiving system. In rare circumstances, for example, if a system erroneously sent a patient's birthdate when the birthdate was actually unknown, the receiving system should replace its existing value for a field with a null value. The transmission of two double quotes (""), (ASCII 34, ASCII 34), in a field tells the receiving system to replace any existing value with the null value.

6.5 *Segment Types*—Data shall be exchanged in segments of different types. Each segment is introduced by a field identifying the segment type and terminated by a carriage return (ASCII 13). The following segment types are defined.

6.5.1 *Message Header Segment (H)*—This segment shall contain information about the sender and the receiver; that is,

it shall identify the sender and the receiver of the message. It also contains the definition for the field, component, repeat, escape, and subcomponent characters (in that order).

6.5.2 *Patient Identifying Segment (P)*—This segment type contains information about an individual patient.

6.5.3 *Observation Order Segment (OBR) (Previously O):*

6.5.3.1 When sent from the requestor to the observation producer, this segment shall represent an order for a test, diagnostic study, or battery of observations. When returned to the requestor by the observation producer (for example, clinical laboratory, heart station), it shall be considered an order status segment or result *header* for a battery of observations and provides information about the order and the battery of observations. When returned to the requestor, the order segment includes the information originally sent by the requestor as well as information added by the producer, and is usually followed by observations segments (one for each observation within the ordered battery).

6.5.3.2 For clinical laboratory tests the order segment contains all specimen information. However, there is not necessarily a one-to-one correspondence between specimens and test order segments. Ordinarily, order segments will contain orders for one battery, such as electrolytes or a CHEM12. When two batteries that employ the same specimen are ordered in different order segments, the specimen-specific information will be duplicated in each of the test order segments.

6.5.3.3 It is permissible to order more than one battery in one order segment when all attributes of the order are identical for each of the separate observation batteries requested in that segment. However, when these batteries are returned to the requestor with observations, each battery should be preceded by its own order segment.

6.5.3.4 In the case of tests, an order segment may apply to multiple specimens in some rare cases. For example, an order for a creatinine clearance requires two specimens: urine and serum. The test order segment has provisions for identifying the multiple specimens for such tests.

6.5.4 *Observation Segment (OBX) (Previously R)*—Each result segment shall contain the results of a single analytic determination, for example, serum potassium, clinical observation (for example, pulse), or a component of a narrative report (for example, chest X-ray impression or present illness).

6.5.5 *Comment Segment (C)*—Comment segments shall apply to the patient, the order (request) segment, the observation segment, or the scientific segment, or they may be freestanding messages sent to or from the laboratories, unrelated to a particular patient or test procedure.

6.5.6 *Error Checking Segment (E)*—This optional segment is to provide for simple error checking within a message.

6.5.7 *Request Results Segment (Q)*—This segment shall be used to request the values of observations previously ordered and possibly previously reported. A single request results segment asks for an individual observation, a list of many observations, or observation batteries. It may also request all observations taken on a single date, a series of dates, or a range of dates, or observations for an individual patient, a group of patients, or all patients.

6.5.8 *Scientific Segment (S)*—This segment shall be used to exchange results between laboratory sites for the purposes of proficiency testing or method development.

6.5.9 *Guarantor Segment (GT1)*—The guarantor segment (borrowed with permission from HL7) is used to transmit guarantor information needed for billing. It is at the same logical level as the PV1 segment of HL7. It or its sister segment (IN1), or both, can be included in a message to provide information needed by the producer to bill for the performance of a study or an observation. A guarantor segment applies to all of the orders that follow until superseded by another guarantor segment. Any segment of a higher level, such as another patient segment, also terminates the scope of a guarantor segment.

6.5.10 *Insurance Segment (INS1)*—The insurance segment (borrowed with permission from HL7) is used to transmit billing information about the patient. It has exactly the same role as the guarantor segment when insurance is expected to pay for a set of observations.

6.5.11 *Addenda Segment (A)*—An addenda (A) segment is a logical continuation of the immediately preceding segment.

6.5.11.1 When a logical segment is longer than 220 characters it must be broken into an initial segment (designated according to the type of segment it is) and one or more A segments. A large logical segment can be cleaved into as many separate segments as needed to keep each physical segment below the maximum line length of 220 characters (see 5.3). The break can occur at any character position within the logical segment. At each such break point, the sending system adds a carriage return <CR> or <CR> <LF> to left edge and an A plus the chosen field delimiter to the right edge. If | is the field of delimiter, A | would be the first two characters in any A segment. This produces as many A segments as break points.

6.5.11.2 When the separate lines are reassembled by the receiving system this process is reversed. So, when a receiving system encounters an A segment, it takes the body of this segment (everything between the leading A| and the trailing CR) and appends it to the text of the preceding line. It continues to append the body of each consecutive A segment to the tail of the string it has accumulated until it encounters a segment of type other than A. Fig. 3 shows a schematic of a message containing A segments. The patient segment in the

figure has been broken into three segments, the first identified by a leading P, the next two by leading As.

6.6 *Field Data Types*—Table 2 lists the valid data types allowed.

6.6.1 *AD Addresses*—Fields containing postal addresses are of data type AD. An address consists of the following six components, separated by component delimiters:

- (1) street address or post office box number
- (2) apartment number or other internal address
- (3) city
- (4) state or province
- (5) zip or postal code
- (6) country

For example, 1432 Hosteler Street ^ Apt 232 ^ Chicago ^ IL ^ 60603 ^ USA.

6.6.1.1 The country designation is only required when the address is outside of the source country. Special address components, such as “care of” or “attention” should be included in component two, internal address.

6.6.2 *CE Coded Entry*:

6.6.2.1 The coded data type (CE) plays a special role in this standard. It is used to transmit most of the computer understandable clinical information within a message. This standard encourages the transmission of diagnoses, symptoms, problems and findings as CE data types, and it requires that observation identifiers (that is, observation batteries such as vital signs, CHEM12 and spirometry and individual observations such as diastolic blood pressure, calcium, and FEV1) be transmitted as CE data types.

6.6.2.2 By providing a place for recording both the code and its source table (for example, ICD9, SNOMED, or LOCAL) as part of the transmitted data, the CE data type decouples the definition of the message structure (syntax) from the diagnostic/observation codes (semantics). This is a major strength, because it permits the semantics of the message to evolve without requiring changes in the exchange standard. It also permits the use of multiple code systems for different purposes, for example, ICD9 for hospital diagnoses, SNOMED for surgical pathology results and easy migration from one set of codes, for example, ICD9 to ICD10. Finally, it permits cooperating entities to transmit clinical information today

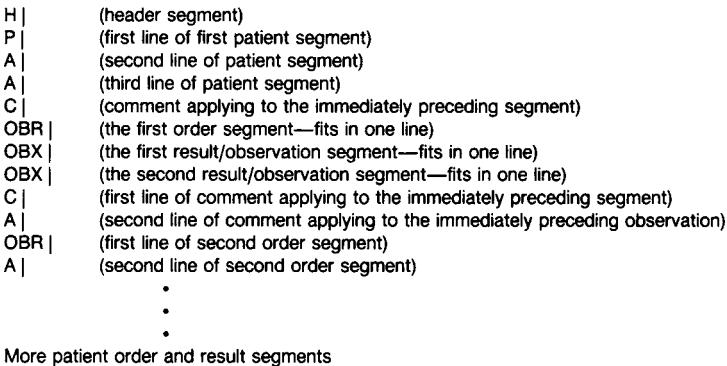


FIG. 3 Example of a Message

using locally defined codes (for example, a commercial laboratory’s test IDs) while they wait for the development of national or international code systems that meet their needs.

6.6.2.3 In the following paragraphs, we discuss fields that contain observation identifiers and fields that contain diagnoses, impressions, problems, etc. Though both kinds of fields are of data type CE, we discuss them separately because their usages and source tables are so different.

6.6.3 *Diagnostic/Finding Codes:*

6.6.3.1 The original Specification E 1238 – 88 defined diagnostic descriptors with two components: <diagnostic code> ^ <text descriptor>. We have expanded this to six components, organized into two triplets, as follows:

<Code1> ^ <text name/description1> ^ <nature of code 1> ^
<Code2> ^ <text name/description2> ^ <nature of code 2>.

6.6.3.2 This approach provides greater flexibility and permits the use of two different coding systems to identify the same diagnostic entity, for example, a local code and ICD-9, or SNOMED and ICD-9, when needed. The use of the second triplet to identify a second code is optional. The default coding system for the first triplet is ICD-9-CM (I9C). The default coding system for the second triplet is a locally defined code (L). Consequently, this approach is downward compatible with the previous structure. In most transmissions, with the use of defaults, only the first one or two components will be necessary, as was the case in Specification E 1238 – 88. The individual components are described in the following.

(1) *Code 1*—This is the code that identifies the diagnosis or finding. It must be a code taken from the coding systems described in the third component.

(2) *Text Name or Description 1*—This is text that describes, or provides more specificity to, the universal code. This text can be used in different ways depending upon the requirements of the senders and receivers.

(a) It can be the source text (for example, the diagnoses, as recorded by the attending physician) that was translated into the code given in component 1. For example:

410.1 ^ anterior MI ^ I9C

(b) It can provide specificity to the recorded code, for example, to specify whether a leg problem occurred on the right or the left. For example:

718.7 ^ right knee joint mouse ^ I9C

NOTE 2—ICD-9 does not distinguish between right and left side.

(c) It can be the formal text descriptor associated with the code. For example:

410.1 ^ acute myocardial infarction of outer anterior wall ^ I9C

NOTE 3—This is the text description for this code.

(d) It could be the only representation of the diagnosis in case the diagnosis was not, or can not be, translated into a code. For example:

^ Hgb Seattle Disease

NOTE 4—Specific hemoglobinopathies are not represented in ICD-9.

(3) *Nature of Diagnostic Code*—This field identifies the nature of the diagnostic coding system represented in the first component of a CE entry. Table 4 gives a listing of valid diagnostic coding systems and the mnemonic identifier for each coding system.

TABLE 4 Diagnostic Coding Systems

Names	Code	Source
American College of Radiology Finding Codes	ACR	Index for Radiological Diagnosis Revised, 3rd Edition 1986, American College of Radiology, Reston, VA.
CEN ECG diagnostic codes	CE	CEN PT007. A quite comprehensive set of ECG diagnostic codes (abbreviations) and descriptions has been published as a pre-standard by CEN TC251. Available from CEN TC251 secretariate, % Georges DeMoor, State University Hospital Gent, De Pintelaan 185-5K3, 9000 Gent, Belgium or Jos Willems, University of Gathuisberg, 49 Herestraat, 3000 Leuven, Belgium.
CLIP	CLP	Simon Leeming, Beth Israel Hospital, Boston, MA. Code for radiology reports.
Gabrieli Medical Nomenclature	G	Electronic Healthcare Records Research, Inc., 1633 Statler Towers, Buffalo, NY 14202.
ICD9	I9	World Health Publications, Albany, NY.
ICD9-CM	I9C	Commission on Professional and Hospital Activities, 1968 Green Rd., Ann Arbor, MI 48105.
ICD-10	I10	World Health Publications, Albany, NY.
Local general code	99zzz or L	Locally defined codes for purpose of sender or receiver. Local codes can be identified by "L" (for backward compatibility) or 99zzz (where "z" is an alphanumeric character) include the designator "L" to identify the local code and a second subcomponent to identify a specific local code.
Local billing code	LB	Local billing codes/names (with extensions if needed).
Read Classification	RC	The Read Clinical Classification of Medicine, Park View Surgery, 26 Leicester Rd., Loughborough LE11 2AG (includes drug procedure and other codes, as well as diagnostic codes).
Systemized Nomenclature of Medicine (SNOMED)	SNM	Systemized Nomenclature of Medicine, 2nd Edition 1984, Vols 1 and 2, American College of Pathology, Skokie, IL.
SNOMED III	SNM3	See above.
Unified Medical Language	UML	National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20894.

6.6.3.3 The second three components repeat the first three for a different coding system. Sending the full six components is not required. In fact, if the coding system is ICD-9CM, only one single component, the ICD-9CM code, is required because ICD-9CM is the default coding system. For example, if 410.1

was sent, the receiving system would take this to mean the ICD-9CM code for acute anterior myocardial infarction. When local identifying codes are used senders should include a universal code as well, so that data from systems with different local codes can be received by the receiving system.

6.6.3.4 A single system may have to deal with multiple local codes, for example, one for the X-ray department, one for the local lab and yet another for a referral lab. These are distinguished by the second subcomponent at the third component, for example, L&LAB, L&XR, L&REF. The receiving system would have to specify the local services codes that defined valid sources of patient data. Any other code would require manual intervention.

6.6.3.5 If a system receives data from multiple sending systems, the Sender ID from the message header segment serves to locate the correct local coding system in combination with the local coding system identifier. In an environment where many sending systems are interfaced to many receiving systems, one cannot assume that all local coding systems are uniquely identified across systems. It can only be assumed that the local coding system is unique within a sending system. Therefore, to a receiving system, the local coding system is always uniquely identified by the combination of Sender ID (from the message header segment) and local coding system (the second subcomponent in the third and sixth component of a CE field).

6.6.4 Test/Observation Identifiers:

6.6.4.1 The same coding scheme defined for diagnoses, findings, and symptoms can also be used to identify tests or clinical observations.

6.6.4.2 Fields containing the identifier for a test battery, diagnostic study, or clinical measurement, depending upon the application, have an identical structure to that of the diagnosis identifier described in 6.6.2.1. They consist of six components,

organized into two triplets, as follows:
<Code1 for study> ^ <text name/description1 of Code1> ^
<nature of Coding System1> ^
<2nd code for same study> ^ <text name/description
related to Code2> ^ <nature of Coding System2>.

6.6.4.3 The six individual components of a diagnostic study identifier are described below.

(1) *Observation/Study Code 1*—This is a code from any registered coding system (see Table 4). The Specification E 1238 universal code (AS4) is the default code for the observation battery identifier and the observation identifier. For now, this universal code is based on CPT4 (3). However, CPT4 does not provide enough specificity for many diagnostic results. It provides no identifiers for the components of the blood count differential (for example, polys, bands, MCV) for the urinalysis, for individual antibiotic sensitivities (for example, ampicillin or penicillin MIC), for many serologic studies, nor for most clinical observations such as diastolic blood pressure or the review of systems. Subcommittee E31.11 has created new codes and modifiers to CPT4 codes in order to provide unique identifiers for most laboratory tests and clinical observations (see Appendix X1). The universal observation code identifier shall be sent as a single field that includes both the CPT4 code (when one exists) and any Specification E 1238 modifiers. The modifier component is separated from the official CPT4 code by a period (ASCII 46) (Note 5).

NOTE 5—The CPT4 code permits a few two digit integer modifiers but these are separated from the main code by a dash.

(2) *Text Descriptor for Code 1*—This component is a text description of the test/study or measurement (see Table 5). It can serve three purposes:

(a) To identify an observation/test that the sender does not or cannot represent with a more formal code; for example, acetylcholine receptor antibodies. When only text is transmitted, the receiving service will have to intervene manually to determine the nature of the observation.

(b) To provide a full text description for the observation identified by Component 1.

(c) To provide added specificity to the code in Component 1.

(3) *Nature of Coding System*—This third component identifies the coding system (or source book) for the code in component 1. The available coding systems for identifying observations are shown in Table 6.

TABLE 5 Example Diagnostic Codes

Nature of Coding System	Example
ACR:	51.71 ^ Congestive heart failure ^ ACR
ICD9-CM:	186.9 ^ Testicular cancer ^ I9C 186.9 ^ Testicular cancer 531.3 ^ Gastric ulcer in lesser curvature ^ I9C
ICD9 & SNOMED:	186.9 ^ ^ M-9061/3 ^ ^ SNM
LOCAL CODE & ICD9:	186.9 ^ ^ 793 ^ Cancer of Testicle 186.9 ^ ^ 793 ^ Cancer of Testicle ^ L&CLIN <937> ^ Cancer of Testicle ^ L ^ 186.9 ^ ^ I9C (the nature of both code systems must be stated in this last example because I9C is default for 1st triplet and "L" default for 2nd, not vice versa).
ICCS	1601.255 ^ Staphylococcus ^ ICS
SNOMED:	M-9061/3 ^ Testicular cancer ^ SNM

TABLE 6 Procedure/Observation/Drug ID/Health Outcomes Coding Systems

NOTE—The Read and NLM codes in Table 4 also include drugs. A number of sources of unique drug names exist: British Approved Names (BAN), French approved nonproprietary names (DCF), and International Nonproprietary name (INN). These sources are now being reviewed. Those that also provide unique codes will be added to the registry of coding systems using the abbreviations given in parentheses.

Coding System	Code	Source/Description
Specifications E 1238/E 1467 Universal	AS4	American Society for Testing and Materials and CPT4 (see Appendix X1 of Specification E 1238 and Appendix X2 of Specification E 1467E 1467).
CPT-4	C4	American Medical Association, P. O. Box 10946, Chicago, IL 60610.
CPT-5	C5	(under development—same contact as above)
EUCLIDES	E	AFP codes. Available from Euclides Foundation International nv, Excelsiorlaan 4A, B-1930 Zaventem, Belgium; Phone: 32 2 720 90 60.
FDA K10	FDK	Dept. of Health and Human Services, Food and Drug Administration, Rockville, MD 20857 (device & analyte process codes).
HIBCC	HB	Health Industry Business Communications Council, 5110 N. 40th St., Ste 120, Phoenix, AZ 85018.
ICCS	ICS	Commission on Professional and Hospital Activities, 1968 Green Road, Ann Arbor, MI 48103.

TABLE 6 *Continued*

Coding System	Code	Source/Description
ICD-9CM	I9C	Commission on Professional and Hospital Activities, 1968 Green Road, Ann Arbor, MI 48105 (includes all procedures and diagnostic tests).
ICHPPC-2	IC2	International Classification of Health Problems in Primary Care, Classification Committee of World Organization of National Colleges, Academies and Academic Associations of General Practitioners (WONCA), 3rd edition. An adaptation of ICD9 intended for use in General Medicine, Oxford University Press.
ISBT	IBT	International Society of Blood Transfusion. Blood Group Terminology "1990." VOX Sanguines 1990 58(2):152–169.
IUPAC/IFCC	ICU	Recommendations of Quantities and Units in Clinical Chemistry DRAFT (to be published in 1992). Henrik Olesen, M.D., D.M.Sc., Chairperson, Department of Clinical Chemistry, KK76.4.2, Rigshospitalet, University Hospital of Copenhagen, DK-2200, Copenhagen.
Local	99zzz or L	Locally defined codes for purposes of sender or receiver. If multiple local codes exist, the format should be 99zzz, where z is an alphanumeric character & <name>, where name is a locally defined controller of a local code, for example, lab, radiology, etc.
Medicare	MCR	Medicare provider codes/names.
Medicaid	MCD	Medicaid billing codes/names.
UCDS	UC	Uniform Clinical Data Systems. Office of Peer Review, Health Care Finance Administration, The Meadows East Bldg., 6325 Security Blvd., Baltimore, MD 21207; (301) 966 6851.
Japanese chemistry	JC8	Clinical examination classification code. Japan Association of Clinical Pathology. Version 8, 1990. A multiaxial code including a subject code (for example, Rubella = 5f395, identification code (for example, virus ab IGG), a specimen code (for example, serum = 023), and a method code (for example, ELISA = 022).
Health outcomes	HI	Health Outcomes Institute codes for outcome variables available (with responses) from Health Outcomes Institute, 2001 Killebrew Drive, Suite 122, Bloomington, MN 55425; Phone: (612) 858 9188. See examples in Appendix X1 .
Euclides Lab method codes	E6	Available from Euclides Foundation International nv, Excelsiorlaan 4A, B-1930 Zaventem, Belgium; Phone: 32 2 720 90 60.
Euclides Lab equipment codes	E7	Available from Euclides Foundation International nv (see above address).
Euclides kind of quantity codes	E5	Available from Euclides Foundation International nv (see above address).
Drug codes:		
Chemical abstract codes	CAS	These include unique codes for each unique chemical, including all generic drugs. The codes do not distinguish among different dosing forms. When multiple equivalent CAS numbers exist, use the first one listed in USAN. USAN 1990 and the USP dictionary of drug names, United States Pharmacopeial Convention, Inc., 12601 Twinbrook Parkway, Rockville, MD 20852.
National drug codes	NDC	These provide unique codes for each distinct drug, dosing form, manufacturer and packaging. (Available from the National Drug Code Directory, FDA, Rockville, MD, and other sources.)
WHO rec# drug codes	W1, W2	World Health organization record number code. A unique sequential number is assigned to each unique single component drug and to each multicomponent drug. Eight digits are allotted to each such code, six to identify the active agent, and two to identify the salt of single content drugs. Six digits are assigned to each unique combination of drugs in a dispensing unit. The six digit code is identified by W1, the eight digit code by W2.
WHO rec# code with ASTM extension	W4	With ASTM extensions (see Appendix X1), the WHO codes can be used to report serum (and other) levels, patient compliance with drug usage instructions, average daily doses and more (see Appendix X1).
WHO ATC	WC	WHO's ATC codes provide a hierarchical classification of drugs by therapeutic class. They are linked to the record number codes listed above.
Device code:		
MDNS	UMD	Universal Medical Device Nomenclature System. ECRI, 5200 Butler Pike, Plymouth Meeting, PA 19462 USA. Phone: 215-825-6000; Fax: 215-834-1275.

(4) *Code 2*—This component contains any secondary code used by the sender to identify a test battery, individual observation, measurement, or diagnostic studies. The default coding system for the second code is the local coding system (L).

(5) *Text Description for Code 2*—If different from the description of the first code, include a description for the second code.

(6) The coding system that defines the code given in Code 2. The default for the second code triplet is L for local codes.

6.6.5 Example Observation Identifiers:

^ ^ ^ 743 ^ Glucose

743 ^ Glucose ^ L&LAB

^ ^ ^ 743

6.6.5.1 It could also be sent together with universal codes.
82948^ Random Glucose ^ ^ 743 (82948 is CPT4 code for random glucose)

82948 ^ ^ ^ 743

743 ^ ^ L&LAB ^ 82948 ^ ^ AS4 (If the local code is sent first, the coding system must be explicitly stated).

6.6.5.2 In point-to-point implementations of this standard for the laboratory, locally defined text and codes will often be used to identify individual observations (test results). If only the local code is being transmitted, it could be sent as ^ ^ ^ 743.

6.6.5.3 Subcommittee E31.11 encourages the inclusion of a universal identifier AS4 as shown in [Appendix X1](#) in addition to any local identifier to make it easier for the receiving system (for example, an office practice) to identify and file results from different sources.

6.6.6 *Multiple Observation or Observation Battery Identifiers in One Field*—Multiple identifiers (for different studies) can be sent as one order in one identifier field. When multiple study identifiers are included in one field, they should be separated by repeat delimiters.

6.6.7 *CK Composite ID With Check Digit*—Fields with data type CK shall be presented as three subcomponents, the ID (identification) number, check digit, and nature of check digit check (optional), separated by subcomponent delimiters. If the number was 99999-5 with 5 a Mod10 check digit, the ID would be reported as 99999&5&M10. If Mod11 check digit, the indicator would be M11. Subcommittee E31.11 encourages the use of check digits for identifiers with CK data type. However,

a check digit is not required. Applications that do not now employ check digits in their patient identifiers can also send their identifiers in a CK field. A null in the second subcomponent indicates that no check digit is included. The default check digit type is mod 10. A hospital number with the mod 10 check digit would appear as follows:

“999999&6” or “999999&6&M10

6.6.7.1 How to Compute a Mod 10 Check Digit—The algorithm for calculating a Mod 10 check digit is as follows:

(1) Assume you have an identifier equal to 12345. Take the odd digit positions counting from the right, that is, 531, multiply this number by 2 to get 1062. Take the even digit positions starting from the right, that is, 42, append these to the 1062 to get 421062. Add all of these six digits together to get 15. Subtract this number from the next highest multiple of 10, that is, 20 – 15 to get 5. The Mod10 check digit is 5. The Mod10 check digit for 401 is 0, for 9999, it is 4, for 9999999, it is 7.

6.6.8 CM Composite Miscellaneous—The CM data identifies composite fields that have a variety of special structures.

6.6.9 CNA Provider and User IDs:

6.6.9.1 Physicians’ and other caregivers’ codes may be transmitted as internal code numbers, as full names, or both, as mutually agreed upon between the sender and the receiver. This field has a three component structure, code ^ name ^ code type. When a name is sent it should have the same structure as patient name (see 6.6.16), but the parts of the name are separated by subcomponent delimiters (&) instead of component delimiters. When both the name and ID number are sent, ID numbers should come first and be separated from the name by a component delimiter.

6.6.9.2 The order of the parts of the name shall be (1) last name, (2) first name, (3) middle initial or name, (4) suffix, for example, Jr. and (5) title, for example, Dr. or Mr., etc., (6) degree, for example, PhD, MD, DDS. Thus, if Dr. John G. Jones, Jr. had an identifier of 401-0, his number and name would be transmitted as

401-0 ^ JONES&JOHN&G&JR&DR&MD ^ L.

6.6.9.3 If a given part of a name is absent or does not apply, a null should be sent for the corresponding subcomponent using the same rules for leaving off terminal subcomponent delimiters that apply to field delimiters. Thus, if only the doctor’s ID number and last name were available, you would send: **401-0 ^ JONES ^ L.** When necessary, more than one ID may be sent within one field. When a person has multiple values for one of the entries, for example, two middle initials, a compound last name, or two degrees (M.D., Ph.D.), these multiples should be included in their respective component location, separated by spaces.

6.6.9.4 Multiple person IDs in one field are separated by repeat delimiters. The provider identifier can be either local or universal codes; for example, HCFA’s universal physician code is indicated by UPIN, as follows:

32975 ^ JONES&JOHN&G&JR&DR&MD ^ UPIN.

6.6.9.5 This specification differs slightly from HL7 (and Specification E 1238 – 88) in its composite ID-person name specifications. Following the pattern of a CE data type, it permits the specification of a code system (for example, local

versus the Social Security Universal Doctor Number) in the third component and uses subcomponent delimiters (not component delimiters) to separate the parts of a name. Accordingly, the code specification (CNA) is slightly different from HL7 Version 2, which uses CN to designate composite ID-PERSON NAME. Other data types are identical between HL7 and this specification.

6.6.10 CQ Fixed Measurements and Units:

6.6.10.1 When a field contains a single defined observation, for example, patient’s weight, patient’s height, or collection volume, the default units of measurement for that observation are specified in the field definition. When the observation is measured in the default units, the units need not be transmitted. If the measure is recorded in units different from the default, for example, if the weight is measured in pounds rather than kilograms, the measurement units must be transmitted. In this case the units are transmitted in the same field as the measurement. The units follow the measure and are separated from it by a component delimiter, for example, 100 ^ lb. If the units are ISO + units, the units should be recorded as single case abbreviations as specified in 10.37 and its tables. If the units are ANSI or local, the units and the source code table must be recorded, as specified in 10.37. But in these cases, component delimiters should be replaced by subcomponent delimiters.

6.6.10.2 Weight in kilograms would be expressed as “70 ^ kg” in a CQ field, because kilograms is an ISO unit. Weight in pounds would be expressed as “150 ^ lb&&ANS + ” because it is a customary U.S. unit defined within ANSI + .

6.6.10.3 In future extensions of this specification, CQ fields will be used sparingly, because the same data can be sent as an OBX segment as part of the order and the use of OBX segments to record clinical observations needed by the producing service is more flexible and general.

6.6.11 Reserved for Future Use.

6.6.12 Reserved for Future Use.

6.6.13 Reserved for Future Use.

6.6.14 ID String that Represents an ID—The legal IDs are defined in a field-associated table.

6.6.14.1 Many ID fields permit the entry of free text to describe a category that is not in the Specification E 1238 list of defined codes or to embellish an existing code. Whenever free text is entered into an ID field it must be entered as the second component (that is, preceded by a component delimiter) to distinguish it from a defined code.

6.6.15 NM Numeric—A string that can only be interpreted as a number. It consists of the ASCII digits (0-9), a decimal point (.) and can be preceded by a plus or minus sign, for example, **999, – 32.45.**

6.6.16 PN Person Name—This data type is used to specify a person’s name, for example, the patient’s name. It is similar to the CNA data type except that it includes no person code nor code types. A PN field can consist of up to six components, separated by component delimiters:

6.6.16.1 Last name,

6.6.16.2 First name,

6.6.16.3 Middle name or initial,

6.6.16.4 Name suffix, for example, Jr. or III,

6.6.16.5 Prefix title, for example, Dr., Mr., or Ms.

6.6.16.6 Degree, for example, PhD, DDS, MD.

6.6.16.7 For example,

JONES ^ JOHN ^ MICHAEL ^ III ^ DR ^ MD.

Only the first two to three components are required. When patients have multiple values for one of the entries, for example, two middle initials, a compound last name, or two degrees (M.D., Ph.D.) these multiples should be included in their respective component location, separated by spaces.

6.6.17 *ST String*—This is a simple text string, left justified. It may represent a number or short text. If multiple separate messages are sent as strings in a single field they should be separated by repeat delimiters. String fields are limited length (see [Table 1](#) for examples) compared to TX data type, which is virtually unlimited in length (up to 64K).

6.6.18 *TN Telephone and Beeper Number*:

6.6.18.1 Local phone numbers shall be recorded as NNN-NNNN, where N is a digit and the hyphen is the conventional telephone number separator. The number of digits on either side of the hyphen may vary according to the country.

6.6.18.2 If an area code or region code is required, it should precede the local telephone number and be enclosed in parentheses, for example, **((312))959-0800**, for a United States area code and phone number. The country code should precede the area code when it is needed, for example, **1(312)959-0800** for a call to the United States from outside of the United States. When an extension is required, it should follow the phone number and be preceded by X, for example, **((532))596-6666X4790**, where 4790 is an extension number of variable length. When a beeper number is also required, it should follow the local phone number and the extension, if present. The beeper number is identified by a leader B, for example, **((532))596-6666X4790B43905**. Both the telephone extension and the beeper number can be a variable number of digits.

6.6.18.3 Text to indicate the applicability of a telephone number can be appended to the end of the phone number with a leading C for comments, for example, **659-3225C6am~235-0211C on Saturdays**.

6.6.18.4 When multiple telephone numbers apply, they may be included in one field and separated from each other by repeat delimiters. The first such entry is considered the primary or the daytime number.

6.6.19 *TS (Time Stamp) — Previously Date-Time*.

6.6.19.1 *ANSI Date Format*—In all cases, dates shall be recorded in the YYYYMMDD basic date format as defined by [ANSI X3.51](#)-1986 and ISO 8601-1988. December 1, 1986 would be represented as an eight-character string, 19861201. When times are transmitted, they shall be represented as HHMM and be linked to dates as specified by [ANSI X3.51](#). Date and time together shall be specified as a twelve-character string: YYYYMMDDHHMM. If seconds are required the date-time should be fourteen-character string: YYYYMMDDHHMMSS. The preceding is also the basic format for ordinal date and local time of day (ISO 8601, [5.4.1.b](#)) without the T between date and time as permitted by ISO.

6.6.19.2 *Time Zones*—If it is necessary to relate the current time to its time zone, as might be necessary if the reporting and requesting service are in different time zones, use the coordinated universal time convention (ISO 8601-1988 and ANSI

3.51-1986), where the offset from the universal time is appended to the date-time plus or minus HH or HHMM, for example, Jan 1, 1989, 1:30 p.m. in New York City is five hours behind Greenwich mean time. Thus it is represented as **198901011330-05**. A date-time that took advantage of all of those options could occupy 19 characters of storage.

6.6.19.3 *Decimal Points and Fractions of Seconds*—In keeping with ISO 8601, a transmitter who requires greater precision than whole seconds could send fractional seconds by following the seconds characters with a dot (.), and then the decimal fractions of a second. December 1, 1986, at 13:30:25.02, would be reported as **19861201133025.02**. This specification does not permit fractional representations of minutes, hours, or other higher order units of time as ISO does.

6.6.20 *TX Bulk Text*—The TX data type consists of free and unlimited text (up to 64K bytes). Leading spaces are preserved, trailing spaces are trimmed. Repeat delimiters have meaning. They are regarded as paragraph terminators or hard carriage returns (for example, they would display as though a CR/LF were inserted). A receiving system would word-wrap the text between repeat delimiters in order to fit it into an arbitrarily sized display window, but start any line beginning with a repeat delimiter on a new line.

6.6.20.1 *Use of Escape Sequences in Text Fields*—When a field of type TX is being encoded, the escape character may be used to signal certain special characteristics of portions of the text field. In general, the escape character is whatever display ASCII character is specified in the Escape Character Field in the message header. For purposes of illustration, the character ‘\’ will be used to represent the escape character. An *escape sequence* consists of the escape character followed by an escape code ID of one character followed by 0 or more data characters followed by another occurrence of the escape character. The following escape sequences are defined:

\H\	start highlighting
\N\	normal text (end highlighting)
\F\	field delimiter
\S\	component delimiter
\T\	subcomponent delimiter
\R\	repetition delimiter
\E\	escape character
\Dnnn\	decimal code value of an 8 bit character
\Xdddd\	hexadecimal data
\Zdddd\	locally defined escape sequence

(1) To start *Highlighting*, indicate that the following characters should be made to stand out, but leave the method of doing so to the receiving application. Depending on device characteristics and application style considerations, the receiving application may choose reverse video, boldface, underlining, blink, an alternate color or some other means of highlighting the selected text. For example, the message fragment:

TL| TOTAL CHOLESTEROL \H240*\N\ [90-200]
might cause the following data to appear underlined on a screen or report:

TOTAL CHOLESTEROL 240* [90-200]
whereas another system may choose to show the **240*** in red.

(2) The *special character* escape sequences (\F, \S, \T, \R, and \E) allow the corresponding characters to be included in the data in a text field, even though the actual characters are reserved. For example, in the message

TLI TOTAL CHOLESTEROL 180 \F90-200\F
TLI \S\-----\S\

would cause the following information to be displayed, given suitable assignment of delimiters:

TOTAL CHOLESTEROL 180 | 90-200 |
^-----^

(3) When the *hexadecimal* escape sequence (\Xdddd\) is used, the X should be followed by one or more pairs of hexadecimal digits (0, 1, ..., 9, A, ..., F). Consecutive pairs of the hexadecimal digits represent eight-bit binary values. The interpretation of the data is entirely left to an agreement between the sending and receiving applications that is beyond the scope of this standard.

6.6.21 *Money Data Type (MO)*—The money data type provides a way to transmit prices and costs in any currency. This data type consists of two components. The first specifies the money amount, and the second specifies the currency. In the United States, the currency is assumed to be U.S. dollars when not specified. In other countries, other defaults may be assumed by local agreement. The currency will be specified as the short ISO codes for currency (ISO 4217-1990). Examples of ISO 4217 codes for major currencies include:

CODE	Country and Currency Name
CAD	Canadian Dollar
CHF	Swiss Franc
CNY	Chinese Yuan
DEM	Deutsche Mark
ESP	Spanish Peseta
FRF	French Franc
GBP	British Pound Sterling
JPY	Japanese Yen
SUR	Russian Rouble
USD	United States Dollar

6.6.22 *Reference Pointer Data Type (RP)*—This data type transmits information about data stored on another system. It contains a reference pointer that uniquely identifies the data on the other system, the identity of the other system, and the type of data. This information is transmitted in three components arranged as follows:

<pointer> ^ <application ID> ^ <type of data>

where:

- pointer = This is a unique key assigned by the system that stores the data. The key is used to identify and access the data.
- application ID = This is a unique name (up to six characters in length) of the system that stores the data. It is equivalent to the application ID of the placer or filler number (see 9.11 and 9.12). Application IDs must be unique across a given ASTM implementation.
- type of data = This is a code that represents the type of data being stored. For example:

SI = scanned image
SD = scanned document
TX = 'machine readable' text
FT = formatted text

Other types may be added as needed. For example:

I1234A321634BC ^ EFC ^ SDI

6.7 Examples of Messages Using This System:

6.7.1 The example in Fig. 4 illustrates how the employment of this specification leads to a valid message. It shows a message header segment, a patient segment, three test order segments for electrolytes, complete blood count (CBC), and erythrocyte sedimentation rate (ESR), and their associated observation segments. In the example, observation identifiers are sent as universal AS4 codes (CPT4 with Specification E 1238 modifiers). The example also includes one error check segment, two comment segments, and a message terminator segment. The header, patient, and all of the order segments illustrate the use of addenda segments to accommodate continuation lines. Continuation lines are required when a segment exceeds the 220-character maximum. They would not be required for the example in Fig. 4. A line beginning with AI is a continuation line. In the example, the carriage return is indicated by <CR>.

6.7.2 Additional examples showing the use of these standards to transmit EKG, chest X ray, and surgical pathology results are given in Fig. 5.

6.8 Rules about retransmission of results (for example, corrected results or final results after preliminary results have been received) are as follows:

6.8.1 When results are retransmitted, the sender, when possible, should indicate which of the individual results were changed or deleted by setting appropriate codes in the Result Status field in the OBX segment. This standard has provision for flagging individual observations as corrected for the benefit of the receiving systems. However, this standard does not specify how the receiving system should process corrected observations, that is, whether they should retain both (the previously transmitted incorrect observations along with the corrected ones) or replace them.

6.9 *Orders that Spawn Multiple Orders*—A requestor's OBR segment may be parent to many producer OBR segments. For example, *Routines* ordered as a single test code may explode into orders for CBC, electrolytes, and urinalysis in the laboratory system. An order for CK enzymes Q8 h × 24 h will explode into three separate orders. Other orders generate secondary orders conditional on the results of the initial analysis. Blood cultures may, for example, spawn orders for antimicrobial susceptibilities, depending upon the results of the original culture as described in 6.10.2. The child order segments can be linked to the parent order by mechanisms described in 9.13, 9.36, and 9.39.

6.10 Producer Generated Orders:

6.10.1 The results of some orders generate other orders within a producing service, for example, orders for antibiotic susceptibilities are automatically generated in response to positive blood culture results. If many organisms are isolated from one blood culture, multiple sensitivity batteries may be produced. In this case, there may be the need to distinguish each of these antibiotic sensitivities and associate them with the source blood culture and a particular organism (these issues are dealt with by the parent and linkage field 9.36 and 9.39).

6.10.2 Laboratory systems deal with cultures and their respective sensitivities in different ways. Some consider the results of the cultures and their sensitivities as a single battery,