



# Standard Specification for Defining and Sharing Modular Health Knowledge Bases (Arden Syntax for Medical Logic Modules)<sup>1</sup>

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## 1. Scope

1.1 This specification covers the sharing of computerized health knowledge bases among personnel, information systems, and institutions. The scope has been limited to those knowledge bases that can be represented as a set of discrete modules. Each module, referred to as a Medical Logic Module (MLM), contains sufficient knowledge to make a single decision. Contraindication alerts, management suggestions, data interpretations, treatment protocols, and diagnosis scores are examples of the health knowledge that can be represented using MLMs. Each MLM also contains management information to help maintain a knowledge base of MLMs and links to other sources of knowledge. Health personnel can create MLMs directly using this format, and the resulting MLMs can be used directly by an information system that conforms to this specification.

1.2 The major topics are found in the following sections.

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## 2. Referenced Documents

### 2.1 ASTM Standards:

**E 1238** Specification for Transferring Clinical Laboratory Data Messages Between Independent Computer Systems<sup>2</sup>

**E 1384** Guide for Content and Structure of the Computer-Based Patient Record<sup>2</sup>

### 2.2 ISO Standards:

**ISO 8601** – 1988 Data Elements and Interchange Formats—Information Interchange (representation of dates and times)<sup>3</sup>

### 2.3 ANSI Standards:

**ANSI X3.4** – 1986 Coded Character Sets—American National Standard Code for Information Interchange (7-bit ASCII)<sup>4</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *Medical Logic Module (MLM)*, *n*—an independent unit in a health knowledge base. Each MLM contains maintenance information, links to other sources of knowledge, and enough logic to make a single health decision.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *time*, *n*—a point in absolute time. Also known as a timestamp, it includes both a date and a time-of-day.

3.2.2 *time-of-day*, *n*—hours, minutes, seconds, and possibly, fractions of seconds past midnight.

3.2.3 *date*, *n*—Gregorian year, month, and day.

3.2.4 *duration*, *n*—a period of time (for example, **3 days**) that has no particular start or end point.

3.2.5 *institution*, *n*—a health facility of any size that will provide automated decision support or quality assurance.

## 4. Significance and Use

4.1 Decision support systems have been used for health care successfully for many years, and several institutions have already assembled large knowledge bases. There are many conceptual similarities among these knowledge bases. Unfortunately, the syntax of each knowledge base is different. Since no one institution will ever define a complete health knowledge base, it will be necessary to share knowledge bases among institutions.

4.2 Many obstacles to sharing have been identified: disparate vocabularies, maintenance issues, regional differences, liability, royalties, syntactic differences, etc. This standard addresses one obstacle by defining a syntax for creating and sharing knowledge bases. In addition, the syntax facilitates addressing other obstacles by providing specific fields to enter maintenance information, assignment of clinical responsibility, links to the literature, and mappings between local vocabulary terms and terms in the knowledge base.

4.3 The range of health knowledge bases is large. This specification focuses on those knowledge bases that can be represented as a set of Medical Logic Modules (MLMs). Each MLM contains maintenance information, links to other sources of knowledge, and enough logic to make a single health decision. Knowledge bases that are composed of independent rules, formulae, or protocols are most amenable to being represented using MLMs.

4.4 This specification, which is an outcome of the Columbia-Presbyterian Medical Center 1989 Arden Home-stead retreat on sharing health knowledge bases, is derived largely from HELP of LBF Hospital, Salt Lake City, UT (**1**)<sup>5</sup>, and CARE, the language of the Regenstrief Medical Record System of the Regenstrief Institute for Health Care, Indianapolis, IN (**2**).

## 5. MLM Format

5.1 *File Format*—An MLM is a stream of text stored in an ASCII file (**ANSI X3.4** – 1986). One or more MLMs may be placed in the same file. Within a file, an MLM begins with the marker **maintenance:** and ends with the marker **end:**.

<sup>2</sup> Annual Book of ASTM Standards, Vol 14.01.

<sup>3</sup> Available from ISO, 1 Rue de Varembe, Case Postale 56, CH 1211, Geneve, Switzerland.

<sup>4</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

<sup>5</sup> The boldface numbers in parentheses refer to the list of references at the end of this standard.

5.2 *Character Set*—Within an MLM only the printable ASCII characters (ASCII 33 through and including 126), space (ASCII 32), carriage return (ASCII 13), line feed (ASCII 10), and horizontal tab (ASCII 9) may be used. The use of horizontal tab is discouraged because there is no agreement on how many spaces it represents. Other characters, like the bell and backspace, are not allowed within the MLM. (There is no limitation on the characters that may occur between MLMs within a file; for example, a form feed character may separate two MLMs even though it cannot occur within an MLM.)

5.3 *Line Break*—Lines are delimited by **line breaks**, which are any one of the following: a single carriage return, a single line feed, or a carriage return-line feed pair.

5.4 *White Space*—The space, carriage return, line feed, and horizontal tab are collectively referred to as **white space**.

5.5 *General Layout*—**Annex A1** contains a complete description of MLMs expressed in BACKUS-NAUR Form. See **Appendix X1** for MLM examples. (Planned editions and changes for future versions of this specification are listed in **Appendix X2**.) A typical MLM is arranged like this.

**maintenance:**

**slotname: slot-body;;**  
**slotname: slot-body;;**

...

**library:**

**slotname: slot-body;;**

...

**knowledge:**

**slotname: slot-body;;**

...

**end:**

5.6 *Categories*—An MLM is composed of slots grouped into three categories: maintenance, library, and knowledge. A category is indicated by a category name followed immediately by a colon (that is, **maintenance:**, **library:**, and **knowledge:**). Category names need not be placed at the beginning of a line.

5.7 *Slots*—Within each category is a set of slots.

5.7.1 Each slot consists of a slot name, followed immediately by a colon (for example, **title:**), then followed by the slot body, and terminated with two adjacent semicolons (;;) which is referred to as **double semicolon**. The content of the slot body depends upon the slot, but it must not contain a double semicolon.

5.7.2 Each slot must be unique in the MLM, and categories and slots must follow the order in which they are listed in this standard. Some slots are required and others are optional.

5.8 *Slot Body Types*—These are the basic types of slot bodies:

5.8.1 *Textual Slots*—The textual slots contain arbitrary text (except for double semicolon, which ends the slot). As the MLM standard is augmented, slots that are currently considered to be textual may become coded or structured. An example of a textual slot is the title slot, which can contain arbitrary text.

5.8.2 *Textual List Slots*—Some slots contain textual lists. These are lists of arbitrary textual phrases separated by single semicolons (;). An example of a textual list slot is the keywords slot.

5.8.3 *Coded Slots*—Coded slots contain a simple coded entry like a number, a date, or a term from a predefined list. For example, the priority slot can only contain a number, and the validation slot can contain only the terms **production**, **research**, etc.

5.8.4 *Structured Slots*—Structured slots contain syntactically defined slot bodies. They are more complex than coded slots, and are further defined in Section 7. An example of this kind of slot is the logic slot.

5.9 *MLM Termination*—The end of the MLM is marked by the word **end** followed immediately by a colon (that is, **end:**).

5.10 *Case Insensitivity*—Category names, slot names, and the **end** terminator may be typed in uppercase (for example, **END**), lowercase (for example, **end**), or mixed case (for example, **eNd**).

## 6. Slot Descriptions

6.1 For each slot description, next to the slot name is an indication of whether the slot is textual, textual list, coded, or structured, and whether it is required or optional. Slots must appear in this order.

6.2 *Maintenance Category*—The maintenance category contains the slots that specify information unrelated to the health knowledge in the MLM. These slots are used for MLM knowledge base maintenance and change control.

6.2.1 *Title (textual, required)*—The title serves as a comment that describes briefly what the MLM does. For example, **title: Hepatitis B Surface Antigen in Pregnant Women;;**

6.2.2 *Filename (coded, required)*—The MLM filename uniquely identifies an MLM within a single authoring institution. It is represented as a string of characters beginning with a letter and followed by letters, digits, and underscores (\_). A filename may be 1 to 80 characters in length. Filenames are insensitive to case. The MLM filename is distinct from the name of the ASCII file which happens to hold one or more MLMs. For example,

**filename: hepatitis\_B\_in\_pregnancy;;**

6.2.3 *Version (coded, required)*—The current version of the MLM is expressed as a fixed point number with two decimal places to the right of the decimal point. MLMs start at 1.00 and advance by .01 for small revisions and by 1 for large revisions. For example,

**version: 1.00;;**

6.2.4 *Institution (textual, required)*—The institution slot contains the name of the authoring institution. For example,

**institution: Columbia University;;**

6.2.5 *Author (textual list, required)*:

6.2.5.1 The author slot contains a list of the authors of the MLM, delimited by semicolons. The following format should be used: first name, middle name or initial, last name, comma, suffixes, and degrees.

6.2.5.2 An electronic mail address enclosed in parentheses may optionally follow each author's name. Internet addresses are assumed. Bitnet addresses should end in **.bitnet** and UUCP addresses should end in **.uucp**. For example,

**author: John M. Smith, Jr., M.D. (jms@cuasdf.bitnet);;**

6.2.6 *Specialist (textual, required)*—The domain specialist is the person in the institution responsible for validating and installing the MLM. This slot should always be present but