Toward Standardization of Terminology in Anesthesia Information Management Systems

One of the first attempts to create a national database for anesthesia outcomes occurred in the late 1990s. The National Center for Clinical Outcomes Research (NCCOR) was organized for the purpose of developing a data warehouse to which participants would send their perioperative records. In return, NCCOR would deliver comparative derivatives of their data. This effort failed for a variety of reasons. One of the major obstacles to its success was the lack of a standardized medical terminology. Even if participating hospitals had an AIMS system, they faced the daunting task of reformatting and normalizing their data into a standard data file for submission. In addition, the lack of a standard data dictionary for anesthesiology meant that participating hospitals could not be sure that their data collection was comparable with that of other hospitals collecting data with different terms and semantic meanings.

Since 1984, the Anesthesia Patient Safety Foundation (APSF) has been an advocate for outcomes research in the specialty and has recognized the need for aggregate databases in outcomes research. The Institute of Medicine Report *To Err is Human: Building a Safer Health System* recognized that several groups in the United States were already working on methods to improve patient safety and named the Anesthesia Patient Safety Foundation (APSF) as a leader in this field.[1] In 2001, the APSF endorsed the use of anesthesia information management systems (AIMS) as a means of collecting data for this purpose. AIMS are installed in less that 5% of US hospitals, yet the value of these systems is apparent in terms of legibility and accessibility of the patient's medical record as well as for research and practice analysis. According to the Institutes of Medicine report *Crossing the Quality Chasm,* "automated clinical and administrative data enable many types of health service research applications, such as assessment of clinical outcomes associated with alternative treatment options and care processes; identification of best practices; and evaluation of the effects of different methods of financing, organizing, and delivering services."[2]

One of the most significant barriers to adoption of information systems is the complexity and length of the

product installation process. The installation of an AIMS system often includes the development of a customized set of terms and phrases to be created specific to each institution. There are few guidelines available and minimal standardization of the terms used. Complete product installations in excess of one year are not uncommon; this situation is unduly burdensome to vendor and customer alike. The result is a delay or barrier to the adoption of technology that at the least solves the problem of legibility and accessibility of the anesthesia record and necessary for meaningful outcomes research.

This lack of standardization for terms in AIMS inhibits the sharing of data between information systems from the same vendor, let alone across institutions with different vendor systems. This data interoperability issue did not arise with the advent of automated systems. It exists for paper-based anesthesia records and continues to stifle comparative research in the specialty. Attempts have been made to standardize subsets of terms pertinent to the specialty, such as the American Association of Clinical Director's (AACD) "Glossary of Times Used for Scheduling and Monitoring of Diagnostic and Therapeutic Procedures". However, these lexicons have not been widely adopted and, to date, no group has attempted a more complete terminology for the specialty.

The APSF approached the problem of developing meaningful outcomes research from a new perspective. This organization recognized that the primary problem preventing meaningful outcomes research was the lack of a standard anesthesia terminology. In 2001, the APSF executive committee commissioned the Data Dictionary Task Force to create a standardized terminology for AIMS. Dr. Terri Monk of the University of Florida was appointed chairperson and given the responsibility of organizing this

task force and recruiting individuals in academic medicine, private practice, and industry to serve on this committee. She named Dr. Iain Sanderson of Duke University Medical Center as Technical Director for the DDTF. The original mission of this task force was to:

1. Establish a data dictionary for the collection of perioperative information
2. Identify the specific perioperative outcomes to be investigated.

Existing standard terminology were to be used wherever possible. A deliverable of this process would be a set of anesthesia terms that could be pre-loaded into an AIMS system during an initial installation, providing a considerable service to the vendors of these systems and institutions investing in them. This baseline set of terms would not preclude customization, but could reduce the need or desire for it.

In 2002, the DDTF learned of considerable expertise and experience in creating anesthesia terminologies in the United Kingdom (UK). Our anesthesia colleagues in the National Health Service (NHS) in the UK had been working independently on an anaesthesia terminology under the auspices of the Society for Computing and Technology in Anaesthesia (SCATA) for over 10 years. Members of SCATA were submitting their anesthesia terms to UK's Clinical Terms Version 3 initiative (CTV3), an extension of the well-respected Read Codes. In 2003, the DDTF joined forces with members of SCATA in the UK and evolved into the International Organization for Terminology in Anesthesia (IOTA) with the mission to create a standardized terminology for the global anesthesia community. IOTA also contains members from the Canadian Anesthesiologists Society and the Society for Technology in Anesthesia. The American Society of

Standardization of Terminology (Cont.)

Anesthesiologists (ASA) has also appointed members of the Committee on Performance and Outcomes Measurement (CPOM) to represent them at all meetings and to lead the effort to establish meaningful outcomes research questions for the specialty of anesthesia. The Content Director for the DDTF/IOTA is Dr. Andrew Norton and the Technical Director is Dr. Martin Hurrell. Both of these individuals are members of SCATA and have been involved with terminology work in the UK for over a decade.

Concurrently, the DDTF became aware that the US government was considering the adoption of a major medical terminology called SNOMED (Systematized NOmenclature of MEDicine). SNOMED was originally developed by the College of American Pathologists (CAP). SNOMED International is a non-profit organization that oversees the strategic direction and scientific maintenance of SNOMED. Their goal is to develop a complete dictionary of medical terms. The latest SNOMED product, SNOMED CT, incorporates the CTV3 terms from the National Health Service (NHS) and is now licensed to be used throughout the NHS in the UK. SNOMED is extensively mapped to other lexicons, such as the ICD9-CM diagnosis coding system. In July 2003, the National Library for Medicine purchased a national license for SNOMED CT in the US, making it free for all US medical entities. In September 2003, the DDTF was formally adopted by SNOMED as an official extension group that would establish the terminology for anesthesia in the US and UK. The work of IOTA is now creating the "Anesthesia Subset" of terms for SNOMED CT.

The development of a standardized anesthesia terminology will greatly facilitate outcomes research in the future. However, we now recognized that future AIMS systems will need more than just a terminology to enable outcomes research and artificial intelligence applications for reasoning and decision support. The next generation of AIMS systems will need a schema to define the structure for well-formed anesthesia XML documents and a common model or ontology to develop an anesthesia-specific vocabulary. An ontology defines the terms used to describe and represent an area of knowledge. Ontologies are used by people, databases, and applications that need to share subject-specific (domain) information - like *medicine*, tool manufacturing, real estate, automobile repair, financial management, etc. Ontologies include computer-usable definitions of basic concepts in the domain and the relationships among them. They encode knowledge in a domain and also knowledge that spans domains. In this way, they make that knowledge reusable."

IOTA has chosen to develop the anesthesia ontology using Protégé with the OWL plugin. (A 'clinician friendly' front end for the Protégé-OWL plugin has been created for IOTA by the Information Management Group in the Computer Science Department at the University of Manchester, UK.). In February, 2004 the Web Ontology Language (OWL) was approved as a key standard to underpin the future development of the Semantic Web by the World Wide Web Consortium (W3C – http://www.w3.org). IOTA uses OWL DL (Description Logic) which allows the use of DIG compliant reasoners such as Racer to validate the ontology and also to support computer-based decision support.

Thus the IOTA project embraces three activities:

1. Ontology development

2. Schema definition (consistent with the HL7 Clinical Statement initiative)

3. Terminology development

Together these aim to deliver an international standard for the communication and understanding of anesthesia information which will enable a new era in research and clinical audit.

References:

1. Committee on Quality of Health Care in America, Institute

Standardization of Terminology   (Cont.)

of Medicine. *To Err Is Human: Building a Safer Health System.* Washington DC: National Academy Press; 1999.

2. Committee on Quality of Health Care in America, Institute of Medicine. *Crossing the Quality Chasm.* Washington DC: National Academy Press; 2001.

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- Terri G. Monk, MD
Duke University Medical Center

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Standardization of Terminology
(Editor's Comments)

I've appended a glossary so those of us that are not actually involved with data dictionaries can get a glimmer of what the task force has done.

From
http://www.webopedia.com/TERM/D/data_warehouse.html

Data Warehouse: Abbreviated *DW*, a collection of data designed to support management decision making. Data warehouses contain a wide variety of data that present a coherent picture of business conditions at a single point in time

Data dictionary: In database management systems, a file that defines the basic organization of a database. A data dictionary contains a list of all files in the database, the number of records in each file, and the names and types of each field. Most database management systems keep the data dictionary hidden from users to prevent them from accidentally destroying its contents. Data dictionaries do not contain any actual data from the database, only bookkeeping information for managing it. Without a data dictionary, however, a database management system cannot access data from the database.

Xml: Short for Extensible Markup Language, a specification developed by the World wide web consortium (W3C). XML is a pared-down version of SGML, designed especially for Web documents. It allows designers to create their own customized tags, enabling the

definition, transmission, validation, and interpretation of data between applications and between organizations.

SGML: Short for Standard Generalized Markup Language, a system for organizing and tagging elements of a document. SGML was developed and standardized by the International Organization for Standards (ISO) in 1986. SGML itself does not specify any particular formatting; rather, it specifies the rules for tagging elements. These tags can then be interpreted to format elements in different ways. SGML is used widely to manage large documents that are subject to frequent revisions and need to be printed in different formats. Because it is a large and complex system, it is not yet widely used on personal computers. However, the growth of Internet, and especially the World Wide Web, is creating renewed interest in SGML because the World Wide Web uses HTML, which is one way of defining and interpreting tags according to SGML rules.

From http://protege.stanford.edu/plugins/owl/tutorial/

OWL: Ontology is a conceptual model about some domain. Ontologies can be used to represent information/knowledge about domain concepts, and the relationships that are assumed to hold between them. For example, ontology about animals could specify the typical characteristics of the various species of animals, e.g. their number of legs, color of the coat, and typical habitat. Such ontology can then be used by humans or intelligent software agents to classify animals found in the bush. Thus, ontology provides useful metadata about things (individuals). The World Wide Web is a natural application area of ontologies, because ontologies could be used to describe the contents of web pages. For example, the definitions from an animal ontology could be used to annotate images from certain animals, and thus tell an intelligent agent that this image shows a black squirrel, while another image shows a spotted koala. OWL defines syntax and semantics for an ontology language that can be used on the web for these purposes.

STA at the ASA

2004 STA Dinner & Ty Smith Annual Lecture
Saturday October 23, 2004
Caesar's Palace

What Do You Do with 28 Million Acre-Feet of Water?
Timothy Ulrich
Area Manager for the Bureau of Reclamation
Lower Colorado Dam Office

Chair: Peter Fine, MD, UNDNJ Medical School
Registration: http://www.anestech.org/Meetings-ASA.php

2004 Breakfast Panel
Wednesday, October 27, 7:30 - 8:45 am
Las Vegas Hilton
PDAs for Point-of-Care Information in the Operating Room
Moderator: Robert Loeb, MD, University of Arizona
Panel:

PDA Databases for Patient Tracking & Billing
Hugh Allen, MD
Virginia Mason Medical College

Knowledge Resources I - Prewritten Software
Keith Ruskin, MD
Yale University

Knowledge Resources II - Accessing Local Information
Ravindra Prasad, MD
University of North Carolina

Registration: http://www.anestech.org/Meetings-ASA.php

Computers In AnesthesiaXXV
October 27-30, 2004
Hyatt Regency Lake Las Vegas Resort

The Computers In Anesthesia (CIA) facilitates an annual meeting which focuses on the use of computers in Anesthesia. This year's meeting will immediately follow the annual meeting of the American Society of Anesthesiologists (ASA), and is sponsored by STA.

Course Director: Susan Feather, MD
Scientific Chair: David Feinstein
Registration: http://www.anestech.org/Meetings-Computers.php
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STA Members Presenting

Abstracts
Anesthesia Consultation Using Telemedicine Technology- A Pilot Study
David T. Wong, M.D., Damon Kamming, F.R.C.A., Frances Chung, F.R.C.P.C., Department of Anesthesia, Toronto Western Hospital, Toronto, Ontario, Canada.
October 25, 2004 2 - 4 PM Room Hall C2

Structured Peer Review Analysis of Anesthesia Equipment-Related Adverse Outcomes
Vilma A. Joseph, M.D., M.P.H., **Rhoda D. Levine, M.D., Robert S. Lagasse, M.D.**, Department of Anesthesiology, Albert Einstein College of Medicine/Montefiore Medical Center, Bronx, New York, United States.
October 26, 2004   9 - 12:00 PM Room Hall C2

Teaching Fiberoptic Endoscopy, LMA and Other Airway Equipment for Difficult Airway Management: Survey of Residency Training Programs in the US
Abdel R. El-Ganzouri, M.D., Sandra C. Toleikis, M.A., **Kenneth J. Tuman, M.D.**, David M. Rothenberg, M.D., Anthony D. Ivankovich, M.D., Anesthesiology, Rush University Medical Center, Chicago, Illinois.
October 26, 2004   2 - 4 PM   Room Hall C2

STA Members Presenting (Cont.)

Refresher Course
Understanding Your Anesthesia Machine
Andrews, J. Jeffrey M.D.
October 24, 2004 2:45 - 3:35PM Las Vegas Convention Center
Room N107-108

Modern Anesthesia Machines: What You Should Know
Olympio, Michael A. M.D.
October 27, 2004   8:30 - 9:20AM Las Vegas Convention Center
Room N101-102-103

A Fire in the Operating Room: It Could Happen To You
Ehrenwerth, Jan M.D.
October 23, 2004 11:00 - 11:50AM Las Vegas Convention Ctr
Room N117

PBLD
Hey Anesthesia, Nice Simulator! Can You Teach Our Medical Students with This?
Pardo, Jr., Manuel M.D.
October 23, 2004   3:30 - 4:45AM Las Vegas Convention Center
Hall N1, Table 6

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Refresher Course
Working in the Operating Rooms of the Future
Goldman, Julian M. M.D.
October 25, 2004   3:25 - 4:15PM Las Vegas Convention Center
Room N101-102-103

Cover Article -

Toward Standardization of Terminology in Anesthesia Information Management Systems

- will be presented as a lecture at the ASA
  Sunday, October 24, 2004; 11:00am
  Las Vegas Hilton, Conference Room 7 and again
  at the CIA meeting that follows the ASA.

  There will also be a demonstration of the terming tool using Protege with an OWL plug in at the CIA meeting.

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