

Data Representation, Coding, and Communication Standards



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KEYWORDS

• ICD-10 • CPT • Standards • Pathology • Coding • Informatics

ABSTRACT

The immense volume of cases signed out by surgical pathologists on a daily basis gives little time to think about exactly how data are stored. An understanding of the basics of data representation has implications that affect a pathologist's daily practice. This article covers the basics of data representation and its importance in the design of electronic medical record systems. Coding in surgical pathology is also discussed. Finally, a summary of communication standards in surgical pathology is presented, including suggested resources that establish standards for select aspects of pathology reporting.

DATA REPRESENTATION: IT'S JUST A BUNCH OF WORDS, RIGHT?

The immense volume of cases signed out by surgical pathologists on a daily basis gives little time to think about exactly how these data are stored. Yet, an understanding of the basics of data representation has implications that affect a pathologist's daily practice.

DATA REPRESENTATION IN A PARAGRAPH: EVERYTHING COMES FROM BYTES

As reported by Sinard,¹ all data are stored in binary form; the fundamental unit of data is the byte, which can be "on" (1) or "off" (0). Eight bytes form a bit, and combinations of bytes that are on or off (ie, 00010001 or 10110010) are used to

represent integers. Because each integer between 0 and 128 can represent letters and punctuation based on the American Standard Code for Information Exchange (ASCII), numerous possibilities emerge. Moreover, as bits are stacked (ie, 8-bit, 16-bit, and 32-bit), many combinations of off and on positions are possible, representing many possible forms of data (Fig. 1). Software, also created from these data, decodes these bits and bytes into something that pathologists can understand. While pathologists usually do not need to understand this decoding step in practice, the challenges in this step – a fundamental step – can generate frustration between pathologists and information technology (IT) departments, if IT members are not clear on what the pathologist needs to see and accomplish in his/her workflow.

DATA REPRESENTATION, VARIABLES, AND PATHOLOGY REPORTS: TOO IMPORTANT TO BE AN AFTERTHOUGHT

Variables are an important part of data representation and storage; they can be analogized as "containers" for information (Fig. 2). In pathology reports, there are variables for a patient's name, date of birth, paraffin blocks, gross description, final diagnosis, and so forth. A pathology report, however, is also a variable in itself, stored in a "database" of similar variables. Most importantly, how these variables are organized can optimize (or jeopardize) a physician's workflow. For example, Jackson describes² a case in which an abnormal pathology result was hidden in the

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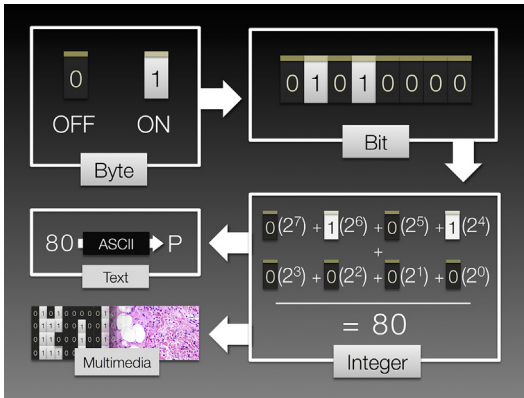


Fig. 1. The fundamental unit of data: the byte. Bytes are units of data with off (0) and on (1) positions; 8 bytes combine to form a bit. Combinations of bits are used to represent integers, text, and virtually limitless other types of data.

comments section of an electronic medical record (EMR) and initially missed by the clinician, who had to click around to finally locate the desired result. When revisiting the analogy of containers and variables, the abnormal result was likely accessible to pathologists in their laboratory information system (LIS); however, when transmitted to different EMRs for clinicians to access, it was sent to an inappropriately labeled (and less easily accessible) container. Sadly, such findings are not unexpected for EMRs catering to clinical services; developers of such records may think of pathology results as an afterthought, hence may not design organized

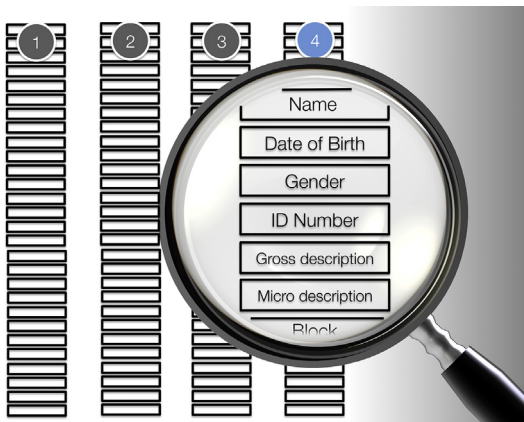


Fig. 2. Visualization of variables as “containers” in data storage. Pathology software may contain arrays of pathology reports. Each report, in turn, contains myriad variables to store information. When transferring reports to another information system, whether the other information system has “the same containers” must be considered. Information systems that follow standards, such as HL7, can transmit and accept these variables more easily.

and easily visible containers to hold such data (after they are transferred from pathologists’ LIS). Thus, pathologists’ input in the design of such EMRs, as well as interfaces between these EMRs, is crucial to ensure that data are properly represented.

Hernandez and Allen³ emphasize the role of pathologists as leaders in transforming “raw data” into “meaningful information.” This role prompts questions, such as, “Exactly how do I want to convey my points to the clinician?” “Do I just use words and numbers?” and “Do I want a table to show my immunohistochemical findings or a figure to depict prostate biopsy results?” Such questions prompted Sperberg-McQueen and Dubin’s⁴ review of 2 major types of data representation— analog and digital, which is different from the term *digital* most are accustomed to. In this case, they refer to *analog* data representation as a model that resembles physical properties as closely as possible, such as bar graphs/tables to represent numbers or colors to represent grading of dysplasia; conversely, *digital* data representation represents purely symbolic forms, such as actual numbers or text.⁴ Examples are shown in **Fig. 3**. In particular, because standardized codes, such as ASCII, exist, it is much easier to transmit digital forms of data representation between EMRs, as opposed to analog forms. Given that clinicians are increasingly expecting laboratory results to interface with their currently available/implemented EMRs, the decision by a pathology laboratory to incorporate more analog forms of reports, although visually pleasing, may invoke more challenges in delivering information electronically to other EMR systems. Even seemingly simple items like a table of immunostains in Microsoft Word does not display properly in EMRs unless those EMRs are programmed to handle such elements. Such is one of many examples depicting the challenges of data representation in surgical pathology.

CODING IN SURGICAL PATHOLOGY: A DUTY TO DOCUMENT DUTIES

Regardless of the number of diagnoses made and cases signed out, medical coding is required to actually document pathology services in a way other departments understand. The use of codes, such as *Current Procedural Terminology (CPT)* and *International Classification of Diseases (ICD)*, summarizes many services and diagnoses as simplified alphanumeric codes, which are interpreted by other parties (eg, researchers and billing departments). The use of such codes is mandated under the US Health Insurance Portability and Accountability Act.⁵

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