

Conceptual Database Modeling: A Method for Enabling End Users (Radiologists) to Understand and Develop Their Information Management Applications

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As medical technology advances at a rapid pace, clinicians become further and further removed from the design of their own technological tools. This is particularly evident with information management. For radiologists, clinical histories, patient reports, and other pertinent information require sophisticated tools for data handling. However, as databases grow more powerful and sophisticated, systems require the expertise of programmers and information technology personnel. The radiologist, the clinician end-user, must maintain involvement in the development of system tools to insure effective information management. Conceptual database modeling is a design method that serves to bridge the gap between the technological aspects of information management and its clinical applications. Conceptual database modeling involves developing information systems in simple language so that anyone can have input into the overall design. This presentation describes conceptual database modeling, using object role modeling, as a means by which end-users (clinicians) may participate in database development.

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IN RESPONSE to rising costs and patient and physician concerns over the quality of the healthcare experience, information management is of increasing importance to the practice of medicine, and more specifically, radiology. Information management is the creation and application of processes directed towards the collection and review of data in a structured and effective manner. A successful information management system allows informed managerial and clinical decisions. Because of their role as distributors of clinical information throughout the healthcare system, radiologists have great potential for participation in information management. In radiology, as in other fields, database applications are the primary tools for the collection and transformation of data into useful information. Using tools that are poorly understood by the average radiologist, programmers, not clinicians, typically develop databases and implement information systems. Separating these design process from those persons intimately involved in the clinical environment, such as radiologists, often results in information applications that do not fully meet the needs and expectations of the intended users.¹ This presentation describes

conceptual database modeling, using object role modeling (ORM), as a means by which end-users (clinicians) may participate in database development.

Information systems should facilitate the creation of searchable, measurable collections of data for the tracking and improvement of outcomes and performance. If the person using and managing the data is the same person that had input into the design of the database, there is a higher probability of accuracy, quality, and usability of the collected data than if database development occurred without such physician input.¹ Insufficient, or a complete lack of input in the development process by the eventual users leads to information systems that do not meet user needs, are poorly accepted, are often underutilized, and fail.²

Information management by radiologists includes, primarily, reporting of diagnostic information generated when reading films. However, it also includes tracking utilization patterns of the different imaging modalities and variability of clinical outcomes, documentation of the type of information sought by and provided to clinicians, and the evaluation of departmental quality standards and performance goals. Unfortunately, due to lack of time and technical training, their input into the fundamental design of applications has been uncommon. Conceptual database modeling is a tool that allows radiologists to participate in the process of creating databases.

CONCEPTUAL DATABASE MODELING: A DESIGN APPROACH

A database is built around a model of a healthcare system, be it an entire hospital or a single

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department. This model outlines the processes that occur within that system and serves as a guide for what data to collect along those processes. A well-designed system includes, in the model, how pieces of data relate to each other. This relational database is then used as a substrate for sophisticated analysis and problem solving.

Conceptual database modeling is the first step in database development, and is where those with little or no programming experience can have the most influence on the design of the information management system.³ This modeling approach uses a graphical format allowing the end user (radiologist) to represent the information needs of an information management application in English language without worrying about the technicalities, such as programming languages, field sizes, and layout of tables. With this model format, end users, modelers, programmers, and information technology personnel can all understand, and ultimately facilitate open communication among these groups.

The key step to conceptual database modeling is the first one, describing information examples using English sentences. Beyond that, software programs, such as VisioModeler (Visio Corp, Seattle, WA), a tool for designing databases and analyzing existing database structures, provides an English language mechanism for completing the conceptual model and actually generate the database in a way that is understandable by end users. This feature allows the computer to automatically handle the technical creation of the database applica-

tion from the conceptual model. Database modeling software is able to link all the steps of application design and can generate any database for which it has a driver.

SUMMARY

Using modeling software, we have created an information management system designed for our breast imaging center. The system handles basic operations, such as scheduling and reporting, but incorporates advanced functions such as continuous quality improvement (CQI) and ABC. The robust capabilities of the application are made possible by the input of end-users into conceptual database model design. This demonstration serves to illustrate the idea that conceptual database modeling represents an avenue for end-users to participate in the database development process. Increasing the amount of clinical and management input in the development stage helps information systems meet their user's needs, become accepted, more often utilized, and successful.

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