ABSTRACT

The use and creation of data continues to proliferate, with each year seeing further reliance on information systems to support practitioners and organizations. This surge is expected to continue at an even faster pace with the increased use of inexpensive storage methods of any type of data, plus greater reliance on computerized clinical decision-making tools. Yet data integrity remains essential to every organization and to every healthcare practitioner in order to ensure the correct use of patient information to optimize care. It provides the assurance that the data you see every day is the same as it was the day before. It promises that the drug dosage regimen “QID,” whether you define it as four times daily or four times daily with meals and at bedtime, is applied using the same parameters for every patient (as you define a patient), across every day (or any time period), as you define day in your healthcare setting. It also means that referential connections between data values must be consistent. When a specific patient takes a specific combination of drug products, referential integrity must be applied to ensure the correct products, drug ingredients, and strengths are recognized as being received by that patient. Definitions about data and their referential relationships must be made by the business person (the practitioner), rather than by information technology (IT). Only by doing this can appropriate business rules by applied by a database, which manages the information used in electronic medical records. Once a decision is made about what a datum represents, and how it relates to other data, whether by an individual or a group, it is imperative that the decision remain consistent over time. Should the definition evolve, it is also imperative that that evolution be tracked. Thus, organizations must establish governance committees to maintain consistency both across an organization and across time. Governance committees must have the highest level of authority to ensure that rules are not overridden on a casual, intermittent basis. Once business rules for data have been established, use of a relational database provides one of the strongest tools for ensuring that data integrity is maintain. This paper explores the concepts serving as the foundation for today’s relational database management systems. A top-down approach is described using an Entity-Relationship diagram that can be used to create a relational model for implementation in a relational database management system. A bottom-up approach is described using functional dependencies and normalization. A pharmacist should be able to apply these concepts in corporation with a database architect to ensure the appropriate, consistent use of drug data within an organization. A pharmacist must be able to validate all drug information being used across the organization in order to minimize medication errors and optimize patient care. Only by being the subject matter expert on governance committees and working closely with IT and quality assurance can pharmacy maintain appropriate control over the use of drug information by healthcare technology.

Keywords: Attribute, Data Integrity, Entity, Entity Relationship Diagram, Foreign Key, Functional Dependencies, Primary Key, Relational Data Model, Relational Database Management Systems, Relationship

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INTRODUCTION

The need for correct information in healthcare is vital, but the ability to maintain – and provide – correct information lags behind our need today. The need for better use of data in healthcare is well-supported (Troiano, D., Jones, M.A., Smith, A.H., 2015). Correct information is only as good as the integrity of the data. This means not only must correct values – and only correct, consistent values - always exist, but correct, consistent relationships between values must always exist as well. Pharmacy has long operated under the axiom “the right drug to the right patient at the right time.” Today’s application of technology within healthcare leads to a rephrasing of this to: “the right information to the right person at the right time.” Information systems throughout an organization require careful review and assessment in order to ensure that this occurs. (Lapinsky, 2008; Ward, 2004) A lack of data integrity has been cited as a potential underlying cause of missed clinical identification of adverse drug reactions. (Durrieu, G., Batz, A., Rousseau, V., et al., 2014) It has also been recognized in analysis of e-prescriptions for correct national drug codes for products that significant deficiencies in data quality exists. (Dhavle, A.A., Ward, S., Rupp, M.T., et al., 2015) The authors noted that more than 2 out of every 1,000 e-prescriptions contained a free-text drug description that described a completely different drug concept than that associated with its national drug code (NDC) value. This represented a subset of the 42,602 e-prescriptions that were evaluated, of which only 67.70% (28,172) were found to contain a representative NDC number.

Further, as noted above, there is a call for increasing the use of data in electronic health records and code sets for caring for patients, as well as drug databases for clinical decision support (Troiano, D., Jones, M.A., Smith, A.H., 2015). In addition, there is an increased demand for integration of pharmacy data sets, other patient data sets and even data from collectives of research networks for such purposes as population-based monitoring of disease management, post-approval drug safety and efficacy monitoring, patient care and fraud, waste and abuse detection across organizations and regions. (Green, S.L., Pfenning S., 2015; Belperio, P.S., Backus, L.I., Ross, D., 2014; Griesbach, S.A., Lustig, A., Malsin, L., et al., 2015; AMCP, 2015). Each of these initiatives underlies the need for high data integrity; the combination of any of these makes the need paramount. But data integrity can become mind-boggling. Understanding the simple phrase “Data integrity is ‘keeping data ‘whole’” becomes an etymological adventure. The more an individual uses data over time, or the more data is used by a wider audience with broader needs, the greater the risk for different interpretations – thus, the need for stronger rules to ensure data integrity. Data integrity must be applied across a system. Not a computer system; rather, an organizational system. Maintenance of data integrity requires agreement on the definition and purpose of all data by all individuals within an organization. Today’s widespread use of electronic storage and sharing of data highlights our limited ability to control quality and consistency of data. Thus, it is imperative that we utilize processes and tools to ensure data integrity.

Appropriate enterprise governance and data governance must be assigned from the top authority in an organization down in order to improve odds that no data mistakes are made. Data governance is the task of setting standards for what type of data can be entered in a record of a column. It is commonly the authority of a team of technical and business users. Enterprise governance is the corporate assignment of authority to the person who has the right to decide data governance rules. If a database is used by only one person, that person has the authority. If a database is used by multiple departments in an organization, it is wise to establish an enterprise governance committee to identify and enforce lines of authority across decision makers throughout the organization. This ensures that the person responsible for data in a column is not overridden inappropriately.
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