The digitization of the healthcare industry is happening fast. A major result of this transformation from paper to electronic records is the proliferation of healthcare data. And with that, of course, comes the healthcare database. A lot of them.

Databases are foundational to any use of data, and yet I find that many people are confused about how they work and the role they play in healthcare. I hope to clear up that confusion with this commentary.

What Is a Healthcare Database?

Let’s start with a simple definition. A database is any collection of data organized for storage, accessibility, and retrieval. There are different types of databases, but the type most commonly used in healthcare is the OLTP (online transaction processing) database.

In our discussion, a healthcare database serves to replace the paper documents, file folders, and filing cabinets of old. The data is now more convenient and immediate.

An OLTP database is one that a single computer application runs on. An electronic health record (EHR) is a prime example of such an application. The main strength of an OLTP database is that it allows for quick, real-time transactional processing. It is built for speed and delivers sub-second response times. For example, when a patient presents at the front desk, you search for her name in the EHR and instantly see a result. Likewise, you enter her blood pressure into the EHR and the information is instantly stored there. We take this speed for granted, but we have the OLTP database architecture to thank for it.
What Healthcare Databases Are Used for Today

For the most part, healthcare databases are used as the foundation for running the many transactional systems flooding the industry. The OLTP database structure accommodates the creation of a wide range of transactional applications: EHRs, lab systems, financial systems, patient satisfaction systems, patient identification, ADT tracking, administration, billing and payment processing, research, HR, and education. Name any application in use at a hospital or in a physician’s office, and the chances are good that it runs on an OLTP database.

It’s important to note that each OLTP database is constrained to a single application: the EHR has its OLTP database, the lab system has its own database, the HR system has its own database, and so on. It should be clear at this point that each healthcare organization—especially large physician groups, hospitals, and health systems—rely on a large number of databases. Here’s a real-world example to illustrate that fact. I’m currently helping a medical group client integrate their disparate databases. They have the following applications (and therefore the following databases):

- Practice management system
- EHR
- Costing system
- Patient satisfaction
- Ambulatory surgery
- Radiology
- Pathology
- Financial system
- HR system
- A claims database (which isn’t theirs to manage but which needs to be integrated)

To be honest, they probably have even more databases than that—the ones I listed are just those included in our statement of work. If a medical group manages this many databases, you can imagine how many an integrated delivery system handles.

Strengths and Weaknesses of Healthcare Databases

Pros of OLTP Databases

It’s obvious: the benefits of OLTP databases are equal to the benefits of the applications that run on them. Significant advances in automation and standardization of business and clinical processes can be attributed to these applications and databases.

With healthcare databases, data can also be stored externally and backed up in a secure place to prevent data loss. And because front-end software can provide tip text and enforce data integrity, the back-end data can therefore become more standardized and accurate. Lastly, because the data is electronic, it can allow for quicker processing of typical transactions such as lab results, payment claims, etc.
One of the biggest benefits of all of these databases is the amount of data healthcare organizations have been able to capture. They now have huge data stores that can be used to inform better, more cost-effective care.

**Cons of OLTP Databases**

But at the same time, having all of this data in OLTP databases creates a problem—two big problems, in fact:

1. There is an overwhelming amount of raw data. Anyone who has spent hours surfing the Internet understands that accessing a flood of information doesn’t necessarily translate into gaining knowledge or understanding. Healthcare organizations are now presented with a flood of data. Everyone in the organization—from the CEO to the individual clinician—needs a way to turn all of that raw information into targeted, actionable knowledge. Making sense of the raw data on its own, without tools and processes to guide the process, can be overwhelming if not impossible.

2. Data is siloed. Data siloes are a natural result of the OLTP database architecture in which each application has its own database. OLTP databases simply aren’t architected to allow analytics that spans each database silo. And the kind of knowledge and insight that healthcare organizations need to succeed in today’s era of value-based care requires analysis across applications and systems.

Fortunately, a solution to these two problems exists in the form of a second kind of healthcare database: an OLAP (online analytical processing) database. In layman’s terms, we refer to this kind of database as an **enterprise data warehouse** (EDW).

**The Enterprise Data Warehouse: A Healthcare Database to the Rescue**

OLAP databases exist as a layer on top of another database or databases—usually on top of OLTP databases. In other words, an EDW is a database that exists as a layer on top of all of a healthcare organization’s transactional application databases.

An EDW is structured to combine data from OLTP databases and create a layer optimized for and dedicated to analytics. The result is that organizations can perform sophisticated analysis on data from a variety of sources: the EHR, billing, costing, patient satisfaction, and more. EDWs have become essential to realizing the full benefit of healthcare organizations’ many OLTP databases, including EHRs.

**The Health Catalyst Data Operating System (DOS™) Helps Healthcare Organizations Move Beyond the Data Warehouse**

Traditional data warehousing, which solved some of the data integration issues facing healthcare organizations, is no longer good enough. As Gartner reported, traditional data warehousing will be outdated and replaced by new architectures by the end of 2018. And current applications are no longer sufficient to manage these burgeoning healthcare issues. The technology is now available to change the digital trajectory of healthcare.
The Health Catalyst Data Operating System (DOS™) is a breakthrough engineering approach that combines the features of data warehousing, clinical data repositories, and health information exchanges in a single, common-sense technology platform.

DOS offers the ideal type of analytics platform for healthcare because of its flexibility. DOS is a vendor-agnostic digital backbone for healthcare. The future of healthcare will be centered around the broad and more effective use of data from any source. Clinical and financial decision support at the point of care is almost nonexistent in healthcare, restricted to a few pioneering organizations that can afford the engineering and informatics staff to implement and maintain it. With DOS, this kind of decision support is affordable and effective, raising the value of existing electronic health records and making new software applications possible.

About the Author

Drew Cardon joined Health Catalyst in November 2011 as a data architect. Prior to this, he worked for nine years in the state tax and revenue industry as a project manager and implementation consultant with Accenture, and later with Fast Enterprises. He was involved in the installation of large information technology systems for the State Tax Commissions in Arizona, Utah, and Oklahoma. He holds a Bachelor's degree in business from Brigham Young University and an MBA from the University of Notre Dame.