

From: Christopher Singleton
Dimensional Models for Health Care

MEMO

In this assignment I researched on a large hospital chain called "Virginia Mason". Some of the researched was on how in the healthcare industry a data warehouse plays many different roles according to the need. Other research was on directly about Virginia Mason, a little bit about their history and how they were founded and what information I could get about their data warehouse structure with what it is based on. In using the concepts with a continued understanding of how multi-valued attribute bridge tables can be useful in many different areas of the healthcare industry's data warehouse and use of other techniques that benefit in development of a data warehouse to the user, other organizations and including Virginia Mason's clients. I've included links and references where needed in showing where I got my information through-out this article. In doing the research from many resources on the web, most of the links are at the top for each heading (webpages and articles downloads).

About the data warehouse diagram: (Barlow, n.d.) (Transitional Bioinformatics Warehouse Database Design v3.doc)

In the data warehouse diagram on the second to the last page, I included as much detail as I could without placing too much into the data warehouse. The idea behind this diagram is in understanding how you would use multi-valued dimensions and the benefits that they pose with using them in so many ways. The data warehouse diagram is made specifically to cover the criteria of what is needed in satisfying the requirements. I included several techniques that would also play into making the data warehouse design diagram and are important to realize the difference from when you need them, versus when they are not necessary with incorporating. The whole idea is to specifically stay within the guide lines based on the criteria specified, while still showing enough in making examples of what their database would look like at a bare minimum.

About the organization: (Robinette, 2013)

In this assignment I'm going to focus on Virginia Mason Medical Center, which has a wide variety of services with many different kinds of patient's needs. Virginia Mason is a non-profit organization that was established in 1920 by James Tate Mason MD, John M. Blackford MD and Maurice Dwyer MD radiologist are the co-founders of Virginia Medical Center. The founder's goal was to make a medical center a one-stop place in taking care for any medical need. The hospital has over 336 licensed beds for acute, chronic patients with over 460 physicians who offer primary care and some of which offer specialty care at any given time and employs over 5,300 people. This organization houses a wide variety of medical clinics spread through-out the Pacific Northwest and provides directly too many surrounding communities.

With new technology system advances, Virginia Mason is one of the first in the region to use and offer specialties with new kinds of innovative technologies, like fibro scan that allows doctors to evaluate liver disease with their patients on a non-invasive level of diagnostics. The Virginia Mason Medical Center has been declared the most wired hospital for two years in a row out of 289 surrounding hospitals in the Northwest with achievement's in clinical information technology, which include a sophisticated computerized physician order entry system, an integrated inpatient-outpatient system, a mistake proof medication bar code system and a secure web portal that caters to over 60,000 enrolled people.

The purpose of a Data Warehouse: (Manag, 2005)

In a de-normalized data warehouse with Virginia Mason would include purpose driven multi-dimensional cubes that allow their physicians, IT medical staff in getting valuable aggregated information on the fly through evaluating data analytics by slicing and dicing quickly from what data they have already collected in those areas that are particular to the needs in analyzing and providing dashboard (reports) products directly to their medical staff and customers. Such needs using reports that Virginia Mason would analyze with multi-valued dimensions (bridge

tables that hold attributes for reasons and diagnosis) would be with pre-existing conditions, medical treatments with durations, successes of medicines for different kinds of treatments, supplies to what is appropriate with facility care, patient care, reduction of patient visits by evaluation trends with patients medical needs and financial costs with a future forecast in order to keep the facility up and running. With a good cube design you can pull large amounts of aggregated data quickly in such ways that can give you valuable information in determining important present and future decisions. Not only that, you can generate dynamic reports that allow you to present to your staff, customers and clients on an “as needed basis”.

Both software and hardware play an important role when it comes to retrieving data from a data warehouse. The whole point of structured de-normalizing in a data warehouse allows aggregated data (condensed obtainable data that you can get quickly) and historical data analysis (data mining), which also efficiently decreased the amount of time in getting large amounts of data directly from the server’s small computer systems interface low voltage (SCSI, LVD) multi-hard drives on a RAID system. In the medical field, saving data redundancy and time are of the most important, so I would think that they would typically go with a small computer systems interface (SCSI) types of drives, server processors and error control correction (ECC) ram, which will reduce redundancy (error problems) with the data significantly. One of the key points in shaping how the system is put together has a lot to do with the employees working with the database.

As much detail as possible about the data in the data warehouse and the sources of the data:

Data sources would include multi-rack mount server system platforms that directly connect to other institutions (government, pharmaceutical, lab facilities and security services) either through the cloud, web or both. Government systems would give information on what pharmaceuticals can be used with certain combinations and also what drugs are off the market or not allowed. Pharmaceutical companies would give information on interactions, dosage and price points or point of sale information. Lab test facilities would give results and specifications on how they test (dosage, combinations, interactions and outcomes). Tables would comprise of attributes (dimensional) and measures (fact tables). Fact table efficiency would have to be taken into consideration, because of the multitudes of data that that would continue to grow. This means that reducing or minimizing the fact tables would be one of the priorities set in place.

The data that exists in the Virginia Mason data warehouse is very strictly taken care of; meaning that confidential information would be scrutinized in such a way that no information can leak out (encryption technologies, employee to patient accountability). Most medical databases are classified by their objectives, meaning the type of work they perform, clinical patient care, objectives for public health and can grow to be very large. There would be a great need for report development nearly in ever department with consistent documentation based on the data in the system. This means that transformation with data integrity and cleaning would be of the up-most importance, as well in saving space because of the amount of data being collected on a daily basis. The type of information collected would mostly be based on the data warehouse design. This is where the criteria comes into place with specifically the needs of

everyone. I'm sure that the date would be coming in from many sources through-out many different kinds of agencies. Some of these sources would house their information encrypted and/or encrypt upon transmission from one source to another.

In a typical medical warehouse database design you would start off with questions that bring what is needed in putting in the warehouse as such, the patient, why they visited the hospital, current medical condition, diagnosis, medications that the patient needs, staff who performed the work, did the medications work and/or give other problems. This sets up the idea of bringing in multi-valued bridge tables. The idea is to break the structure of the database into its simplest form, yet also giving what is needed by reason that allows the database to function with efficiency based on the criteria provided. By reason I would like to also say that also means placing into practice everything that I have learned throughout this course. (Accumulating snap-shot, outrigger, mini dimension, fact-less fact bridging and multi-valued bridge tables).

At the heart of the database design would be an accumulating fact table together with a transaction fact table in supporting the different roles needed. The accumulating snap-shot fact table would directly support the [Dim Physician] table, [Dim Lab Observation] table along with the [Dim Date] table that inter-connects also to the [Fact Transaction] table. You would have a disease classification table that directly connects to the [Fact Transaction] table with a diagnosis bridge table connecting to the [Dim Disease] table, which would allow you to get information about disease diagnostics quickly. For the reason of why the patient visited, you would have a [Dim Patient] table that is directly connected to a [Fact Clinic Reason] bridge table (multi-valued attributes) and [Dim Patient Registration] table. The idea is to make a point on how the database would come together in serving the specified requirements, which is also based on the needs of the client. Usually none of the work would begin until you have all the information needed, included all questions based on their criteria. Then you can finally begin to lay everything out.

One of the best ways to figure out the layout of making a diagram is getting information that is needed from the source (employer, client) and displaying what tables would be needed in order to satisfy those requirements. Please note that I have shown how I would begin laying out the tables according to their relationship. Patient demographics would also play into the [Fact Clinic Reason] a multi-valued attributes and also please note that stop medication reason and/or disease cured can also hold multi-valued attributes. The [Dim Medication] table can connect directly to the [Fact Healthcare Transaction] table. The reason why there is a need for [Dim Season] would be to find out how many patients on what particular part of the year are most visited. Sure we could get the same information from the [Dim Date] table, but this is directly related to the number of patients at certain times of the year (registration). Just to give you a basic idea, otherwise I could go on nearly forever.

Just some of the typical basic need for tables would be: (There are much more tables normally.)

<u>Patient</u>	<u>Physician/Condition</u>	<u>Fact/Fact-less</u>	<u>Date</u>
[Dim Patient]	[Dim Physician]	[Fact Accumulating Snap-shot]	[Dim Date]
[Dim Patient Demographics]	[Dim Observation]	[Fact Healthcare Transaction]	[Dim Season]
	[Dim Disease]	[Fact-less Fact Disease Group]	
	[Dim Medication]	[Fact-less Fact Patient Registry]	
	[Dim Lab Observation]	[Fact Lab Test Accumulating Snapshot]	
		[Fact Clinic Reason] (Multi-valued)	

Description of the data warehouse that is used: (Mason, n.d.)

In the heart of Virginia Mason's data warehouse organization of design is the Virginia Mason Production System (VMPS), which is a set of integrated processes originally taken from the TPS (Toyota Production System) of the Toyota management philosophy. In order for Virginia Mason to have a vision in becoming a quality leader in healthcare, they realized that they needed to become error free while focusing on delivering the highest quality (perfect patient care) care to their patient's needs. The key to accomplishing the very best care with their patients is in understanding their medical staff and getting improvement ideas in providing a better experience for both the patients and the people who work for Virginia Mason. As an on-going plan in getting this knowledge from their employees, Virginia Mason has developed small workshops called "RPIW's", which means rapid process improvement workshops. Such benefits that come from these workshops include, patients spend more time with providers, patients benefit from greater safety, staff members benefit from less reworks which allows in providing better healthcare for their patients and significantly reducing waste. Another benefit is the on-going reshaping of the database by asking questions from the staff that works at Virginia Mason. This not only allows for an effective data warehouse, but also allows additional properties, attributes and continues the structure for what is needed. One of the greatest questions that you can ask is "Are these changes needed in order to meet the criteria?"

In such a large medical institution like Virginia Mason, there would be a wide variety of techniques involve with their data warehouse design. There would be many different data marts inter-connected and organized in a star schema in order to keep the data warehouse as simple as possible. There would also be snow flake whenever necessary for creating outriggers in reducing the size of dimension tables for those attributes that do not change. There would be many multi-valued bridge table dimensions, one or more in the data marts where needed to give reasons for patient diagnosis, drug interactions with chemical compositions, supply product evaluations, equipment explanation projections for the hospital and even the employee's evaluation section. A lot of the personal data would have only the necessary outrigger tables (snowflake schema) for those attributes of their patients and co-workers

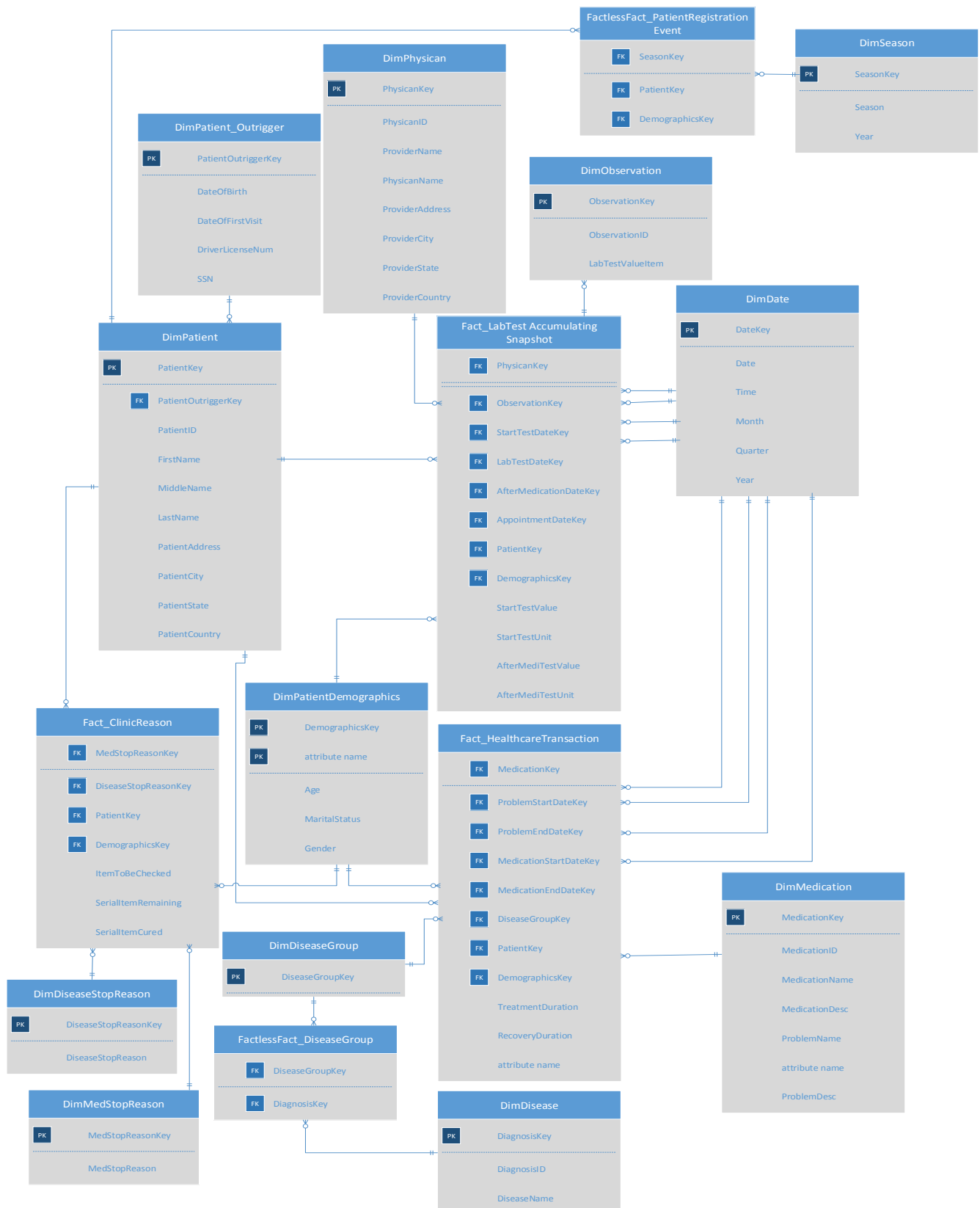
information that never changes, while mini-dimension tables would hold those attributes for data that changes or needs updating often (star schema).

Describe how the organization has benefited from the data warehouse:

(Campbell)

Without a doubt Virginia Mason's warehouse database would consist of many data marts all interconnected, but the diagram that I created gives a basic idea of how their data warehouse database would normally be like. I am sure there are way more tables for each area of expertise that have even more attributes than I can give or are structured in ways. The greatest benefit is that at any moment they can easily pull data from their data base and quickly generate reports in order to save more lives. This is critical when you have people with chronic illnesses and other diseases that are life threatening, because time in making appropriate decisions is of value in caring for their patients needs. The data warehouse allows them to analyze information and use their best judgement base on that data in doing all the required activities that are needed. This also includes medications that have lifesaving abilities, because they can diagnose based on the results directly from the database. You can make analogies base on if the patient has visited any other countries, symptoms or indications that the patient may have a certain disease or other illness. The data warehouse also allows for direct analytical processing to other servers (SQL Server) and excel so that you can create informative reports quickly and easily with virtually no waiting time, because the data is aggregated and the structure is de-normalized. Aggregation allows large amounts of data grabbing on the fly with very little lag. You can design robust reports that gives you the ability in understanding where you can make important decisions based on the data collected. Data mining allows you to forecast based on trends which saves you a lot of time and money in the future. Another good benefit that the data warehouse allows you is in understanding when the busiest times of the year are, so that you can schedule the work load accordingly. This would not only save lives, but allow workers to not be over whelmed with so much on their hands at times and/or be over staffed when there is much less of a work load. (www.rainmakeworks.com, 2008-2009)

The data base diagram: (Barlow, n.d.) (Transitional Bioinformatics Warehouse Database Design v3.doc)



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