

IMPROVING OPERATIONAL MANAGEMENT IN HEALTHCARE BY COMBINING ANALYTICAL AND TRANSACTIONAL DATA

In healthcare, the speed of data delivery and availability can make the difference between life and death of a patient - even more so for ICU (intensive care unit) patients. It is therefore very crucial that the physician has accurate and correct data which flows with the patient at all times during their stay in the hospital. Traditionally, the data is collected alongside the patient in different departments. The problem of the traditional process is that the data is mostly siloed and it is difficult to grasp the information at one glance for the operation staff. The inefficiencies in pulling the data together in a meaningful way leads to longer than ideal patient wait times, difficult allocation of duties and staff, inefficient bed management, and high stress levels ultimately resulting in lost revenue, high cost for staff planning, and high staff turnover rates.

That's why our customer¹, a public healthcare network with three centres decided to create a single platform, called the "Operation Center Dashboard" which aggregates the data from different systems, enriches the information with insights, and displays them in a way that they can be used by the operational teams.

"We built a operation center that functions like the tower of an airport. It gives you a 360 degree view of what's happening on the hospital floor. It's tells us who is on the sky. Who has landed? Where, when? Where are they supposed to go? When are they supposed to go? And who is taking care of them? And what are their needs?"

- Director of Data Integration and Governance

Challenges

With the digitalization, our customer was able to collect patient data more easily. But the bigger challenge was to generate insights from all the data that was collected. The data was collected on departmental level and siloed in systems across the entire hospital. There wasn't an underlying system or architecture that could turn the data into valuable insights on the fly.

At one time, the organization had decided to integrate all the data in an enterprise data warehouse (EDW) so the data was centralized in one place. All the different data sources including various databases were connected to the EDW and the data was delivered every day at midnight. This system was established a few years ago and meanwhile the challenges to work with the data increased significantly:

- All the historic data was in one place. But anything that happened after midnight, was only captured the next midnight which might have been too late.
- Data points were selected based on their usefulness for the analytics and then put into the EDW. This process was helpful back when the process was established. But now, the need for real-time data analytics has increased dramatically.
- ETL developers built, maintained, and added connections to the EDW. This process worked quite well until more hospitals were merged into the network that also used different systems. The complexity to manage the data flow in the entire network became very complicated leading to long time-to-users.
- New teams were hired to work with the data such as data scientists and data engineers. To ensure that these teams had the access to the right data at all times, data engineers had to find new ways to access data through the systems that were not represented in the warehouse architecture yet.

¹ Due to their public status, hospitals are not allowed to give endorsements and therefore, cannot be named.

These technical problems also led to significant economical challenges because the people on the floor such as nurses, doctors, and support staff couldn't use the data as needed:

Lost Revenue

Due to regulations, wait times are enforced and funding for the healthcare institutions is largely tied to wait times as well as services rendered.

High Personnel Costs

The healthcare personnel are unionized and have strict rules around working hours. Since it wasn't clear what the expected volumes and occupancy will be like in the upcoming days, scheduling staff became inefficient and led to higher levels of overtime pay.

High Turnover Rates

High stress levels at all levels (doctors, nurses, patient flow team, and support staff) led to burn-outs and churns.

Action

Facing the above mentioned challenges, the Head of Data Management and Data Governance and their team started to look for another solution with the following objectives:

- Centralize all systems of the entire network into one single source of truth for the entire organization.
- Enable access to real-time data so the operation team on the floor can work with the data as it becomes available.
- Build an event-driven system that takes all the different factors into account.

The ultimate goal was to build a so-called "Operations Center Dashboard." This dashboard would be the result of all the data aggregated from different systems and prepared into insights. Shown on a screen in the Operational Center Room, the operational teams could act on them right away.

After some extensive research, the Head of Data Management and Data Governance decided to go with data virtualization. They wanted to add a data virtualization layer to the existing system to enable easy and real-time data access and self-service capabilities.

"We can now bring all the different sources together in a meaningful way and paint a comprehensive picture of the patient on an almost real-time level. All information collected by the care staff such as temperature, blood pressure, etc. when a patient walks into the hospital show up on our systems in a few minutes. The underlying data integration and management system enables us to present a unified picture in the Operation Center Dashboard."

- Director of Data Integration and Governance

Results

While looking for a smart data federation solution, they came across Data Virtuality, a data integration solution that uniquely combines data virtualization and ETL. The team dove into building the new system with the Data Virtuality Platform and within 3-4 months, the new Operational Center Dashboard was up and running. The different sources were integrated in a meaningful way, helping to paint a comprehensive picture of the patient journey. All this in almost real-time. Once a patient enters the hospital, their information is shown on the system within minutes. The dashboard includes information about the patients such as their current location, the assigned bed, their current wait time, and if applicable, special needs (like a porter is needed to transfer the patient). The new architecture not only enabled transactional but also analytical use cases. The Advanced Analytics team including data analysts and data scientists have direct access to the data and can concentrate on modelling and experimenting with the data rather than spending their time searching and preparing the data.

The operational and economical value of the dashboard is already noticeable:

-  Improved wait times in all departments
-  Reduced personnel overtime costs
-  Improved bed utilization
-  Less overtime leading to less stress and lower turnover rates among healthcare staff

Future Outlook

The data journey of the Data Management and Governance team hasn't ended yet. The final destination, as of now, is to enable a fully modern e-health system which connects all devices. This system could gather all information related to the patient (collected in- and outside the hospital) and thereby allow the most efficient way of operating the hospital. At the final stage, it will be enhanced at a finer grain by incorporating predictions and insights from the many machine learning tools developed in-house that are currently running independently.

About Data Virtuality

- Founded in 2012 by Nick Golovin (PhD) in Leipzig, Germany after 8 years of research
- Offices: Frankfurt am Main, San Francisco, Leipzig
- Awards: Most Innovative Data Management Provider 2021 and 2019 (A-Team Insights), 2020 and 2019 Deloitte Technology Fast 50, Forrester Wave 2017, Gartner Cool Vendor 2016
- Solutions:
Data Virtuality Platform
Data Virtuality Pipes Professional
Data Virtuality Pipes