

CASE STUDY

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Healthcare

Big Data Analytics, Consumerization of IT, Client Mobility



Leeds Teaching Hospitals uses big data to study accident and emergency trends

Using big data technologies to analyze doctors' notes helps to plan resources and spot under billing



The Leeds Teaching Hospitals 
NHS Trust

“The use of big data analysis on our patient care notes enables us to prove things our clinical intuition was telling us. In the new world anecdotal evidence isn't enough. What we think isn't sufficient to spend money. We need proof.”

*Iain MacBairdy,
Business Manager, Emergency Medicine,
Leeds Teaching Hospitals*

Leeds Teaching Hospitals identified an opportunity to be proactive in planning its care by analyzing the data it held on patients. By aggregating and making sense of the unstructured notes written on patients' records, it was able to identify trends in injuries and conditions that patients present, and spot billing discrepancies that could be leaking funds.

Challenges

- **Data capture.** Make it easier for clinicians and administrators to capture data at the point of admission and throughout the patient care cycle.
- **Data analysis.** Use natural language processing to make sense of unstructured care notes, and combine them with structured care data for analysis.

Solutions

- **Big data.** The data from Symphony* software was processed in a data center using software from Two10degrees to analyze its text content and turn unstructured data into structured data.
- **Simple queries.** The team at Leeds Teaching Hospitals used its existing SQL* skills to analyze the data stored in its data warehouse, powered by the Intel® Xeon® processor E5 family.
- **Mobile data.** Symphony software, already used for managing patient data in the emergency department, has been ported across to tablet devices powered by the Intel® Core™ i5 processor, for future use throughout hospitals.

Impact

- **Billing optimization.** The team was able to identify where doctors had requested treatments that had not been logged correctly into the system, and so had not been correctly billed or accounted for.
- **Resource optimization.** The team identified trends in patient conditions that could help it to plan resources effectively.

Planning the unpredictable

By their very nature, accidents and emergencies are unpredictable. Clinicians and administrators in hospitals can never be sure what kind of treatment the next patient to arrive will require, but they can be certain that there will be a steady stream of patients turning to them for the care they are uniquely able to provide. The more hospitals can understand about the trends in care, the easier it is to plan resources to optimally deliver it.

Leeds Teaching Hospitals is one of the largest National Health Service (NHS) Trusts in the UK. It has multiple hospitals sites, two Emergency Departments and further specialist facilities including the Leeds Cancer Centre, the Yorkshire Heart Centre, the Leeds Musculoskeletal Centre and the Leeds Centre for Older People's Medicine. Its purpose is to deliver safe, effective and personal healthcare to every patient, every time. To achieve this, it's important to plan and allocate resources effectively.

That's why Leeds Teaching Hospitals worked with Intel, Ascribe, Two10degrees and Microsoft on a pilot project to analyze its patient data to spot trends and other signals that can help it with resource planning.

Using big data analysis to understand care trends

As compute costs have fallen in recent years, organizations have increasingly turned to big data technologies that can process huge amounts of data and use it to deliver insight that can better inform decision making. Leeds Teaching Hospitals worked with Intel, Ascribe, Two10degrees and Microsoft to run a pilot program that analyzed the patient data it held, so it could better understand how the Emergency Department (ED) operates.

Leeds Teaching Hospitals uses Symphony, a leading IT system for managing emergency and unscheduled care. Made by Ascribe, Symphony is



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used to record over 30 million patients and over 7 million attendances each year worldwide. It provides a graphical interface for capturing patient data and enables the hospital to keep track of every patient's details, including where they are and what they are waiting for.

There are two types of data captured in Symphony: structured data, which might include the completion of text boxes or the selection of particular tick boxes to indicate treatment types and patient attributes; and unstructured data, which comprises the text notes that clinicians add to the patients' records. The aim of the big data project was to analyze the unstructured text data using natural language processing technologies and combine it with the structured data, which analysts would traditionally use to understand the safety, quality and cost-effectiveness of unscheduled care. For the pilot project, seven years of anonymized patient records were analyzed, amounting to hundreds of thousands of patient records.

The analysis process worked like this: case notes were extracted from the real patient data in Symphony and stored in Microsoft's cloud infrastructure in Dublin. Two10degrees provided natural language processing software, originally designed for the construction industry, which Ascribe and Two10degrees modified to analyze patient data, together with Microsoft's Hadoop* distribution, HDInsight*. The resulting structured data was delivered to Leeds Teaching Hospitals' on-premise data warehouse, based on a HP ProLiant* DL380p Gen8 server, powered by two Intel Xeon processors E5-2640 product family.

The team at Leeds Teaching Hospitals used existing SQL skills to query the newly structured data and discover fresh insights about how the ED is running. For example, the aggregated data from case notes could reveal how many patients are presenting with sports injuries and when these are most likely to occur. Matching alcohol- or drug-related injuries with the postcode of the ambulance pick-up helped to identify trouble spots, so that preventative measures can be used, such as helpers on the street or mobile healthcare teams.

"We found there is a remarkable and shocking volume of mid-afternoon drink cases, brought in by ambulances. There is also a remarkable spike in activity during freshers' week [an introductory week for new students before term begins]. This generates five times the attendances with drink-related conditions than we would expect," said Iain MacBairdy, business manager, emergency medicine, Leeds Teaching Hospitals.

The analysis also compared the number of times a treatment such as an X-ray, MRI scan or CT scan was requested in the unstructured patient notes but not indicated in the structured treatment data. "We discovered that we have been losing money by not accurately recording and charging for diagnostic tests, such as CT scans, in our clinical software in a way that can then be picked up by those who do the billing," said MacBairdy.

The solution enables the Trust to be proactive in managing its own governance, and in identifying where retraining can help improve the quality of data captured and, ultimately, the quality of patient care. "This solution will enable us to perform more effective case reviews and assist us with clinical governance. Sometimes we only find out that there are issues when we are notified of a serious incident (SI) and we can now find out, and take action, earlier," said MacBairdy. "It is immensely valuable as a training tool, too. We need to understand where in our clinical processes data is captured so we can work effectively. For example, we need to monitor our dignity rounds to make sure we are treating patients with the dignity and respect they deserve. It's important to know whether we offered patients a hot drink, for example, when they have been waiting awhile for treatment, and our analysis of the care notes can tell us this."

Lessons learned

Healthcare providers collect a huge amount of data that is used for providing patient care. But this data can also be used for optimizing resource planning and management. Leeds Teaching Hospitals found that it could use the unstructured data in doctors' notes to identify peak times for certain injury categories and discrepancies in billing that could affect the funds available for future treatment.

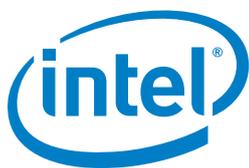
Using mobile devices to capture data

To make it easier to capture structured data in the future, Intel and Ascribe have worked together to create a mobile version of Symphony that works on tablet devices. That makes it easier for clinicians to prioritize care by quickly capturing patient details as ambulances arrive (freeing up the ambulance to attend another incident), or to update patient notes at the bedside. The demonstration ran Windows* 8 on the Samsung Ativ* xe700t1c tablet device, powered by the 3rd generation Intel Core i5 processor.

"There are huge efficiency savings to be had from taking slates to a bedside and updating the patient record there. There are significant potential savings with reduced stationery and printing costs, which would amount to £20,000 per year as a conservative estimate in Leeds," said Andy Webster, lead clinician of Leeds Teaching Hospitals' Emergency Department (ED).

Using a tablet device will also make it easier for clinicians to see real-time patient data at the point of care. "This could be very useful for child protection purposes," said MacBairdy. "Understanding that a child may have certain risk predictors, backed up by historical records that can be quickly read, would be an important asset for a clinician."

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