PREDICTING THE NEED FOR MORE WARD NURSES

How many nurses are needed on an acute hospital ward to ensure that patients receive all the care that they need, and are kept safe? As hospitals treat an increasingly dependent and complex case mix of patients, the demands on nurses have increased accordingly. Some countries have adopted fixed ratios (eight or ten patients per nurse) but this is an arbitrary figure based on average workloads. Many hospitals perform daily or shift-based reviews of staffing versus patient needs, but the picture changes much more frequently than this given the rapid throughput of patients.

The Francis report on care quality at the Mid-Staffordshire NHS Foundation Trust in early 2013 was a watershed for the NHS. Published in response to concerns about high mortality rates and poor governance, the report recommended that hospitals adopt more systematic and responsive approaches to determining nurse staffing levels.

The Learning Clinic exploited its huge database of clinical data to build a "ward busyness" model. The model uses selected data linked to the timeliness of observations, patient acuity and other features of ward activity to determine whether it is possible to predict when a ward's workload is becoming unsustainable. In such instances, the model allows hospital managers to deploy extra nurses to such wards and ensure that staff are being used as effectively as possible, ensuring safer care and better outcomes for patients.

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BIG DATA IN HEALTHCARE

While healthcare is often described as lagging behind its industry siblings in terms of technology maturity and adoption, experts are no less bullish on Big Data's potential impact[19].

This is partly because healthcare is fast becoming a Big Data industry with a data explosion that makes analytics an absolute requirement. In fact, the projected growth of healthcare analytics is nothing short of staggering. According to research from Markets and Markets, the global healthcare analytics market is predicted to grow 27% per year, from $5.8 billion in 2015 to $18.7 billion in 2020[20].

With the race for raw material creating a gold rush of sorts, the generation of and access to data is increasing exponentially, from Electronic Health Records to social platforms, health insurance claim records, environmental factors and genomic markers. And the current rush is just the beginning; experts say that a significant portion will be driven by the IoT, which seems made for healthcare:

> *Millions of smart sensors and devices connected through the internet to provide up-to-the-second data on everything from a patient's heart rate to how many pills they've taken that day to the ambient temperature of their hospital room, can provide the type of detailed, actionable, ongoing management that most providers can only dream about [21].*

HOW BIG DATA AND ITS FEEDER TECHNOLOGIES IMPROVE DIAGNOSTIC ACCURACY AND SPEED

17%
improvement on cardiology diagnoses

91%
reduction on Norovirus Outbreaks

Ahead of the IoT tsunami, Big Data Analytics is already showing its value. The following are but a few examples of how healthcare institutions are using Big Data and its feeder technologies to improve diagnostic accuracy and speed, ignite health engagement, drive efficiencies in care operations, enhance treatments, and dramatically reduce the spread of infectious disease:

> **Cardiology diagnostic accuracy[22]:** AI technologies use 10,000 attributes collected from 90 metrics in six different locations of the heart to pinpoint disease states more quickly and accurately and improve the accuracy of cardiology diagnoses by 17%.

> **Predicting onset of psychosis[23]:** A proof-of-concept exploration leveraged Natural Language Processing (NLP) and, using a novel combination of semantic coherence and syntactic assessments as predictors of psychosis transition, was able to predict the onset of psychosis in high-risk youths with 100% accuracy.

> **Speeding cancer treatment[24]:** Baylor College of Medicine is using Big Data to speed cancer diagnoses and treatments. Using 'electronic triggers' from Electronic Health Record data to flag and follow up with patients with abnormal findings from an initial screening or evaluation, they have nearly halved diagnostic times for colorectal cancer patients.

> **Targeting Metabolic Syndrome[25]:** Aetna is using Big Data to expand their health services offerings and tailor them to provide highly personalised guidance. In a partnership with GNS Healthcare and Newtopia, Aetna can accurately predict who will develop Metabolic Syndrome within the next year, including which risk factors will be the biggest contributors, and is using that to target and personalise interventions to promote behaviour change.

> **Diabetes management[26]:** Managing diabetes effectively is like having a part-time job and many diabetics don't check their blood glucose as often as they should. Google wants to change this. With their newly-patented contact lens that continuously measures the blood glucose of diabetics through the tears it touches, they are now partnered with Sanofi and Joslin Diabetes Center to revolutionise the way that people interact with their diabetes care.

> **Reducing Norovirus Outbreaks[27]:** The Learning Clinic, in partnership with the Portsmouth Hospitals NHS Trust built an electronic system to identify and highlight cases of norovirus so infection control staff could intervene earlier. Over a four year period, they were able to virtually eliminate outbreaks, reducing them 91% (falling from 21 to just one).

These are but a few examples of how Big Data, broadly conceived, is beginning to transform healthcare, and it has only just started. What these companies have in common is that they are moving quickly and learning to think differently about how to solve problems. And, as technology cycles shorten and experimentation costs drop, they use 'agile' techniques to iterate quickly as they learn what matters most.

Norovirus, or winter vomiting virus, is the most common cause of epidemic gastroenteritis and outbreaks occur frequently. The virus causes diarrhoea and vomiting and can lead to fatal complications. Hospital outbreaks of norovirus often lead to the closure of affected wards resulting in a loss of bed capacity, especially in winter when bed pressures are at their highest. Outbreaks also result in a loss of productivity, as many staff may be affected.

The Learning Clinic worked with Portsmouth Hospitals NHS Trust (PHT) to build an electronic system to identify and highlight cases of norovirus so that infection control staff could intervene earlier. The VitalPAC system exploits the vast amount of data being captured in real time by ward nurses on every ward, recording routine and other clinical information. The system interrogates the data and identifies patterns of symptoms that might predict a case of norovirus. The system automatically notifies the Infection Control Team accordingly so that they can intervene earlier and prevent spread. This might include isolating patients in side-rooms, more rigorous hygiene measures and intensive cleaning of all affected areas.

Between 2009-10, when the initiative began, and 2013-2014, the number of norovirus outbreaks at PHT fell by 91%, from 21 to just one. The number of patients affected by norovirus-like symptoms fell by 92%, the number of affected staff fell by 81% and the days of disruption in the hospital as a result of the virus fell by 88%.

The number of reported outbreaks also fell across the Wessex region and across England as a whole, but by a far lower percentage (15% in Wessex and 28% across England). Nationally, norovirus outbreaks affect 13,000 patients and 3,400 staff every year, leading to 8,900 days of ward closure and the loss of more than 15,500 bed-days. They cost the NHS £41.5 million a year, suggesting savings across the whole system of £38 million per year if every hospital achieved the same result as Portsmouth.

References
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