PragmatIC®

Flexible integrated circuits to inspire innovators

RFID in laboratories

BUSINESS CASE STUDY

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How RFID can be used to save the NHS £400M per annum

Summary

In the UK we are moving to super pathology laboratories, which are state-of-the-art specialist facilities that serve hundreds of GP surgeries and hospitals across wide areas of the UK. These labs process in the order of 10,000 samples per day. In 2020 we also saw the establishment of Lighthouse Labs to handle COVID-19 testing, each with capacity to handle tens of thousands of samples per day.

This rising demand is of course accompanied by the constant drive for cost savings. A company called SamplePod Ltd, based in the North East of England worked closely with one pathology centre to identify a solution that could significantly improve the performance of the labs by adding Radio Frequency IDentification (RFID) to samples, but the cost of the commonly available RFID technology was high, such that the return on investment simply didn't make sense. Then a chance introduction to PragmatIC at the end of 2017, opened the door to a solution that could save the NHS £400M per year.

Background

In 2016, Lord Carter delivered his second independent review of the NHS pathology services in England. At that time pathology represented around 4% of the NHS expenditure, employing 25,000 staff. Lord Carter reported that the system was highly fragmented in small in-house labs, such that data and statistics were not standardised, and therefore true costs and quality standards were difficult to assimilate across the whole system. He recommended that pathology needed to be managed as an end-to-end clinical service in its own right, both as a provider of optimal lab-based services and a core contributor to the clinical aspects of a patient's journey through the health system.

This led to the formation of super pathology labs, consolidating multiple in-house hospital services into larger format operations. The idea being that these larger facilities could invest in high capacity analysis machines and deliver economies of scale and faster turn around times. The new facilities are also aiming to increase the utilisation of the machines, all of which would then contribute to lower costs per sample.

Another advantage of these new centres is that they are fully automated, minimising human interaction with samples, which means there is less chance of contamination of samples or wrong results.

Facts and figures

If we take a typical new facility, they can have a total floor area of around 9,000 square metres, including the main laboratory, plus management and administration suites. Such a lab takes over a year to build and would cost around £12M. At the start of operation, the lab would be expected to handle around 10,000 samples per day, rising to 25,000 over time as the work previously done in other small local labs is brought into the larger facility.

Challenges

In the lab that SamplePod Ltd. worked with, they found that although equipped with state-of-the-art equipment capable of running 24/7, the facility actually ran at less than 30% of its total capacity. Which offers the opportunity to increase the number of samples processed without additional capital investment, if the bottlenecks can be eliminated.

The present collection and transport system works as follows: samples taken, either at the GP surgery or in another hospital or clinic, are given a unique ID in the form of a printed barcode on the test tube, and a specific colour of cap indicating the type of test required. The tube is then bagged and then that bag and a printed information sheet is enclosed in another bag, which has a second barcode applied. The sample is then logged into the system at point of entry, which is then used to notify the lab.

Samples are then collected in batches from the start point, the courier scans the outer label and transports the collection to the lab. On arrival at the lab, staff then have to unpack each individual sample, check the bag, note and sample codes to make sure they are the same, recording it. Then sort the samples into where they need to go in the lab, discarding the outer packaging.

Problems encountered

- Phantom samples that are logged at the start, but don't make it to the lab
- Samples lost in transit
- Samples damaged in transit, or paperwork lost in transit
- Mis-matched paperwork, making a sample invalid

Another significant issue is that the lab has no prior knowledge of when samples are going to arrive, so they are reactionary to what turns up. Which means that there can be quiet periods followed by peaks of activity. This pattern is inefficient in terms of resource and given that many of the machines are batch loaded, this further reduces the efficiency.

The solution

SamplePod Ltd designed a universal, multi-use unit to securely pack, transport and decant the full range of sample collection tubes, which is called a SamplePod. Each sample is assigned a unique ID at the collection point using a Radio Frequency IDentification (RFID) equipped label on the test tube. Then this ID is associated with the ID of the SamplePod unit, automatically generating a packing list that can be forwarded to the pathology lab at the same time as the SamplePod is picked up from the location.

This early warning of the arrival of samples allows the lab to ensure that they have the correct staff and reagents ready and to schedule the batching of the samples on the relevant testers. When the samples finally arrive at the lab, the contents can be quickly scanned into the lab IT system and the samples verified against the packing list, identifying any time-critical ones. Then these samples can very swiftly be moved on to testing.

Business case

- There are many areas where cost savings can be made using this system:
- Fewer staff required to receive samples
- Less time to book-in samples
- Reusable pallets replace single use bags
- Disposal costs of the single use bags (as they are classified as clinical waste)
- No paper documentation
- Reduction in GP/hospital visits for re-tests due to lost samples
- Reduction in time lost to resolve lost samples
- Improved utilisation of equipment in the lab

At a run rate of 10,000 samples per day, using SamplePod would save staff and materials costs and result in over 2% reduction in the operating costs of the lab. If due to the increase in operating efficiency, the lab could work at over 90% capacity, then we can estimate that the fully loaded cost per sample could be significantly improved, in the order of 25% saving. This doesn't include the cost savings from not having to re-take the samples due to the lost samples.

There are of course infrastructure costs of installing the system in both the GP surgeries and hospitals, as well as the lab. These costs include hardware and software for the readers, plus the variable costs of the pallets and the RFID tags and labels on the samples. Traditional RFID tags use silicon chips, or integrated circuits (ICs), but the relatively high cost of these tags simply made the ROI uninteresting and the payback period too long. That is when PragmatIC was introduced to QHS as we were both working on NETPark[1] in the North East of England. PragmatIC has a unique technology platform that delivers ultra-low cost flexible integrated circuits (FlexICs) thinner than a human hair that can be easily embedded. Our ConnectIC range of RFID products were the perfect solution for this cost constrained application. Such that if we run the maths and then extrapolate the numbers to the whole of the UK, based on 1.12 billion tests per year at a present cost of £2.2 billion[2], RFID could save the NHS over £400M annually.

What next

Small volume trials of the system are on-going at this time, expected to complete soon. Assuming all goes well, this will be followed by a large trial involving many collection points.

It doesn't have to stop there, after rolling out this first phase to whole of the UK pathology network though, additional features could be added to the system. For example tracking of the courier which would give even better accuracy of the time of arrival of the samples at the lab, or enable the lab to divert the samples, if for what ever reason, there was not sufficient capacity for a particular test at that time.

Another future improvement could be automation of sample unpacking. As the pallets are now a standard format, robotic systems could be designed to unpack and sort the samples.

Moving outside the pathology network, there are also many opportunities in other areas of healthcare. There are hospitals using it already to track expensive capital equipment[3][4] and it has been used on health records[5]. Plus there are plenty of examples of how barcodes have helped improve efficiencies and reduce errors[6] where a lower cost solution is required. But linear barcodes have no error correction, so a small amount of defacement makes them unreadable, which is why the recent Falsified Medicine Directive stipulated 2D codes[7].

Most of the literature around RFID vs barcodes basically boils down to the argument that RFID is more expensive to implement than barcodes, so if we remove that argument, then all the positives for RFID become overwhelmingly attractive. They could be used on controlled drug cabinets, crash trolleys, operating theatre supplies as well as in the general hospital stores. As hospital trusts consolidate to achieve economies of scale it will be increasingly important to implement much better stock control, just as the retail industry has had to do in this era of the omnichannel shopping experience. The ability to ensure that the right supplies are in the right place at the right time, without having to hold a large overhead of stock will become of paramount importance.

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samplepod
https://www.samplepod.co.uk/

[1] https://www.northeasttechnologypark.com
[2] https://improvement.nhs.uk/resources/pathology-networks
[3] https://rfiddiscovery.com/united-lincolnshire-hospitals-implements-rfid-tracking/
[4] https://www.openaccessgovernment.org/effective-medical-bed-tracking/63401/
[5] https://www.gs1uk.org/our-industries/news/2019/05/31/what-impact-have-gs1-standards-had-across-the-nhs
[6] https://www.nejm.org/doi/full/10.1056/NEJMsa0907115
[7] https://www.gov.uk/guidance/implementing-the-falsified-medicines-directive-safety-features