Ireland

Implementing RFID-enabled technology for the transport of precious laboratory samples at St. James's Hospital

Challenge

Laboratory samples, such as cancerous tissues taken during a biopsy, are "precious" since a patient's care could be delayed if the sample was lost. It would be necessary to take another sample (perhaps by another potentially invasive operation) or the hospital might be unable to retrieve another sample, unnecessarily delaying the diagnosis and treatment for the patient.

Approach

St. James's Hospital in Dublin investigated GS1 standards-based RFID (radio frequency identification) technology in 2014 as a method of tracking anyone or anything that could move or be transferred within the hospital. By placing an RFID tag on an asset, person or item and installing an RFID infrastructure within the campus, it can now be tracked and located. The RFID project called PATH (Patient and Asset Tracking in Healthcare) is part of a broader overall traceability strategy in the hospital.

Full visibility of movement of specimens

Increased patient safety

Knowledge of information transfer

Standards-based RFID infrastructure is now in place

St. James's Hospital is a 60-acre campus with approximately 52 different buildings and 4,500 staff. Around 10,000 people walk through the hospital's front door each day—a level of activity that is comparable to that of a small town.

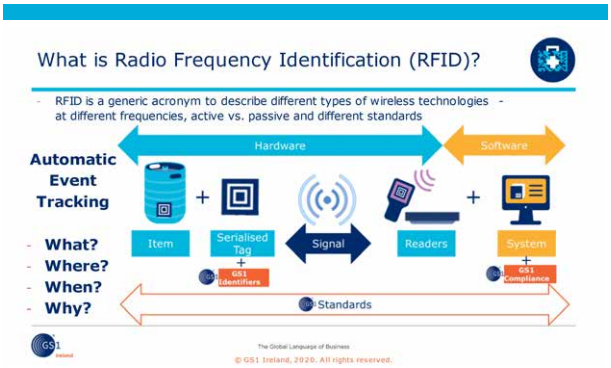
At any point in time, St. James's Hospital had low visibility as to where people, patients and assets were located. When considering a use case for RFID-enabled traceability, the hospital identified significant risks associated with the transport of precious samples from the theatre to laboratory. The traceability process in place was manual and paper-based. A sample could go missing, impacting patient safety and causing potential issues for the patient and hospital.

For example, without a safe and effective system of transporting samples, a missing sample might not be discovered until the end of the day or much later when the consultant was looking for the laboratory test results. The hospital had worked on a solution to track the samples using books to sign samples in and out but it was time consuming, open to error and posed a clinical risk should samples go missing.

"It's of fundamental importance to all at ASD that we deliver solutions that meet and exceed our customers' requirements. The GS1 standards are a core part of our products and they standardise and future-proof our solutions. The synergy between ASD, St. James's Hospital and GS1 Ireland was also a key element to this successful project implementation. We look forward to this continued working relationship and successful implementation of many more projects at St. James's."

Dave Browne,
Managing Director, Aerospace Software Developments (ASD)

The aim of the RFID-enabled solution was to improve patient safety by introducing a safer system for the transport of precious laboratory samples throughout the hospital by using RFID-enabled technology to automatically track the samples from theatre to laboratory.



The hospital also took the opportunity to use the hardware put in place to extend the solution to allow for the tracking of vulnerable patients whose safety is at high risk*. The solution was then expanded to track valuable art and to protect it from theft.

Aerospace Software Developments (ASD), a GS1 Ireland Certified Solution Provider, was engaged by the hospital to implement the RFID solution. GS1 Ireland worked with ASD to provide guidance on the implementation of GS1 standards.

Revisiting RFID

St. James's Hospital had previously embarked on an RFID tracking project, using real-time tracking technology to track vulnerable patients, but there were issues with WiFi connectivity and the solution was not scalable. Furthermore, it was a proprietary solution that was not based on standards.

There were valuable lessons learned from this experience that the hospital used in the design of the new solution to help ensure its success. St. James's Hospital knew it would need:

- A coordinated approach across many departments
- Integration with other IT systems
- Buy-in from users and staff
- A clear chain of custody
- Most importantly, a standards-based solution based on a strong working relationship between ASD and GS1 Ireland

In addition, there were other considerations associated with working in a hospital theatre environment, such as mitigating infection control risks introduced by the new process.

A strategy group was formed to rebuild confidence in RFID as an enabling technology and to invest in a standards-based solution that would be future-proof and scalable.

The group investigated where RFID would be an immediate and worthwhile benefit. A plan was developed to identify current problems that RFID could solve quickly and without too much investment in infrastructure and software.

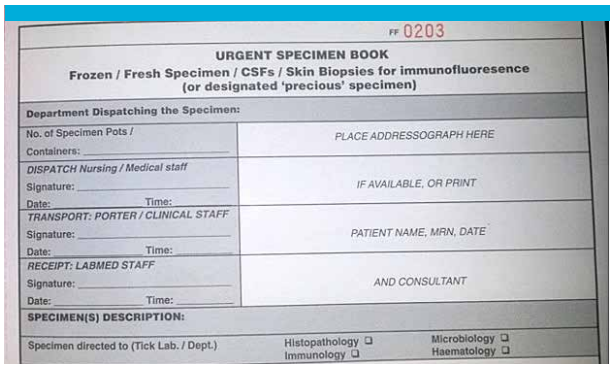
Two business pain points were immediately identified within the hospital: precious samples and vulnerable patients. The hospital started the ambitious project to track and trace all precious samples from theatres to the central pathology laboratory (CPL).

Working in conjunction with ASD, St. James's Hospital successfully completed a proof of concept, tracking precious samples taken in the main theatre, day surgery theatre, endoscopy and ultrasound departments. This was generally regarded as the most difficult use case scenario, demonstrating the complete value of using RFID technology in healthcare.

The before process

Before implementing the RFID-based solution, the transportation of precious samples from theatres to CPL required completing a paper-based register. The original system consisted of an unreliable chain of custody and offered zero visibility with no reliable data. In short, the system had the potential for patient samples taken in theatre to get lost when transported to the CPL.

Test results and diagnosis could be delayed with additional time spent looking for the sample, resulting in the completion of an Adverse Incident Report.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URGENT SPECIMEN BOOK

Frozen / Fresh Specimen / CSFs / Skin Biopsies for immunofluoresence (or designated 'precious' specimen)

Department Dispatching the Specimen:

No. of Specimen Pots / Containers:

PLACE ADDRESSOGRAPH HERE

DISPATCH Nursing / Medical staff
Signature:
Date: Time:

IF AVAILABLE, OR PRINT

TRANSPORT: PORTER / CLINICAL STAFF
Signature:
Date: Time:

PATIENT NAME, MRN, DATE

RECEIPT: LABMED STAFF
Signature:
Date: Time:

AND CONSULTANT

SPECIMEN(S) DESCRIPTION:

Specimen directed to (Tick Lab. / Dept.) Histopathology ☐ Immunology ☐ Microbiology ☐ Haematology ☐

Figure 1: The original system was paper-based with an unreliable chain of custody.

The new process

Today, the RFID solution enabled by GS1 standards tracks the movement of precious samples by using RFID tags on sample bags and RFID readers installed at entry/exit points in the hospital.

The workflow starts with the nurse in the theatre who places and scans an RFID tag encoded with a GS1 unique identifier—the GS1 Serial Shipping Container Code (SSCC)—on the

* in adherence with patient consent policy

bag of patient samples. The GS1 Global Service Relation Number (GSRN), the unique patient identifier, is also scanned to link that patient with the samples.

The samples are then left in a basket for collection by the porters. The porters also have RFID tags each encoded with a GS1 GSRN, a unique staff identifier, embedded in their staff ID cards. So, when a porter collects the samples, his identification is associated with the samples and the patient.

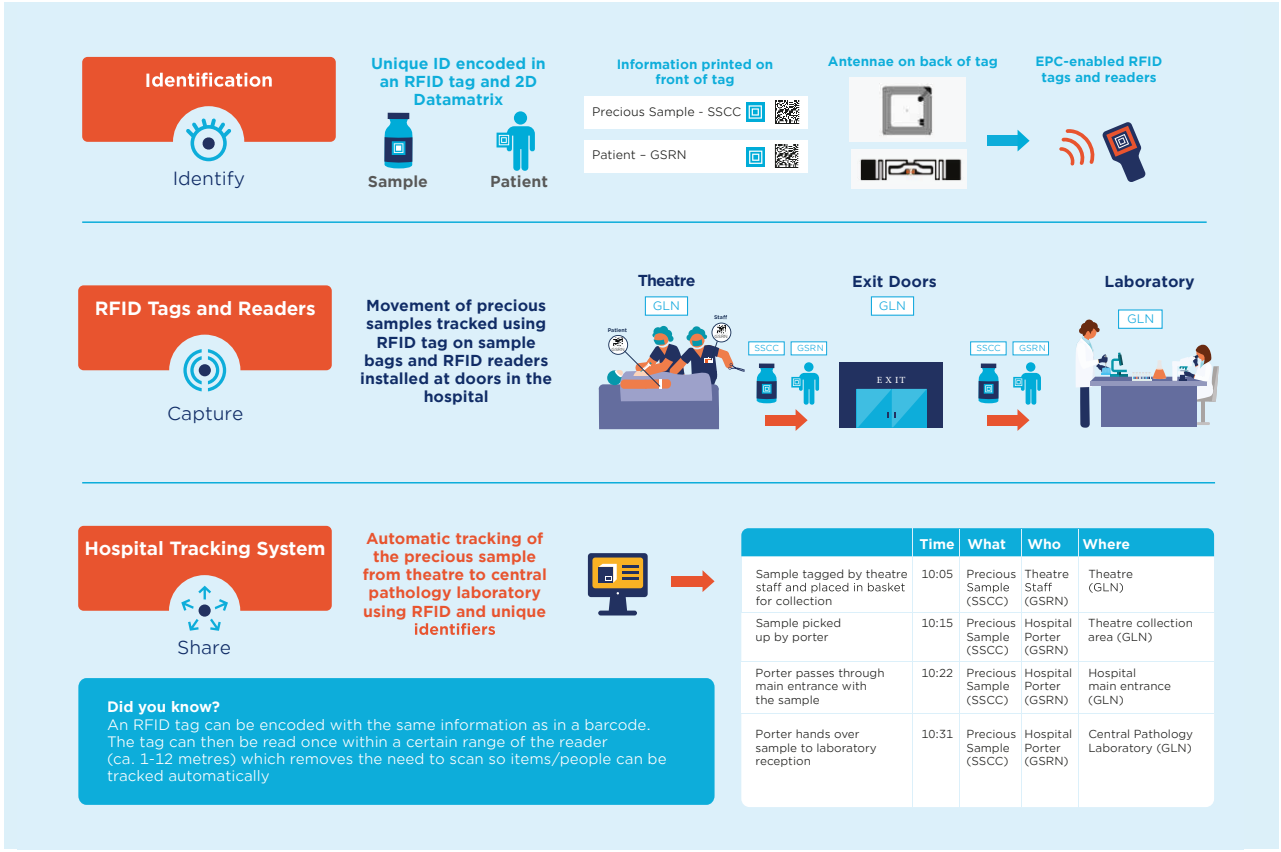
The porters have a pre-determined length of time to arrive in CPL. RFID readers and antennae have been installed at key points in the hospital and in CPL. The chain of custody is passed from the theatre nurse to the laboratory staff when the porter and samples arrive and are read by the RFID readers.

The theatre, exit doors and laboratory have all been assigned GS1 Global Location Numbers (GLNs) that are used to identify RFID reader locations. All unique identifiers—the GSRNs, SSCCs and GLNs—are encoded in tags containing an RFID antenna, which can be encoded with the same information as printed on a two-dimensional (2D) GS1 DataMatrix barcode.

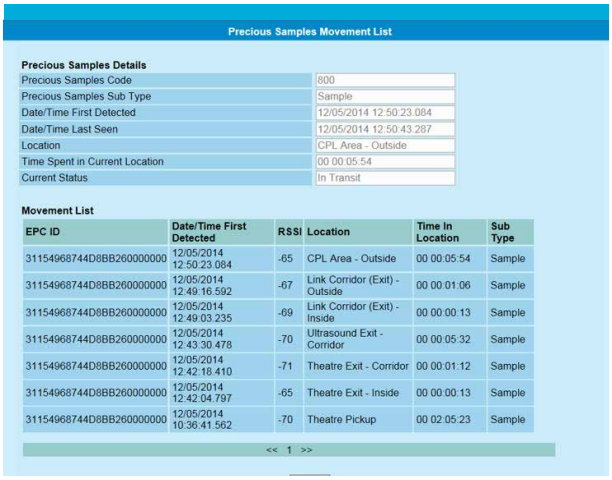
The RFID tags are read when they come within a certain range of the readers installed at doors in the hospital (approximately 1-12 metres), enabling the automatic tracking of these samples throughout the hospital via the ASD-provided system.

If a sample doesn't arrive at CPL in a given amount of time, an alert is sent to the portering services manager, indicating a sample has not reached its destination. The tracking database is consulted to identify the point where the sample was last seen, and the relevant staff is contacted. Before the introduction of this system, it could be the following day before a search even started.

Figure 2: The RFID-enabled tracking system and RFID tags on sample bags



	Time	What	Who	Where
Sample tagged by theatre staff and placed in basket for collection	10:05	Precious Sample (SSCC)	Theatre Staff (GSRN)	Theatre (GLN)
Sample picked up by porter	10:15	Precious Sample (SSCC)	Hospital Porter (GSRN)	Theatre collection area (GLN)
Porter passes through main entrance with the sample	10:22	Precious Sample (SSCC)	Hospital Porter (GSRN)	Hospital main entrance (GLN)
Porter hands over sample to laboratory reception	10:31	Precious Sample (SSCC)	Hospital Porter (GSRN)	Central Pathology Laboratory (GLN)



Precious Samples Movement List

Precious Samples Details

Precious Samples Code	800
Precious Samples Sub Type	Sample
Date/Time First Detected	12/05/2014 12:50:23.084
Date/Time Last Seen	12/05/2014 12:50:43.287
Location	CPL Area - Outside
Time Spent in Current Location	00 00:05:54
Current Status	In Transit

Movement List

EPC ID	Date/Time First Detected	RSSI	Location	Time In Location	Sub Type
31154968744D8BB260000000	12/05/2014 12:50:23.084	-65	CPL Area - Outside	00 00:05:54	Sample
31154968744D8BB260000000	12/05/2014 12:49:16.592	-67	Link Corridor (Exit) - Outside	00 00:01:06	Sample
31154968744D8BB260000000	12/05/2014 12:49:03.235	-69	Link Corridor (Exit) - Inside	00 00:00:13	Sample
31154968744D8BB260000000	12/05/2014 12:43:30.478	-70	Ultrasound Exit - Corridor	00 00:05:32	Sample
31154968744D8BB260000000	12/05/2014 12:42:18.410	-71	Theatre Exit - Corridor	00 00:01:12	Sample
31154968744D8BB260000000	12/05/2014 12:42:04.797	-65	Theatre Exit - Inside	00 00:00:13	Sample
31154968744D8BB260000000	12/05/2014 10:36:41.562	-70	Theatre Pickup	00 02:05:23	Sample

<< 1 >>

Figure 3: Precious Samples Movement List

Challenges

Technology

Previous experience in the hospital with RTLS technology had highlighted the challenges around costs and connectivity. The hospital was then introduced to ASD by GS1 Ireland as the only GS1-certified solution provider of passive RFID solutions in Ireland. ASD worked very closely with the project team to choose the most appropriate hardware (tags and readers) that would optimise the tracking of the precious samples. The software was also customised to link with the hospitals security system.

Change management

In developing the RFID-enabled system, the hospital had lengthy and widespread consultation sessions with all the staff involved. They had particularly detailed discussions with the portering staff who were a vital part of the chain of custody. Since this involved an additional level of tracking, there was initial fear that this may be a source of blame; however, It was very clear to everyone that the introduction of the new system was all about patient safety.

To date, feedback from the staff has been excellent and they have provided the hospital with many suggestions for improvement.

"The RFID infrastructure we now have in place has allowed us to expand our use of Standards-based RFID enabled technology and is now part of a broader overall traceability strategy at St. James's Hospital leading to safer care for our patients"

Vincent Callan,
Director, Campus Development Office, St James's Hospital

Outcomes and benefits

The RFID-enabled transport of precious laboratory samples and a tracking system was implemented in the histopathology laboratory, day-surgery centre and main theatre in 2016. Over a two-year period, from June 2016 to 2018, 16,733 tagged bags were transported, equal to 24 bags per day.

As a result, the system has:

- Increased patient safety by eliminating the risks of not being able to track all precious samples
- Enhanced trust with staff through the visibility of sample movement
- Put in place a standards-based RFID infrastructure that provides the foundation for future standards-based patient and asset tracking solutions (which are in progress)

These solutions have enabled huge organisational efficiencies in patient care and quality as well as improvements in safety, security, portering services and waste management.

"These precious samples are biological samples that cannot be easily taken again. If these samples are lost it can be detrimental to a patients timely diagnosis. It is critical that we ensure we have safe and effective procedures in place so that we have an audit trail and visibility from when the sample is taken to when it is processed- and we have achieved that with the RFID solution!"

John Gibbons,
Laboratory Advisor, Campus Development Office, St James's Hospital

Figure 4: RFID readers installed at doors in the hospital.

Significant benefits

The introduction of the GS1 standards-based approach to RFID tracking has achieved the following:

- Significant cost savings and time savings for staff resources to redeploy to other value-added activities
- Reduction in re-keying and duplication of work, streamlining processes and improving productivity
- Decline in the hospital's reliance on paper-based processes
- Tighter controls throughout the lab sample process
- Scalable solution to track all assets, patients, providers, products, stock and more
- Maintenance of assets that can be actively tracked, enabling huge organisational efficiencies in patient care and quality as well as improvements in safety, security, portering services and waste management

In 2016-17, RFID projects included precious samples, staff including porters, public wheelchairs, Mercer's Institute for Successful Ageing (MISA) patients and fine art.

Projects in progress since 2018-19 have included: Medical Physics Bio Engineering (MBPE) equipment, beds, infusion pain pumps and ICU samples.

With the RFID infrastructure now in place, the hospital has been able to expand its use of standards-based RFID technology to track and trace assets, staff, patients and more, as they move throughout the entire hospital campus. The PATH project is now part of a broader overall traceability strategy at St. James's Hospital.

Other future initiatives include the tracking of patients in the emergency department and equipment on loan from other hospitals, as well as the integration of RFID tracking with the Scan4Safety Project.

Implementation timeline

May 2014 – June 2015

Kick off with GS1's introduction of ASD to St. James's Hospital. Formation of strategy group. Agreement of project-phased approach to begin RFID project based on GS1 standards to track precious samples.

Development of ASD software for the precious samples proof of concept. Training of all staff—nurses, porters and lab scientists.

Completion of infrastructure implementation and software development for precious samples. Completion of proof of concept for precious samples in main theatre, day surgery theatre, endoscopy and ultrasound.

December 2015

Go live with fine art. Completion of public wheelchair tagging and ASD software development modifications.

January – November 2016

Development of RFID solution for vulnerable patients, including creating a suitable bracelet and tag for patients to wear.

Three interfaces between separate software solutions were developed: ASD to read the tags once the patient passes through an egress point; ACT for access control; and SAR for alarm activation. Full system test in MISA.

January – June 2017

Full proof of concept of tracking vulnerable patients in MISA. Go live of tracking vulnerable patients in MISA.

2018 – 2019

Medical Physics Bio Engineering (MBPE) equipment, beds, infusion pain pumps and ICU samples.

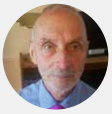
2020 and beyond

St James's Hospital continues to explore and implement RFID solutions, utilising the standards-based RFID structure in place to provide safer and more efficient services for patients.

Conclusion

This RFID solution highlights the huge opportunity for traceability throughout the hospital (not just in clinical areas), the value of collaboration between healthcare providers, solution providers and local GS1 Member Organisations and how laying the foundation with standards-based capabilities is enabling St. James's Hospital to achieve traceability and visibility of staff, patients, samples and assets across the campus.

About the authors



John Gibbons,
Laboratory Advisor and Project Lead, Campus Development Office, St James's Hospital

Mr. John Gibbons was Laboratory Manager in Blackrock Clinic for 21 years (1985-2006) and latterly for 17 years in St. James's Hospital up to the end of 2020. His priority interests included the delivery of services to patients in a quality and safe manner, for example, regularly introducing patient focussed process improvements that enhanced the patient experience and continually improving operational systems and processes that ensured the timely and accurate reporting of laboratory results to the patient's medical team. He also supported his laboratory team, in consultation with clinical users, in the development of new and innovative services that had a local and national remit. He has now taken up a new position of Laboratory Advisor and Project Lead in the Hospital's Strategic Campus Development Office focusing on the Hospital's strategic vision of developing an Academic Health Science Campus.

Vincent Callan,
Director, Campus Development Office, St James's Hospital

Vincent Callan, has 25 years Healthcare experience and has recently been appointed to lead the Strategic Office for Campus Developments at St James's Hospital. He has held various management and leadership positions within St James's Hospital and he has represented the Hospital on local community groups and business forums. The Campus Development Office is responsible for supporting the realisation of Irelands first Academic Health Science Campus including the development of an Innovation Healthcare District.

Vincent is a strong advocate of GS1 standards for safer, more efficient care and has been the project sponsor for the adoption of GS1 standards across the hospital over the last number of years including Scan4Safety and other ongoing projects. Vincent is also the Tri-Chair of the GS1 Ireland Healthcare User Group.

About the organisation

St. James's Hospital is the largest acute academic teaching hospital in the Republic of Ireland with 1,000 beds and provides a comprehensive range of diagnostic and treatment hospital services to a population in excess of 300,000 at local and regional level. SJH also deliver the majority of National Clinicals services with its enduring academic partner Trinity College by locating both their medical school and Health science centre on the SJH Campus.

www.stjames.ie