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SUSQI PROJECT REPORT

Reducing patient travel by providing "same day" ultrasound and nuclear medicine appointments

Start date of Project: May 2025
Date of Report: August 2025

Team Members:

- Christina Gladwell, Consultant Paediatric Radiologist (Left)
- Emily Fittock, Nuclear Medicine Clinical Scientist and Radiology Green Group Lead (Right)

Background:

Norfolk and Norwich University Hospital (NNUH) is a tertiary referral centre for paediatric urology, serving a large geographic population of children who need regular follow up imaging to determine disease progression or improvement. Children will often need both an ultrasound (US) scan, to look at the anatomical detail of the kidneys, and also a nuclear medicine (NM) scan to assess how the kidneys are functioning.

US scans of the kidneys are non-invasive and require minimal preparation (just a full bladder if possible). At the NNUH we have a specific paediatric ultrasound room which is optimised for children. Generally the scan is very well tolerated and can be completed within 20 minutes.

There are two types of NM study which are conducted for the same cohort of children - either a renogram or dimercaptosuccinic acid (DMSA), both of which are slightly more involved than an US. On the day of the NM study, patients attend the Children's Day Ward (CDW) to be cannulated. After this, they report to the NM department where the radioactive tracer is injected through the cannula. If the child is having a renogram, the scan images are acquired over the course of the next 40 minutes, however if the child is having a DMSA then they need to allow 2-3 hours for the radioactive tracer to distribute throughout the kidneys before returning for image acquisition which can take 40 minutes.

Typically, at our institution the bulk of these patients are managed by the paediatric urologists and a smaller proportion are managed by the paediatric nephrologists, comprising a core referral pool of 6 clinicians. Once a scan is requested, it is then scheduled by separate US and NM bookings teams who work in parallel, remotely from each other in the hospital and therefore historically these tests for the same child are booked on separate days.

Pilot data collected from July-Sept 2024 identified 23 patients that could have had their US and NM scans conducted on the same day. With an average round trip of 40.2 miles, we estimate that over the course of a year, combining these two imaging studies has the potential to save 3,575 miles of travel and 1,069 kgCO2e.

Beyond carbon savings, this project has the potential to improve patient satisfaction; reduce time loss from education for the child; time loss from work for the parent; reduce the cost of fuel; and reduce the cost of parking.

Specific Aims:

To provide same day ultrasound and nuclear medicine appointments for children if:

- Both tests are needed in the same time frame
- Both tests are requested at the same time

Methods:

The project commenced by studying the system which allowed us to identity the challenges and target interventions. Please see process map in Appendix 1.

Challenge #1 - identifying the patient cohort.

During our pilot data collection, we noted that 9 of the patients that could have benefited from a "same day" appointment did not have their US and NM studies requested at the same time, which makes booking a "same day" appointment exceptionally difficult. Our first intervention was to engage the referrers in the project, asking them to consider whether a patient will be needing both an US and NM study as follow up and to ensure these are requested at the same time. The referrers were keen to get on board with the project and were happy to go further than this and to email the project lead when they identified a patient who would be eligible for a "same day" appointment.

Patients were considered eligible for this study if they had:

- An outstanding ultrasound and nuclear medicine request that could be conducted in the same time frame AND
- had either of these studies completed during an 11 week period from the end of May to the end of July 2025.

These interventions will help with the prospective booking of "same day US/NM" appointments. However, for the purposes of data collection during the study period, cases were predominately identified by manually searching pending requests on the Radiology Information System (RIS).

Our second intervention was to engage radiologists in the study. Every US or NM radiology request is reviewed by a consultant radiologist and authorised/vetted as appropriate before a study can then be booked. We asked vetting radiologists to add a vetting note to identify patients that are appropriate for "same day US/NM" appointments to support booking teams.

Process of an imaging request:

We recognise that both interventions are liable to error through human factors, and we are therefore looking into more automated ways to identify the patient cohort including:

- Adding a mandatory yes/no ICE prompt when the refer requests multiple radiology scans, to identify whether a "same day" appointment would be appropriate.
- All studies identified as appropriate through the above prompt could then be populated in a spreadsheet through power BI and act as a shared worklist for the US and NM bookings team.

Challenge #2 - booking template.

As described earlier, the NM and US bookings teams are separate in workforce and location, and have not previously been required to work together to book appointments, so this was a complete system change. To help with this change:

- A booking template was devised, please see Appendix 2.
- Ultrasound slots were reserved for "same day US/NM" patients on the RIS daybook, which shows the available patient appointments in a calendar format.
- A Staff engagement session with the US and NM Lead and the NM admin team was held to give feedback on the carbon saving, allow for networking and for the admin team to have the opportunity to give their own feedback.

Challenge #3 - the unexpected.

During the study, there were a few cases which were booked appropriately by admin staff as "same day" appointments but due to patient non-attendance and inability to cannulate, these were unable to proceed as planned. It became apparent that families were getting confused with the multiple appointment letters, as separate letters continued to be sent, and we have plans to combine both US and NM appointment letters in the future.

Measurement and results:

Patient outcomes:

10 patients were enrolled into the study. All had their US and NM studies booked appropriately on the same day. 8/10 patients booked for "same day" appointments had their scans completed as planned.

2 out of the 10 booked as "same day" appointments did not proceed as planned.

- One patient could not be cannulated by the medical team, therefore US completed but not the NM scan. This is an unfortunate but an inevitable occurrence occasionally which cannot be avoided.
- One patient failed to attend their US appointment despite attending later in the day for their CDW and NM appointment. This family was contacted for feedback, and it became apparent that despite being told over the phone about the "same day" project, that they were confused.

By having both US and NM scans on the same day, we anticipate this may reduce the risk of patient Did not attend (DNA) rates. Unfortunately, due to the small patient numbers it is difficult to accurately determine the DNAs rates prior to the intervention and therefore make meaningful comparisons. We have unexpectedly experienced a DNA since implementation of the change, likely due to confusion with appointment letters. We expect risk of DNAs will reduce as we further integrate the change into existing systems.

The change may reduce clinical admin time therefore releasing time for other patient activities.

Environmental sustainability:
The CO2e of reduced patient travel was estimated using a patient travel calculator developed by the Centre for Sustainable Healthcare, Remote Consultations: Do they reduce Greenhouse Gas Emissions? Your Guide to Calculating the Answer (2024 version). We identified the one-way distance of avoided travel per patient using the distance from their postcode to the hospital calculated by Google Maps and entered this into the calculator to give us the CO2e saving per journey. The aggregate emissions factor used to convert from miles to CO2e was 0.3 which assumes between 80% and 90% of the journeys were driven and there were varying percentages of other transport modes included. This is most likely an underestimate of the carbon footprint as it would be expected that approximately 95% of journeys are conducted by car.

With 8 out of 10 patients enrolled having avoided 1 additional episode of travel to the hospital, we have saved 232 miles, equivalent to 88.18 kgCO2e. Please note that this is a conservative estimate due to the emissions factor used which most likely overestimates the percentage of journeys completed by public transport.

Given the savings are based on an 11 week data collection period, there is an estimated annual saving for a cohort of 23 patients of 594.60 kgCO2e, equivalent to 2,013.82 avoided miles.

In addition to the miles of travel saved, our annual carbon savings are equivalent to the below food and drink volumes, which may be more relatable to children especially (taken from the book *How Bad are Bananas* by Mike Berners Lee). A saving of 594.60 kgCO2e is equivalent to the carbon required to produce:

- 1,077 lattes, or
- 8,374 of tea with milk, or
- 424 margherita pizzas, or
- 7,432 ice lollies.

Economic sustainability:
There is a possible financial saving through a reduction in DNA rates, and increased booking team efficiency, however this could not be quantified. The project is otherwise cost neutral.

Social sustainability:
As a small team, and the change being applicable to a relatively small patient group, we have collected qualitative feedback from both patients and staff on the impact of the change. This has taken place at patient appointments, and through our staff engagement session.

Patients
Qualitative data was collated via feedback from successful participants. Parents valued only having to come to the hospital once instead of twice, especially those who lived outside of the local Norwich area. One parent even expected this to be the norm considering that her child required two imaging appointments. This project will ensure that children miss less school and will reduce stress for the parents who may have to take time off work and arrange other childcare to attend the appointments.

Based on pilot data, this project was predicted to save 88 days lost from work and school per year. Additional social impact feedback received from the parents of the patients was as follows:

- Saved two trips from Great Yarmouth (approximately a 30-mile drive taking 1 hour) which is really helpful.
- It is a longer day, but any time in a hospital with a two-year-old seems like a long day.
- The extra time in the hospital (in one day between studies) is not a concern for them, they had a drink and snack in the sunshine.
- CDW funds the parking, so there is no impact on parking cost for the parents.
- Sustainability or the environment is not their biggest priority but every little helps.
- Patient's parent requested a same day appointment, not knowing that this project was running.

Staff

There is no direct measurable benefits for staff. There is a possible small increase in job satisfaction from positive feedback or a negative impact for booking staff as the booking process has got more complicated.

Although the project presented many challenges, feedback from the staff involved in the project was positive and the perception of how the project was going was also positive. During staff feedback and engagement sessions, staff were excited to hear about the impact that they were having and were spurred on to identify other carbon saving projected within their sphere of influence.

Discussion:

The aim of this project was to implement a "same day" or "one stop shop service" for paediatric patients who require US and NM imaging to be completed in the same timeframe. We have successfully shown that this is possible and identified the carbon saving and social impacts. The practicality of such a process was more challenging than expected.

The first challenge that we identified as a team was that referrals for scans in these patients do not necessarily come through concurrently, i.e. an US may have been requested while the child was an inpatient and then the NM study requested following an outpatient appointment at some time in the future. If studies are not requested concurrently then it is exceptionally difficult to prospectively book the studies to be done at the same time, therefore our first intervention during this project was to educate the referrers on the importance of anticipating these patients and requesting the studies at the same time. During this engagement process the referrers also agreed to email the project leads when they identify such a patient.

Another opportunity to identify the cohort of patients requiring both an US and NM study is during the vetting stage, whereby the request is reviewed by a radiologist and authorised or vetted thereby moving the request into the booking stage (Appendix 1). The radiologists that vet such studies include two separate groups of consultants, comprising a pool of 12 consultants. These radiologists were informed of the study and asked to highlight while vetting if the patient has a pending US or NM study, identifying them as "same day US/NM" patients to bookings staff.

Both above methods of identifying the patient cohort requires education and engagement from a large group of staff. And throughout this project the labour intensive task of identifying the patient cohort has mainly been conducted by the project leads. Neither option is sustainable in the long term and to that end more "automated" processes were investigated. One option would be a "flagging"

system at the point of vetting, however this again relies on the vetter to identify and select the flag. The preferred method and the one that is currently being designed is for a compulsory “yes or no” check box to be selected by the referrer at the time of making multiple imaging requests to state whether the patient could have these studies on the same day. A weekly spreadsheet could then be populated through Power BI identifying all studies that have been marked as “same day” studies.

The second difficulty encountered by this project was coordinating the booking of these patients. Prior to the NM study the patient would have to attend CDW to be cannulated, therefore it was felt to be sensible to do the US prior to the cannulation, reducing the risk of the cannula being dislodged before the NM injection. With this agreed we devised a booking template, which is displayed in Appendix 2.

Despite having the booking template and identifying patients that could have a “same day” scan, the scans were still not getting booked appropriately. We realised that the NM booking team release their daybooks only 2 weeks in advance whereas the US booking team release theirs 6 weeks in advance, therefore US slots were getting filled before NM slots were booked. To help overcome this issue, we reserved “same day US/NM” ultrasound slots according to the booking template. There was a concern that these slots might get wasted if a “same day” patient does not get booked therefore we agreed a deadline, after which if a “same day” patient has not been booked then the slots can be released for other relevant bookings.

With the booking template and reserved slots, the booking process has been progressing much more smoothly with less input needed from the project leads. However an individual does need oversight of the “same day” patients and we are uncertain as yet who would take over this role. We envisage this would be an administrative coordinator role however both the US and NM booking teams are short staffed at the moment, with the prospect of voluntary redundancies only making this worse.

Separate from the bookings process, we experienced some other unexpected difficulties. Some patients experienced challenges with same-day appointments, including missed ultrasounds due to confusion over scheduling. As the project progresses and becomes more embedded within the booking system, we plan to devise a “same day US and NM” appointment letter which will detail all both imaging appointment times and CDW cannulation for clarity. This has the additional benefit of saving a further 0.2835 kgCO2e per patient (carbon footprint of a 2 page posted letter).

The future direction of this project is positive due to the engagement from the referrers and the bookings teams and there is support for the success of the project. We feel this project is sustainable in the long term with the automated cohort identification via ICE prompts and Power BI as described above. If we can embed this process into our small subset of patients, it will then be a viable process to roll out to the whole of radiology, including XR, CT and MRI. This would have an even bigger impact on patient travel and satisfaction.

This project will be presented locally to the Radiology Department and additionally during the Green Team showcase, opportunities may arise from these presentations or may inspire others to consider a similar project.

Conclusions:

This project has indicated that a "same day" imaging pathway for paediatric patients requiring ultrasound and nuclear medicine scans is possible and that once this process is embedded, that it could be rolled out to all patients requiring multiple imaging investigations including US, XR, CT and MRI.

At the beginning of this project, significant input was required by the project leads to identify the patient cohort and oversee the booking process. This allowed the project leads to see where the problems were arising and make small adjustments in a "plan, do, study, act" cycle. This was fully expected during the start of the project and allowed the project leads to immerse themselves into the process to identify solutions.

This project has also hugely benefited from the keen engagement of colleagues involved throughout the process from referral, vetting and booking. We have actively fed back results and updates from the project to keep staff engaged.

Limitations have been identified in this study, however these were overcome to book all identified patients as "same day" appointments.

The project has been successful in proving that same day imaging is achievable, the system is not yet perfect however the team will continue with this project after the end of the Green Team Challenge, with the hope of introducing new electronic flags which will greatly assist the process.

It is the hope of the project leads that communication of this project to wider groups inspires similar projects to be conducted as significant project benefits have been demonstrated over a three-month period and staff involved in this project have managed to successfully manage this project around other clinical and workload commitments. This project will be submitted as an abstract to be presented at the 2025 GHASP conference.

References

- Remote Consultations: Do they reduce Greenhouse Gas Emissions? Your Guide to Calculating the Answer (2024 version)
- SusQI resources accessed by SusQI.org
- Berners-Lee, M. (2010). *How bad are bananas? The carbon footprint of everything*. London: Profile Books.

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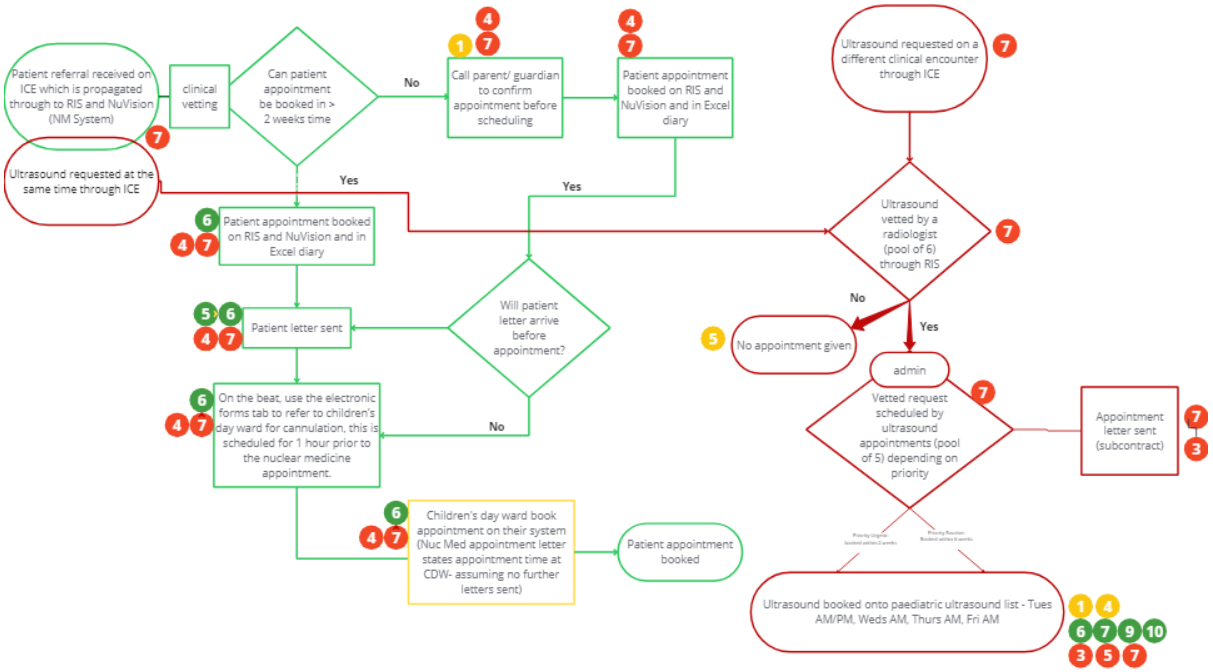
Appendices

Appendix 1- Bookings Process Map

Booking Process - US, NM, CDW



RESOURCE USE KEY

Environmental resources	Social resources/impacts	Financial resources
1 Medications	1 Patient/carer time	1 Medications
2 Medical supplies	2 Patient/carer satisfaction	2 Medical supplies
3 Anaesthetic gases/nitrous oxide	3 Patient/carer relationships	3 Non-medical supplies
4 Propellant inhaler (MDI)	4 £ cost to patient/carer	4 Energy use
5 Non-medical supplies	5 Patient/carer wellbeing	5 Waste disposal
6 Energy use	6 Staff satisfaction	6 Water use
7 Waste disposal	7 Staff wellbeing	7 Staff time
8 Water use	8 Community impacts	8 Contracted services (e.g. cleaning, laundry)
9 Staff travel	9 Supply chain worker wellbeing	
10 Patient travel		

Appendix 2- “Same day” Bookings Template

Wednesday - MAG3		
US	CDW	NM
	09:00	10:00
09:15	10:00	11:15
11:45	12:30	13:30

Thursday - DMSA		
US	CDW	NM
	09:00	10:00
	10:15	11:00
10:30	11:00	12:00

Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
☐ Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention X Staff engagement ☐ MDT / Cross-department communication ☐ Skills and capability of staff X Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) ☐ Support from senior organisational or system leaders	☐ clear guidance / evidence / policy to support the intervention. ☐ Incentivisation of the strategy – e.g., QOF in general practice ☐ systematic and coordinated approach ☐ clear, measurable targets ☐ long-term strategy for sustaining and embedding change developed in planning phase ☐ integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation	☐ Dedicated time ☐ QI training / information resources and organisation process / support ☐ Infrastructure capable of providing teams with information, data and equipment needed ☐ Research / evidence of change successfully implemented elsewhere ☐ Financial investment	☐ aims aligned with wider service, organisational or system goals. ☐ Links to patient benefits / clinical outcomes ☐ Links to staff benefits ☐ ‘Permission’ given through the organisational context, capacity and positive change culture.