

Establishing a domiciliary x-ray service (XRT) using the Fujifilm **FDR Xair** system to deliver care closer to home

Organisation

Northumbria Healthcare Trust, in partnership with North East Ambulance Service and Fujifilm UK Ltd.

Working with primary care partners and care homes across the locality.

What was the aim/problem?

The initial aim of the project was to test whether the newly developed **FDR Xair** portable digital x-ray system from Fujifilm could deliver and enhance care to elderly or vulnerable patients in a residential or community setting. The timing of the initiative coincided with the onset of the first wave of the Covid 19 pandemic and the **FDR Xair** system receiving CE approval for use in the UK.

The pathways to be piloted were:

- I. X-ray in a primary care setting (elective)
- II. X-ray in the community / place of residence (acute), working with the ambulance service, paramedics and pre-hospital medical team (999 and 111 service)
- III. X-ray in care homes for elderly and vulnerable patients required to self-isolate post Covid 19 treatment and follow-up

An essential element of the initiative was to ensure IT integration via a cloud-based solution to allow patient booking, import of worklist, review of previous studies and integration of the report into the Trust's RIS and PACS. Cloud integration also provided the ability to send studies to selected AI algorithms with results returned to the device and to PACS.

The initiative aligned with 'care closer to home' and other ongoing initiatives such as NHS@home, personalised care and supports reducing unnecessary ambulance

conveyances, but with the overall aim of improving patient care and their experience of care for vulnerable groups.

What was the solution?

Extensive pre-trial testing in a hospital environment established that the equipment and quality of images were fit for purpose and could be utilised in a range of potentially challenging out of hospital environments. Adjustments were made to the equipment, exposure factors, carry cases and stands to ensure that they would meet the needs of the potential patient demographic in the community. This included a cloud-based image sharing solution which allowed previous images to be retrieved and viewed from the Trust PACS, and new images to be integrated into the patient record to prevent repeats if the patient needed to be transferred to secondary care. An SBAR methodology was used to ensure this.

- I. Patients were appointed for x-rays in a GP practice and 'proof of concept' was established by carrying out several x-ray examinations of diagnostic image quality, which contributed to the patient's treatment pathway. The patient feedback was universally positive and delivering this care closer to the patient had a significant impact on patient travelling time.

'It was fantastic to be assessed at home'

Very prompt, saved a lot of time and stress

'Ideal as it can stop unnecessary trips to A&E and we had an answer quickly'

- II. The X-ray Response Team (XRT), which included a senior radiographer, paramedic and a junior emergency care doctor, worked with the ambulance service to identify calls where an x-ray at the scene had the potential to make a significant contribution to the patient's diagnosis and enhance their treatment pathway (potentially avoiding unnecessary conveyance to hospital). Such calls included falls or those that required potential for diagnosis of fractures and were identified at ambulance control who then dispatched the XRT. The team was overseen by an ED/PHEM (Pre-Hospital Emergency Medicine) consultant on call.

Of the 18 calls which were attended, and an x-ray was taken, 8 of those patients were assessed as not requiring transfer to A&E, allowing them to be safely managed in their place of residence. Chest, appendicular skeleton and AP projections of the pelvis (where patient habitus allowed) were all imaged. To quantify the results a scoring system was developed, see Table 1.

KEY	
OUTCOME SCORE	MEANING
1	Called but imaging not required.
2	Imaging taken, patient needed to be transported to be further managed in the Emergency Department, NSECH.
3	Imaging taken, patient needed to go to hospital but directed through a pathway due to finding (pathways include direct to base sites that have specialties like Care of the Elderly, and Orthopaedics).
4	Imaging taken, referral made to fracture clinic or other follow up related to image findings, and patient remains in the community
5	Image taken finding allowed patient to be discharged with no further action

Table 1. Outcome scoring system

As this has been a short pilot study the numbers of patients are low, however early results look extremely positive with a non-conveyance rate of approximately 40%.

- III. Elective x-ray in care homes was also tested for proof of concept, with risk assessments to comply with The Ionising Radiation Regulations 2017(IRR17) being carried out in a number of care homes prior to commencement. Care home managers were very welcoming of this initiative, not only for their residents but also due to the potential impact on staffing pressures when patients were transferred to hospital for an x-ray with the subsequent need to self-isolate on their return. This approach has the opportunity to reduce the period of self-isolation for mentally vulnerable elderly residents.



Fig. 1 - FDR Xair portable x-ray unit



Figure 2. Detector storage unit



Figure 3. Hard case for FDR Xair unit, charger and



Fig 4. FDR Xair unit on tripod stand

What were the challenges

As this was a new way of working Employers Procedures under IR(ME)R 2017 and Local Rules under The Ionising Radiation Regulations 2017(IRR17) were developed. In particular IRR17 concerns needed to be addressed to ensure that the radiographers were trained to do a risk assessment at the scene if not already a Radiation Protection Supervisor (RPS). Due to the transportable nature of the FDR Xair system and the risk of damage, regular QA checks need to be undertaken. Sensors were fitted to detect if the device had been dropped.

To ensure that all members of the team were documenting and following the same practice Standard Operating Procedures (SOPs) were agreed and developed.

There were some initial challenges setting up the image sharing solution due to IT governance processes. These were overcome by working with the Trust IT department to ensure that the cloud-based image sharing solution was fully integrated.

What were the results?

The XRT service has been strongly supported by all stakeholders and has enhanced multidisciplinary working between the trust and the ambulance service, as well as primary care partners. This has increased job satisfaction for team members

Deborah Henderson, Project Lead and Trust Lead Radiographer said,

“This project has given the radiographers the chance to be part of a multidisciplinary team and has allowed them engagement in the complete patient pathway, something that they don’t usually experience, and which has been an education to us all. We often see more vulnerable patients in the department that are scared, disorientated and confused, making the examination difficult and often non-diagnostic. Our experience during this project has highlighted how different these patients are in their own environment, and this has been so rewarding. The team have attended patients in many different situations and environments which has required a lot of adapted technique and risk assessment. The FDR Xair system has performed above expectations and has opened up all kinds of opportunities for use in the future.”

The pilot has demonstrated ‘proof of concept’ in all three pathways and feedback from patients and carers has been positive. There has been excellent engagement from the Care of the Elderly (COTE) team, and the Trauma & Orthopaedic (T&O) team are keen to work with XRT to improve the Neck of Femur pathway.

- i) Proof of concept delivering an x-ray service in a GP setting was successful, with good quality images and a portable system that was suitably mobile and could integrate with PACS via a cloud-based solution
- ii) An acute x-ray service integrated with the ambulance team that prevented admissions and enhanced diagnosis at the scene. Where patients required admission, the additional diagnostic information allowed a more streamlined pathway. All patients where admission was avoided would have been conveyed to hospital if imaging had not been available.

Total number of referrals	19
Total number stood down	1
Number of calls attended	18
Imaging performed	18
Admissions to NSECH	11
Admission through streaming pathway	0
Admission avoided	8

Table 2: Summary of outcome data

What were the learning points?

- Test and familiarise equipment use and image preferences on site before taking the equipment into the community.
- A multidisciplinary approach with radiographers, paramedics, doctors and industry partners is the best way to design new pathways and technical solutions to support innovations in care
- A shared understanding with a clear governance structure, training and SOPs are essential to ensure consistency and patient safety
- Review of each case promotes learning and allows for adaptations to be made and pathways to be improved

Next steps

- Extend the current pilot to build more evidence and case studies
- Test the concept with more patient cohorts and pathways, supporting the inequalities agenda for patients who are 'hard to reach' or do not access the care required e.g. Mental Health, Learning Disabilities, patients in a prison setting
- Share the learning, models and outcomes through regional and national diagnostics boards, ambulance services and emergency medicine forums, as well as clinical conferences (UKIO 2021)
- Add other diagnostic tests at the point of care e.g. Fujifilm dry chemistry blood testing and point of care ultrasound
- Utilise the ability to obtain a bedside AI analysis to support clinical decision making at the scene, out of hours or where an immediate x-ray report is not available with an initial focus on chest and fracture work
- Secure capital and revenue funds to extend and evaluate a larger pilot study and to secure and commission a permanent service
- Develop promotional materials to raise awareness of the service and the benefits it offers patients [>>> View XRT Animation << \(link opens in YouTube\)](#)
- Evaluate the broader benefits of the service to demonstrate cost-effectiveness

Want to know more?

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Fig 5. Some members of the X-ray Response Team

The three full reports relating to the pilot are available here: [>>>Case Studies<<](#)

For further information on the Fujifilm **FDR Xair** system, Fujifilm's cloud-based image sharing solution or the AI products, please email: medicalsales_uk@fujifilm.com