

NORTHUMBRIA FDR XAIR SYSTEM TRIAL

Phase 3 Report

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NORTHUMBRIA HEALTHCARE NHS FOUNDATION TRUST

INTRODUCTION

This final phase of the trial aimed to consolidate the learning from previous phases and integrate this into a safe and effective multi-disciplinary service within the pre-hospital acute setting (Please read with Phase 1 & 2 reports). A partnership with the Emergency Department (ED) and the North East Ambulance Service (NEAS) was established, creating a multidisciplinary team that would provide a pre-hospital assessment service, including plain film imaging.

In 2019 NHS England produced the Planning to Safely Reduce Avoidable Conveyance document with the aim of safely and sustainably reducing avoidable conveyance in England by 2023. Avoidable conveyance is when a patient has to be conveyed to a hospital emergency department unnecessarily. The plan encourages multidisciplinary working and initiatives that allow a patient needs to be met in the community. There are many successful examples of this such as falls cars and schemes that have put in place emergency care practitioners (ECP) or specialist paramedic roles (SP). These manage emergency calls from care homes and make an assessment on site which will often make it possible to put into place a temporary care package rather than transport the patient to ED.

The Fujifilm **FDR Xair** unit, is a very portable x-ray unit which allows delivery of a radiologic diagnosis outside of the hospital, improving pre-hospital care. By providing on-scene imaging, more informed clinical decisions can be made about ongoing care. The provision of this service could allow patient transfer directly to a ward where appropriate, bypassing the ED and reducing operational pressures in this area.

The team includes a radiographer, a junior doctor and a paramedic, with an ED consultant providing additional support from within the hospital site. The team can respond to 999 and 111 calls from care homes, sheltered living accommodations and private residences. The service provides paramedic assessment with the addition of off-site plain film imaging before the decision is made by the ED Consultant and junior doctor, for either a safe patient discharge at the scene or to transport to the ED, or ward depending on the patient's condition and medical needs.

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Fig. 1 – X-ray Response Team

KEY AIMS

- To evaluate the **FDR Xair** portable x-ray system for emergency pre-hospital use.
- To avoid unnecessary time spent in the ED for elderly, infirm or vulnerable patients, where appropriate.
- To decrease avoidable conveyance numbers within the ambulance service.
- To evaluate the time-efficiency of the service compared to an ED attendance.
- To improve the patient's experience in the pre-hospital setting as well as in-hospital care.

METHODOLOGY

The third and final phase began upon completion of Phase 1 data analysis; this indicated an appropriate use of the Fujifilm **FDR Xair** system for pre-hospital emergency imaging. Both NEAS and ED teams were approached to discuss the concept and the potential to test this for Phase 3.

A partnership between Radiology, NEAS and ED was established, and steps towards a pre-hospital imaging pilot were put in place through an initial stakeholder meeting. The trial had the support of the Regional lead for Diagnostics and the National Imaging Transformation Team. After discussion, it was agreed that the team would consist of a radiographer, a junior ED doctor (F2/3 or ST1 grade) and a senior trauma paramedic. The team would be

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overseen by an ED/PHEM (Pre-Hospital Emergency Medicine) consultant who was on-call for the service. The team would travel in the trauma car, provided by NEAS, and use the Terrafix system in order to be designated a patient job by the control room.

An inclusion and exclusion criteria for the imaging that could be performed were created by the Radiology Project Lead and Team Lead which guided the control room staff and duty manager as to what would be appropriate for the team to attend. This was based upon the data and knowledge gained from Phases 1 and 2. A decision was made by the strategic team to begin imaging the pelvis within this phase; a plan to complete an AP pelvis was made and that further horizontal beam hip imaging (HBL) could be completed in the Radiology department if hospital transfer was necessary.

The service was named 'X-ray Response Team' (XRT) and NHS approved logos were produced for copyrighting of documentation.

A 'dry run' shift was organised in order to discuss the logistics; this involved developing a clinical governance strategy and organising the workflow of the day, which included:

- Shift time/length
- Job allocation from control room
- Image requesting process
- Locations covered by XRT
- Handover procedure to relevant services

From previous feedback, it was established that for the service to be used to its optimum potential it required consistency of approach, reliability, uniformity and regularity. Following this a monthly rota was created by the team lead to organise availability and establish a reliable system for staffing, as well as create a reliable service schedule for the NEAS Duty Manager and Primary Care.

RESULTS

Quantitative Data

Table 1: Quantitative Data Summary

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

Of the 8 admissions avoided all would have had to be conveyed to hospital if imaging at scene was not available.

A patient log spreadsheet was created in order to securely record all the data from each call-out received.

The key demonstrates the details of the scoring system. Each patient was deemed to benefit from avoiding a hospital attendance or from being removed from their current environment. For example:

- A disability
- A co-morbidity that left them vulnerable to hospital-acquired infections
- Immunosuppression
- Received specialist care outside of the hospital setting
- Frailty

The scoring system was based upon the efficiency of the patient's pathway when emergency imaging was provided within the community. Time spent in hospital was also recorded if the patient incurred a hospital attendance.

Table 2: KPI Data Summary

PATIENT CASE NUMBER	OUTCOME SCORE	TOTAL TIME WITH XRT (MINS)	TIME TO DISCHARGE FROM EMERGENCY DEPARTMENT (HRS)
1	2	98	189
2	2	172	260
3	2	90	234
4	5	83	0
5	5	153	0
6	5	67	0
7	5	135	0
8	2	45	
9	5	101	0
10	2	118	317
11	2	53	224
12	2	36	124
13	1	29	0
14	5	35	0
15	2	49	231
16	2	103	331
17	2	43	217
18	5	60	0
19	2	65	968

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

Qualitative Data

The qualitative data collected during Phase 3 mainly comprised of patient feedback. With the input of the patient experience team an online survey was developed, which could be completed by patients and / or their carers. This aided the collection of appropriate data to determine the value and impact of pre-hospital imaging.

The data summary can be found in Appendix 2.

DISCUSSION

Image Quality

With the support of the Fujifilm Applications Specialist some image processing was adjusted to align the image processing preferences of the Trust's reporting radiographers and radiologists. This allowed the team to start imaging of the pelvis (AP) as operator confidence and image quality improved.

Storage

After clinical testing of the previous storage cases and feedback to Fujifilm it was thought necessary to provide a more lightweight solution for storage and transportation. This was to allow the **FDR Xair** system to be used to its maximum potential as the unit itself was so lightweight, however the storage was too bulky to be fit for purpose.

The cases used for Phase 3 consisted of a small hard case for the **FDR Xair** device tube to protect from damage. The other components of the unit were stored in a compact rucksack for easy transportability. No cases were provided for the mounting stands; this was not thought to be necessary service delivery, as the stands are stowed securely in a car.

Connectivity

Since completion of Phase 2, end-to-end connectivity was achieved allowing access to CRIS (Radiology Information System), PACS (Picture Archiving Communication System), requesting systems and AI (Artificial Intelligence) software. This has improved the efficiency of the imaging process and allows for immediate access to imaging from within the Trust. This has been especially useful when liaising with the on-call PHEM consultant as well as for organising orthopaedic and care of the elderly (COTE) referrals.

The team has been attending callouts throughout North Tyneside and Northumberland. Due to the vast areas covered by XRT, connectivity has been an issue in some remote areas due to lack of signal. This was highlighted as an issue to the Fujifilm team, who have worked on a multi-network solution to provide greater signal coverage and help to resolve the issue.

Patient Experience

Feedback from this phase was overwhelmingly positive and has truly demonstrated the value in improving patient experience by providing an acute bedside imaging service.

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It should be noted that some responses recorded were negative, but after correlating these with written feedback on the survey we have determined that these questions may have been misunderstood. As the surveys are anonymised as per the Caldicott approval, it is not possible to clarify whether these questions were understood correctly. The team lead is working with the Patient Experience team to make these questions clearer to ensure more accurate responses.

Staff Satisfaction

Working with this kind of x-ray machine was vastly different to an in-hospital portable unit and adaptation to accommodate different scenarios can be challenging. However, after some adjustments to our usual approach, the team has successfully implemented the unit into the pre-hospital setting.

Amongst the strategic team and after consultation with the Medical Physics Team and the HSE, it was deemed necessary to have a small core team of experienced radiographers that had received dedicated training on the **FDR Xair** system in order to run a pre-hospital service to its full potential. Risk Assessments (RA) have to be completed on scene to ensure radiation safety and it is important to establish if not suitable the examination will not be performed. Therefore, all XRT radiographers are either radiation protection supervisors (RPS) or have completed training on RA.

The team also highlighted the need for a training guide offering on-demand help during a shift. This was produced by the team lead radiographer. This decision has also improved staff confidence levels when working on this service.

The team also share debrief notes after each callout so learning can be shared and aid future examinations.

Patient Pathway Development

The data collected during this phase allowed the team to develop some alternative patient pathways to avoid having to convey the patient to ED after an XRT pre-hospital assessment with imaging. Once developed, this will allow patients attended by XRT to be conveyed straight to an appropriate ward when they require additional hospital interventions.

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There are several different pathways being looked at such as a neck of femur fracture pathway which will look at streamlining the patients preassessment with the aim to reduce time in the ED department and ultimately at direct ward admission although there are many factors that would need to be in place.

Follow up fracture appointments is another aspect the team are looking at for more vulnerable patients where the clinic appointment maybe virtual but need imaging.

Other potential pathways being looked at are with COTE which would be valuable for patients that may not have a fracture but needed further support and evaluation in a hospital setting.

RECOMMENDATIONS FOR THE FUTURE

The Fujifilm **FDR Xair** unit has many applications, both clinical and non-clinical. Our work has highlighted some key areas where the portability and lightweight features may be beneficial:

- Work with primary care networks to provide routine imaging to vulnerable and frail patients
- Provide Fascia iliaca Compartment Block (FICB) out in the community for patients with fractured neck of femurs.
- Create orthopaedic and COTE pathways to streamline patients imaged acutely to get them to the right place first time rather than traditional route through ED.
- Due to the need for adaptation of technique and the carrying out of a RA in an acute setting this service needs a core team of experienced and suitable trained radiographers and would not be suitable for junior radiographers or Assistant Practitioners. However, in a more elective stream where there would not be a doctor or paramedic these members of staff could support the core team radiograph.
- Provide imaging within mental health and rehabilitation facilities where conveyance to hospital often requires multiple escorts and disruption to the patient's current environment.

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CONCLUSION

The Fujifilm **FDR Xair** system is an innovation that releases radiology from technological and geographical restraints by providing on-demand access to patient imaging wherever it is required. It has the potential to be applied to a vast array of clinical and non-clinical settings.

The pilot only ran 2 days a week as it was unfunded and relied on voluntary work; therefore, was not promoted. This accounts for the small patient numbers, which meant that financial analysis was limited and the decision was made to evaluate this in a longer trial. However, cost of emergency transfer is £236 one way and if a hospital stay is required this cost can be substantial so if numbers imaged in the community were increased we believe significant cost savings could be made. It is important to look at the cost saving as a whole healthcare pathway rather than breaking down to departmental costs as clearly there would not be a cost saving to radiology departments. We believe that the implementation of this x-ray unit into healthcare systems has the potential to create significant economic benefit. This is due to the creation of more efficient patient pathways such as the pathways that were developed during this phase.

The trial has proved a success in evidencing the value and dexterity of such a portable system in providing resilience to radiology services. Phase 3 has demonstrated how radiology can be applied to pre-hospital medicine and aid in reducing ED and ambulance service pressures.

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APPENDIX

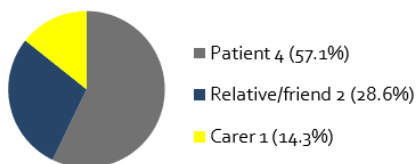
1. Pilot Timeline

<u>Date</u>	<u>Action</u>
14/09/2020	Meeting with ED and PHEM Consultant team to discuss potential for off-site imaging in the emergency setting -? Phase 3 project.
05/11/2020	Pre-Hospital Stakeholder Meeting with Radiology, NEAS & ED.
14/11/2020	Phase 2 complete – End-to-end connectivity.
21/11/2020	First XRT shift – Dry Run.
09/12/2020	Patient Experience Contacted.
16/12/2020 – 17/12/2020	Paramedic XRT Training Days – a demonstration of the equipment and discussion of the service to increase awareness within NEAS.
18/12/2020	XRT Team Job Delegation Meeting
08/01/2021	E-Learning Portal Development Meeting
20/01/2021	Learning Guide Completed
31/01/2021	Phase 3 Complete

2. Patient Survey Data

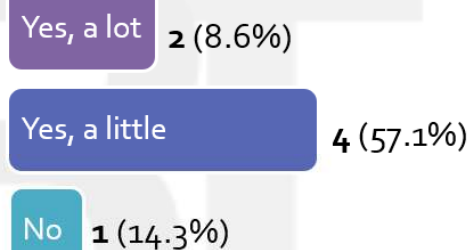
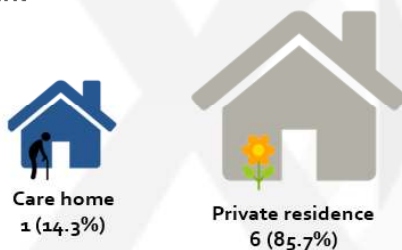
XRT Patient survey data

I am a:

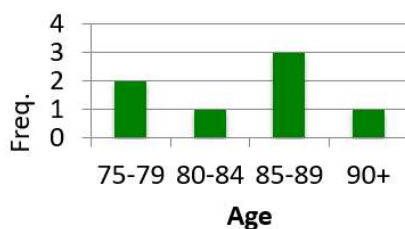


Are your/your relative/client's day-to-day activities limited because of a health problem or disability, which has lasted or is expected to last over 12 months? (Include any issues or problems relating to old age)

Which clinic/location are you in?



What age are you?



Overall, how was your experience of our service?



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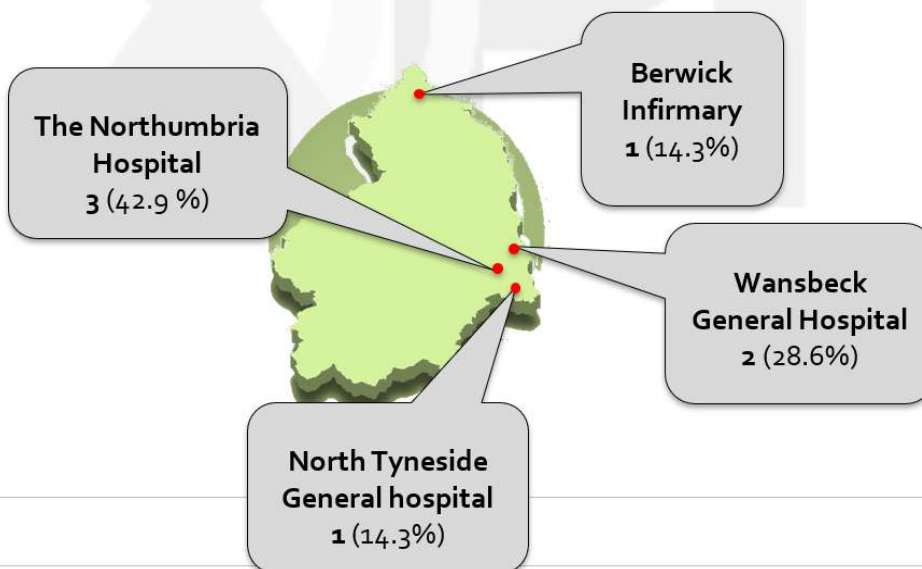
Overall, in this clinic/location, were you/your relative/client treated with respect and dignity? **Always 7 (100%)**

Were you/your relative/client treated with kindness and compassion by the staff looking after you? **Always 7 (100%)**

Were you/your relative/client involved as much as you wanted to be in decisions about your care and treatment? **Always 7 (100%)**

Did you/your relative/client receive timely information about your care and treatment? **Always 7 (100%)**

Where would you/your relative/client normally have to go for your x-ray?

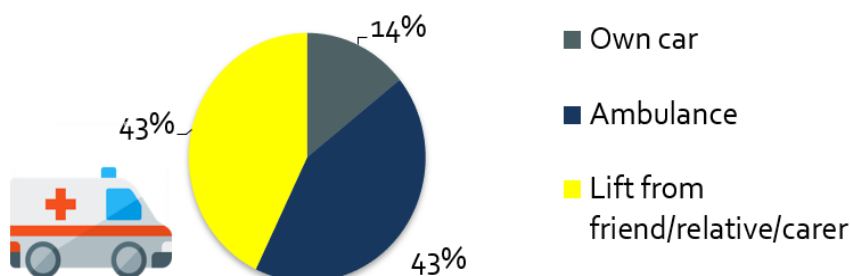


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How would you/they have travelled there?



How do you feel about being assessed at home instead of attending Accident & Emergency in Hospital?

'Ideal as it can stop unnecessary trips to a and e and we had an answer quickly'

'It was fantastic to be assessed at home'

'Much better than having to go hospital'

'Did not want to attend hospital'

Are there any other comments you would like to make about the quality of care received?

'The care team we friendly and professional throughout'

'The mobile x-ray service came to my mothers home and was able to rule out a fracture, therefore there was no need for her to attend NSECH. This freed up the ambulance it's staff and reduced the risk of my mother coming into contact with Covid patients'

'Great'

'Would still rather receive treatment at home'

'Very prompt. Saved a lot of time and stress'

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