

# **NORTHUMBRIA FDR XAIR SYSTEM TRIAL**

## **Phase 2 Report**

Project Lead & Trust Lead Radiographer– Deborah Henderson

Written by: Jessica Brealey – Trial Team Lead & Radiographer

**NORTHUMBRIA HEALTHCARE NHS TRUST**

## INTRODUCTION

The second phase of the trial aimed to establish secure connectivity and lines of communication in preparation for Phase 3.

The motivation for this phase was to adequately prepare for urgent request availability, with a view to reduce unnecessary emergency department (ED) attendances for patients who could be imaged and managed safely within their own home.

In order to prepare for this next phase, Phase 2 involved a semi appointed service for elective imaging, and this was available to care home residents at two selected pilot sites within Northumberland. This provided sufficient data to launch the next final phase in an informed manner. This phase tested end to end connectivity on scene moving on from Phase 1 where patients were registered in the hospital before attending scene and archived to the Patient Archive and Communication System (PACS) on return.

This stage of the pilot was especially important in setting up the necessary connectivity solutions for the **FDR Xair** system to assist in reducing numbers of people in ED departments and waiting rooms. Considering the current Covid-19 pandemic, this assists with social distancing measures in these areas, as well as protecting those who are medically vulnerable.

As a result of the pandemic, care home residents are often not allowed to attend hospital and must only receive care within the home as a protective measure. Phase 2 of the pilot supports these measures by providing imaging within the care home, allowing for more informed care management decisions to be made in a pre-hospital setting.



Fig 1. Radiographer completing X-ray using the **FDR Xair** system in simulated community setting, using training manikin

## KEY AIMS

- To attend care homes on a semi appointed basis to complete elective imaging.
- To resolve issues regarding access to CRIS and PACS Cloud off-site.
- To allow for end-to-end connectivity and immediate image transfer in Phase 3.

## METHODOLOGY

Phase 2 was based at the two care homes used as pilot sites during Phase 1 which had already been risk assessed by the Medical Physics Team (MPE).

The clinical plan for this phase established that if a care home resident required medical care due to trauma or deterioration of health, the designated GP for the care home would attend and assess the patient. If the patient required imaging the GP would call the radiographer via a designated phone and request the imaging to be done at the home at a suitable time for the patient and radiographers.

Phase 1 required the radiographer to attend the patient (within the Radiology Information System (RIS)) at the hospital and pre-register them before leaving to undertake the examination. The radiographer would then return to the hospital department to send the images to PACS and get the images reported.

Phase 2 saw the addition of a cloud portal that facilitated connection between the **FDR Xair** device console laptop and Trust Radiology IT to obtain a worklist, return images to PACS and potentially send on for a cloud AI read all via secured VPN networks. In addition, a Trust laptop was also used for review of any prior images and to register the patient on-scene.

Following the end-to-end connectivity being established, the radiographer could securely connect the pre-configured laptop over the VPN to a cloud server and upload the images to the PACS server through the cloud gateway. This eradicated the need to return to the hospital to send images.

Engagement was made between Trust IT and Fujifilm but it took some time and some support from NHS Digital before it was agreed that a VPN could be used, rather than HSCN,

for the purpose of the trial. The security aspects of the cloud element of the solution introduced the most delays in the trial and prevented connectivity between the **FDR Xair** device and hospital IT for the first 2-3 months.

Going forward it is clear that as part of delivery of a regular service, connectivity should be provided through HSCN to ensure that issues like this do not introduce the lengthy delays that were experienced. As the device is also used outside of the Trust the solution should be subjected to a full IG and security review and approval.

Access to CRIS and PACS was also established by using a Trust laptop which could contact the Northumbria network and gave the team access to a range of clinical tools such as RIS, PACS and ICE (a radiology requesting portal) to raise patient requests and review any prior imaging or reports. The cloud portal solution allowed the **FDR Xair** device to receive a worklist and send images back in to PACS.

Stakeholder meetings continued to take place in order to ensure progress of the pilot and keep the team informed on any issues that need resolving.

## PROJECT MILESTONES

Task	Start	Finish
Set up VPN to trust network	19/10/2020	23/10/2020
Replacement laptop configured with cloud connectivity	26/10/2020	29/10/2020
Trial completed and VPN disabled		20/12/2020

A discussion was made to extend the VPN access due to prior delays in setup. This allowed the pilot timeline to be extended in order to test the connectivity adequately.

## TECHNICAL DESIGN

The solution was deployed using an AWS Availability Zone located in London. NHS Digital Health and Social Care Cloud Security guidelines were followed to put in place safeguards to ensure the protection of patient information. With the exception of the VPN services running in AWS for connection to the **FDR Xair** device, no systems have any inbound connections from the public internet; security groups were also configured to ensure only permitted traffic is allowed on specific ports.

All communication between the **FDR Xair** system and the hospital systems were configured to connect over VPN. The data is stored on the laptop with an encrypted hard drive, and once it has successfully been sent into the MedPortal system the data is deleted from the laptop.

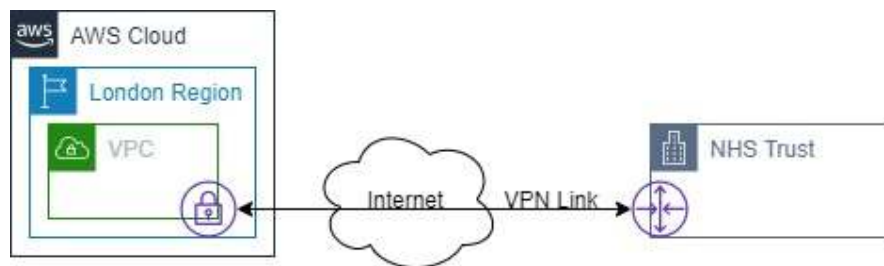


Figure 6. High level AWS deployment diagram

## WORKFLOW

1. Radiographer connects to **FDR Xair** system laptop and downloads worklist from MedPortal which is collected from customer site over VPN.
2. User then images the patient and uploads DICOM images over VPN to MedPortal.
3. MedPortal **Anonymises** patient data and sends data to AI provider to be analysed.
4. When AI analysis is complete the MedPortal solution updates the study with the patient demographics and sends the images and any AI findings to the hospital PACS system.
5. Images are available for reporting.
6. Radiographer can view AI findings shortly after scanning to decide next steps for patient care.

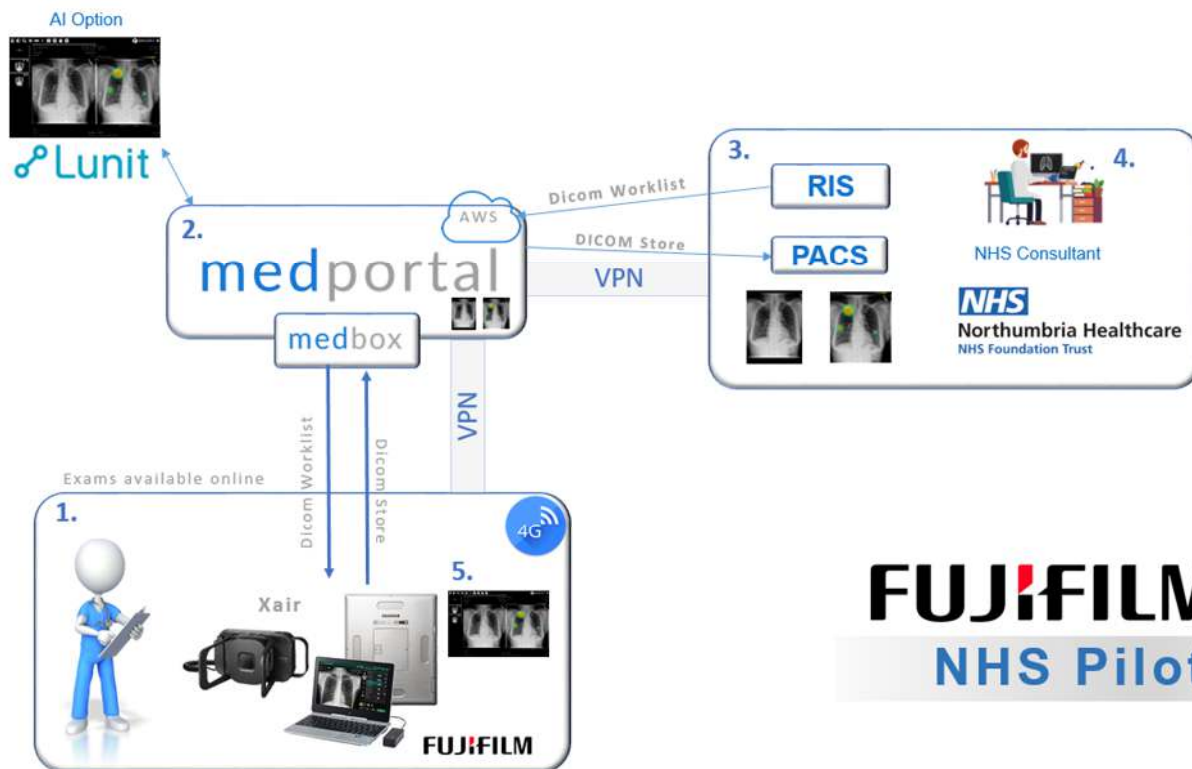


Figure 7. Workflow diagram

## OUT OF SCOPE

As this is a pilot the design does not cover any high availability or disaster recovery. Whilst the data will be backed up regularly, no SLA was offered as part of the solution.

## TRIAL TERMINATION

At the end of trial period, once both parties have agreed the trial is not to be extended, the cloud platform will be deleted with any data located in the cloud and on the **FDR Xair** system also purged.

## DISCUSSION

### *Image Quality*

The **FDR Xair** device continues to provide high-quality images of the chest and extremities. Pelvic imaging is still untested but increasing potential for smaller patients as staff undertake more training with the unit.

### ***Storage***

The fabric carry-case was far more suited to more urgent use and easily transported. The case had many compact storage areas for the components of the unit which allowed quicker access to these components when unpacking the **FDR Xair** system. An issue was flagged that the case was not weather-resistant as it had an open top, this could cause water damage during poor weather.

Additionally, the fabric case for the tube was not deemed robust enough to prevent physical damage to the tube when assessed by the MPE. The hard carry-case from phase 1 continued to be used until a solution was found for the tube storage.

The need for more lightweight storage and transportation cases was highlighted and a new fabric case was developed in response to this Phase 1 feedback.



Figure 2. Backpack



Figure 3. Laptop Storage



Figure 4. Detector Storage



Figure 5. Hardcase for **FDR Xair** unit, charger and batteries

### ***Connectivity***

End-to-end connectivity was achieved towards the end of the phase and was tested by the radiography team. Feedback suggested that this functioned well. However, due to the vast location the Trust covers, signal issues were regularly a problem but this was more relevant to the network provider chosen than the connections themselves.

Due to the large geographical area of Northumberland, the team is now seeking a multi-network solution in order to achieve better internet coverage.

### ***Patient Experience***

Patient experience data collection was not set-up during this phase. However, verbal feedback was received from staff at the pilot sites during examination visits; this showed

that the care home residents generally managed their mental state better when imaged in their own surroundings compared to those who had to visit the Radiology department for imaging. This may be explained by the fact that the mobile visits from the imaging team were less disruptive to their normal routine than attending a hospital appointment.

### ***Staff Satisfaction***

The **FDR Xair** system has proved useful in many applications of use. The team found the unit to be user friendly after some further training and adaptations to their usual technique. The radiography team also found the trial very rewarding so far and found it was far easier to image patients with dementia and other disabilities in their own surroundings.

In the acute setting, the **FDR Xair** device has the potential to be extremely useful for enhancing avoidable conveyance measures in pre-hospital settings. The unit is suited to this environment, but feedback from pilot sites highlighted a need for a continuity of care system in order to adhere to clinical governance measures. This feedback has been instrumental in developing Phase 3 plans.

### **RECOMMENDATIONS FOR FUTURE PRACTICE**

- Emergency imaging as part of pre-hospital paramedic assessment to aid in avoidable conveyance targets.
- Increased availability of service to a range of primary care networks across the Northumberland region.
- Increased internet coverage using a multi-network SIM in order to provide more reliable end-to-end connectivity.

### **CONCLUSION**

Phase 2 allowed us to demonstrate end-to-end connectivity successfully despite highlighting the need for increased network coverage. The **FDR Xair** system continues to deliver a reliable and effective service to our patients. Feedback from patients and staff has been very positive and demonstrated the value of this as an elective service. This phase has allowed the team to adequately prepare to develop an acute imaging service for Phase 3.