Greening the Fluoroscopy Pathway

Topic Area(s)

* Sustainable models of care;
* Estates and facilities (buildings, energy, waste, water);

Please specify your project approach

Mitigation only

Key message / aim

Radiology is considered a top contributor to the carbon footprint of healthcare, both from the energy consumption of imaging devices and the waste created from procedures [2]. Videofluoroscopy is a radiological procedure used to dynamically assess oro-pharyngeal swallow function. A life-cycle analysis of videofluoroscopy has not yet been published, and little data exists as to its carbon footprint, however, some idea of the scope of this can be gained by considering carbon footprinting work that has already been done in relation to other radiological procedures.

As an imaging modality, fluoroscopy is recognised as being particularly energy intensive. Merkle et al calculated the annual carbon emissions of a fluoroscopy machine at 2220–2427kg CO2e, although this figure is based on the average European electricity costs and carbon intensity of 0.296 kg CO2e per kWh [5] rather than UK figures. It is not possible to extrapolate this data to the carbon footprint of a single videofluoroscopy procedure, but it does suggest that the energy used by the machine alone would contribute to a significant proportion of its footprint. Considering the sustainability of the pathway more broadly, there are issues around generation of waste i.e. the use of radio-opaque contrast agents like Omnipaque iohexol, which result in the pollution of aquatic environments []; disposable PPE i.e. aprons and facemasks; and food waste. Lastly, both patients and staff must travel to sites where the procedure is offered, usually main hospitals that serve a large population size.

While we lack granular data on the carbon footprint of videofluoroscopy, there is benefit still to be gained in decarbonising the pathway through the prevention of unnecessary imaging. As consultant radiologist Dr Sarah Sheard said in her address to the European Congress of Radiology, “the greenest scan is the one you don’t need to do.” [4]. The safety and best interests of patients should always come first, and an imaging study should not be withheld for sustainability reasons. However, careful rationalisation of the use of videofluoroscopy as a clinical resource is needed, and unnecessary or inappropriate use should be eliminated where possible.

This was illustrated through a piece of improvement work undertaken at an acute NHS teaching hospital, the results of which demonstrated the opportunities for decarbonisation of videofluoroscopy services.

What was the problem?

The existing videofluoroscopy service was run in a way that allowed speech therapists to request referral of patients into the clinic via the patient’s GP or medical professional. Medical professionals were also able to refer directly. However, referring professionals did not always have sufficient understanding of the rationale for undertaking a videofluoroscopy, and there was an insufficient triaging protocol in place to identify inappropriate patients before they underwent the procedure. This was highlighted through retrospective audit of one year's data, showing 10% of completed procedures were considered to have been clinically inappropriate or unnecessary. Videofluoroscopy is a very resource- and carbon-intensive procedure, alongside its inherent exposure of patients and staff to ionising radiation, so the percentage of inappropriate referrals had significant implications.

What was the solution?

The improvement project was conceived during an annual audit of collated videofluoroscopy referral data. In a one year period, 10% of completed procedures were deemed clinically inappropriate or unnecessary. It was hypothesised that some referrers lacked sufficient understanding of the rationale for performing videofluoroscopy, and that the triaging process was inadequate to identify all patients who lacked sufficient clinical indication to undergo the procedure. Not only did this result in waste of a clinical resource, but it also meant that patients (and staff) were receiving unnecessary radiation exposure, contradicting the 'As Low As Reasonably Practical' principle of radiological imaging.

To address these issues, an improvement project was undertaken to re-design the referral pathway. This included providing education and training to referring clinicians to prevent inappropriate referrals being made, and a more rigorous triaging process to prevent inappropriate fluoroscopic assessments from being performed. The intended impact of these changes was to reduce wastage of resources and prevent unnecessary radiation exposure of staff and patients.

The new triaging process required potential referrals to first be discussed with the speech therapists who ran the clinic, before a referral could be requested from the patient's primary care or medical team. We also ran multiple education and engagement events with relevant healthcare professionals to improve their understanding of the clinical purpose of the procedure. A standard operating procedure was written, which outlined the new referral pathway, and this was then circulated to stakeholders and referring professionals. Repeat audit evaluated the outcome of the changes on a yearly basis.

What were the challenges?

Introducing the triaging process resulted in an overall reduction in the number of referrals into the clinic, highlighted in the following year’s audit cycle. The audit results showed that we were identifying inappropriate referrals through the triaging process, but also suggested that clinicians were not referring patients who needed the procedure as the pathway had become too onerous or time consuming. We sought to learn more about the reason for the fall in numbers through further engagement events with relevant healthcare professionals. We also conducted patient feedback questionnaires. While we did not change the requirement for triaging, we did address accessibility of staff and the modality through which triaging could take place, such as accepting triaging information via email as well as telephone.

What helped the intervention implementation/success?

The implementation of the triaging process was successful in that we were able to reduce the number of inappropriate procedures being conducted from 10% to 0%. In the second audit cycle, we rejected 19% of referrals due to being clinically inappropriate at the point of triage, falling to 14% in the third audit cycle.

Carbon footprinting and in-depth evaluation of the decarbonisation of the pathway has not yet been carried out - this is due to multiple factors including a lack of formal carbon footprinting training available to staff and a lack of ring-fenced time for projects alongside busy clinical caseloads. Furthermore, there are not yet LCA's for the type of radiological imaging used in videofluoroscopy so it is difficult to evaluate the carbon savings of avoiding unnecessary procedures. However, more work on this element of the project is planned.

What were the results/Impact?

Patient outcomes:

The initiative has improved patient safety as it has reduced unnecessary exposure to radiation. It has also reduced waiting times in the clinic by freeing up capacity, which has allowed us to offer more timely fluoroscopy procedures to patients who need it. This has wide-reaching impact i.e. a patient who has been reliant upon tube-feeding in the community can resume oral nutrition after having a videofluoroscopy, with subsequent implications for reduced hospital travel and use of resources through the cessation of enteral feeding.

Population outcomes:

Timely identification and management of swallowing difficulties has significant impact on the health of the population, alongside prevention of the complications of inadequate nutrition or aspiration-related adverse health events secondary to dysphagia, which can result in reliance upon enteral nutrition or prolonged hospital admissions. Optimal utilisation of the videofluoroscopy clinic as a resource results in increased capacity for those who needs it, and also prevents those who don't need it experiencing an unjustified radiation dose.

Environmental impact:

Unfortunately we can not yet estimate the environmental impact of the changes. Carbon footprinting has not been completed on fluoroscopy, although there is a paper from a urology team in Europe that has produced some figures on the energy consumption of fluoroscopy machines and estimated the annual carbon emissions of a machine at 2220–2427kg CO2e. There is no data on the carbon footprint of a single videofluoroscopy procedure, but it could be assumed that this would be fairly carbon intensive considering the energy consumption of the machine and the peripheral resources and impacts of performing the procedure. Also, we are not looking to reduce the number of videofluoroscopy procedures that are performed annually, as this is an essential element of assessing a patient's dysphagia, but only to rationalise the use of those procedures to ensure that there less waste built into the system.

[https://www.eu-focus.europeanurology.com/article/S2405-4569(23)00208-0/pdf#:~:text=Overall%2C%20the%20carbon%20footprint%20of,1.6%20FPHs%20(Table%201)](https://www.eu-focus.europeanurology.com/article/S2405-4569%2823%2900208-0/pdf#:~:text=Overall%2C%20the%20carbon%20footprint%20of,1.6%20FPHs%20(Table%201))

Social impact:

Videofluoroscopy is considered the 'gold standard' of dysphagia assessment due to the information it yields about a person's swallow function; aspiration risk and potential for benefit from rehabilitatory or compensatory swallowing manoeuvres. Rationalising what is a carbon-intensive procedure to only those patients with a clinical need allows us to benefit those who most need it. Appropriate management of swallowing difficulties can have a huge social impact, due to the social nature of eating and drinking. It also improves health outcomes, due to the information gathered about a patient's degree of risk of respiratory complications secondary to aspiration.

Unfortunately there are no patient-reported outcome measures associated with videofluoroscopy that adequately capture the social impact of the procedure. We undertook a generic patient satisfaction survey in relation to the videofluoroscopy service, and feedback was entirely positive bar difficulties with parking at the acute hospital where the service is provided.

Financial impacts:

There is no UK data on the cost of running a videofluoroscopy clinic. The cost of undertaking a private videofluoroscopy is between £300-£400. Using that figure, it is possible to approximate the financial impact of preventing videofluoroscopy being performed on patients who did not need it. 15 (10%) of patients in the first audit cycle were identified as having been inappropriately referred. The projected cost of performing these unnecessary procedures was £4500-£6000. 61 (19%) of referrals were rejected in the second audit cycle, following implementation of the triaging process, which resulted in £18,300-£24,400 of annual savings. 33 (14%) of referrals were rejected in the third audit cycle, which resulted in £9,900-£13,200 of annual savings.

What were the learning points?

The project was successful to bring the existing videofluoroscopy clinic into alignment with national best practice. It was successful in identifying the issue of inappropriate referrals, and in preventing inappropriate referrals from being made. The limitation of this was that the triaging process was felt to be more onerous from referring staff, resulting in a reduction in overall number of patients being referred for the procedure.

The key element of success of the procedure was interdisciplinary working, as this was a collaborative effort between speech & language therapy and radiography. The other element of success was the engagement and cooperation from stakeholders, such as the acute and community speech and language therapy teams who refer in to the clinic.

Next steps

Lasting change has been secured by updating the standard operating procedure to reflect the changes to the referral pathway. The SOP undergoes regular review. Alongside the SOP, annual audit of the clinic is maintained by the SLT team to track performance and identify areas for improvement, which are then discussed in regular meetings with the radiography team. There are plans to expand the initiative through measuring the carbon impact of the introduction of an oesophageal screen as part of the procedure, as it is expected that this will aid in the rationalisation of patients undergoing other radiological procedures such as barium swallows.

Videofluoroscopy is offered across the UK but there is huge variation in the access to this service and also in the way that the service is provided. There are projects running presently which are looking at the standardisation of VFS services and hopefully this project could encourage the inclusion of decarbonisation in the improvement work. This project has relevance to any trust offering videofluoroscopic procedures.

Want to know more?

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Has this case study or story been made public in any form before?Yes

The service improvement work was written up for publication in Radiology Journal, but from a broader perspective.

Resources and References

[https://www.eu-focus.europeanurology.com/article/S2405-4569(23)00208-0/pdf#:~:text=Overall%2C%20the%20carbon%20footprint%20of,1.6%20FPHs%20(Table%201)](https://www.eu-focus.europeanurology.com/article/S2405-4569%2823%2900208-0/pdf#:~:text=Overall%2C%20the%20carbon%20footprint%20of,1.6%20FPHs%20(Table%201))

<https://eurradiolexp.springeropen.com/articles/10.1186/s41747-024-00424-6#:~:text=Among%20medical%20imaging%20modalities%2C%20ultrasounds,2%20and%20Scope%203%20emissions>

Centre for Sustainable Healthcare Carbon Footprinting course