

## **The Impact of the Cyberattack on Radiology Systems in Ireland**

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The National Integrated Medical Imaging System (NIMIS) is the software used in Ireland to electronically capture and store diagnostic images on a picture archiving and communication system (PACS)<sup>1</sup>. This data is stored and connected on a single imaging platform to allow inter-hospital communication which facilitates nationwide specialist consults and improved patient care overall<sup>2</sup>.

In the early hours of the morning on May 14<sup>th</sup>, 2021, the Irish Health Service Executive (HSE) was hit with an unprecedented ransomware cyberattack which sought to steal data, encrypt it, and subsequently seek a ransom for its release<sup>3</sup>. This cyber infiltration was recognized by security firewall software and in a precautionary move, all affected HSE IT systems including NIMIS were taken offline in an attempt to protect patient data. From this point in time, all data was treated as potentially compromised until proven otherwise.

This of course had a significant and detrimental effect on patient care nationwide<sup>4</sup> as access to timely diagnostic imaging was either delayed or postponed. Most outpatient imaging was postponed. Concerningly this included oncology staging and surveillance scans. Some patients awaiting elective surgery had their procedures cancelled as pre-operative imaging was unavailable for review. Patients undergoing potentially curative radiotherapy had treatments postponed, the detrimental effect of which is yet unknown.

Diagnostic radiology is one of the most technologically reliant medical specialties<sup>5</sup>, alongside others including but not limited to microbiology, radiation oncology and clinical biochemistry. In radiology, this temporary shutdown of the NIMIS software not only meant we could no longer see images on diagnostic-quality monitors, we also could not see previously performed imaging studies nor their reports which we would routinely refer to in order to assess for disease progression versus regression. The Radiology Information System (RIS) which was previously used by doctors to request scans was no longer accessible and as such medical and surgical inpatient teams were now having to handwrite radiology requests and walk them to the radiology department, a time-consuming process for the requesting teams and the referee alike.

In our department, a busy university teaching hospital, where previously we had twenty NIMIS reporting workstations, we were initially restricted to three non-designated monitors in the scan control rooms only, severely limiting both productivity and limiting quality assurance. For this reason, emphasis was placed on providing access to clinically emergent imaging only.

To try to best provide an emergent service, several steps were taken. Radiologists including Specialist Registrars (SpRs) and consultants kept a written record of all radiology requests made and all scan reports were handwritten on a formal report as well as transcribed into a master book for each modality. A copy of these reports was provided for each patient's medical notes, and the original copy was stored by radiology secretaries with a view to uploading them to the NIMIS PACS system at the end of this crisis. The hope was that this may alleviate the need for double reporting in the future as there would still be a significant backlog of scans to work through. Four days post ransomware attack, we had procured an extra two reporting station monitors.

One significant potential area of risk which was quickly identified was the concern that we might incorrectly scan the same patient twice, an adverse incident, which would be a reportable offence to the Irish Health and Information Quality Authority (HIQA)<sup>6</sup>. In an attempt to prevent this from happening, one secretary covering each modality began making spreadsheets of all vetted cross-sectional imaging, and each new request was cross-referenced against a master excel file to prevent duplicate requests.

Some unexpected positives did arise from this cyberattack. Due to the decreased number of image reviewing stations, trainee and consultant radiologists co-reported scans which led to unprecedented teaching opportunities<sup>7</sup>.

It was ironic that the reduction in trainee teaching caused by one virus, namely the COVID-19 pandemic, was being somewhat mitigated by the threat of a novel cyber-virus. Due to the limited storage space on ultrasound machines, there was improved interaction between sonographers scanning the patient and radiologists. Real-time scanning in the presence of the SpRs and consultants was performed and discussed with results written on paper and decisions made in consensus. This allowed for improved teaching and interaction, which had been reduced with the Covid restrictions in the prior year. The presence of a team with the patient also arguably improved the patient experience with more patient interaction and discussion. In addition, turnaround time for reports were improved for inpatients. The presence of senior doctors at the time of scanning to ascertain key points in the patient's clinical history, as well as examining the patient where necessary made for improved patient care<sup>8</sup>. Real time discussion between the sonographers and radiologists at the time of scanning also arguably improves concordance between sonographer and final radiologist reports<sup>9</sup>. Finally, having an early decision process also meant less need for data storage space as only representative images were saved. This was important in maximize the number of cases that could be stored at a localmodality until the main back up system was restored.

Other modalities were equally affected, and similar processes were put in place. The return to a paper-based system was cumbersome and manpower-heavy particularly on the clerical side but did emphasise to us the importance of having a back-up paper system to mitigate against electronic failure.

Another feature of dealing with the crisis was liaising and sharing ideas and potential solutions with other Radiology departments around the country. The faculty of Radiology played an important role in sharing information, this was very much appreciated by radiology departments who may have felt otherwise isolated. Most Radiology departments dealt with the issue in a similar fashion however as some hospitals had a different IT infrastructure, there was some variation in methods employed to keep activity functional.

It is hoped that full functionality will be restored to all hospitals over the coming weeks. Hopefully this will not be something we have to face again in the future, however if we do, we might feel better prepared to tackle these issues from the outset rather than learning by trial and error. In addition, it is likely that a lookback and sharing of lessons learnt and experiences will lead to a more uniform response should the situation ever repeat itself.

### **Declaration of Conflicts of Interest:**

The authors declare that they have no conflicts of interest nor financial disclaimers.

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