TMC trials Collaborative Diagnostic Network in Sweden

Delivers 27% improvement in radiology reporting efficiency

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Executive Summary

Telemedicine Clinic (TMC), Europe's leading provider of teleradiology and pathology services, has today released a study that shows that implementation of its collaborative diagnostic network (CDxN) in a group of hospitals can deliver a 27% radiology efficiency increase, boosting capacity for challenged radiology departments.

In a recent trial for the Västra Götaland Region (VGR) in Sweden, TMC worked closely with the local radiology teams at 5 hospitals and demonstrated the dramatic effect that networked solutions can have on releasing capacity and increasing efficiency while continuing to enhance quality and improve patient outcomes.

Overview of project and key findings:

- 5 VGR hospitals were connected via TMC's proprietary platform OPTEMIS RIS and all workstations for network reporting were provided by TMC
- The project focused on the subspecialist area of MR body cases
- The VGR MR body team was established and enabled radiologists who had not known each other to communicate and support each other frequently
- All cases were first read by VGR radiologists and then were assigned to TMC MR body subspecialist radiologists for second reading
- Changes were highlighted on the system by the second reader, marked up on the system and returned to the first reader for review
- This allows radiologists to develop a fast track to subspecialty knowledge and to build substantial subspecialty expertise within the group
- VGR radiologists also received interactive, online case-based training to build up further crucial skills within MR body reporting
- Using TMC's Rad-Unit measurement approach, reporting efficiency improved by 27%
- Radiologists with 300 or more reported MR Body cases achieved the highest reporting efficiencies
- Discrepancy levels decreased by 42% over the course of the project

Why TMC?

TMC's industry expertise in running networks is unique. We've been managing Europe's most advanced teleradiology network, employing more than 200 radiologists serving 120 European hospitals with OPTEMIS RIS, our own unique and specialised teleradiology technology platform.

TMC's OPTEMIS RIS was specifically developed by our experienced in-house software development team working alongside our leading TMC radiologists. It is both a sophisticated network management system and a highly efficient reporting environment, which makes life easy for all concerned.

This combination of cutting edge technology and solid practical radiology experience makes us uniquely positioned to establish subspecialised diagnostic networks.

1. Our challenge

When 5 mid-sized hospitals in the Västra Götaland region (VGR) in Sweden were facing a serious challenge running their radiology services, they needed a solution they could rely on, so they turned to Europe's leading experts for collaboration in diagnostics: Telemedicine Clinic (TMC).

The VGR region was facing a chronic radiologist capacity shortage in several hospitals. The radiology community was comprised mostly of generalists who found themselves covering all subspecialty areas.

Waiting lists were increasing and an excessive amount of cases were being sent away for reporting, resulting in a damaging loss of knowledge for the local team.

Figure 1: The participating hospitals in the Västra Götaland region (VGR)

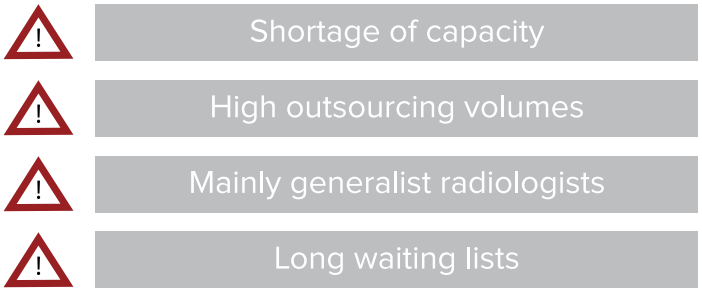

Figure 2: The mid-sized hospitals in Sweden faced challenges that resulted in high volumes sent to TMC for reporting

VGR had been clients of TMC for many years and were aware of the region's ambition to work together collaboratively to tackle these challenges. However, they recognised that the technology available within the region wasn't fully adapted to efficient network collaboration and the know-how to manage such a workflow did not exist, so they reached out to TMC to develop a collaborative diagnostic network that would match their specific needs.

2. The solution:
TMC Collaborative Diagnostic Networks (CDxN)

2.1 What did we do?

As a pilot for a collaborative diagnostic network in Sweden, TMC together with the hospitals in the Västra Götaland region chose to concentrate on MR body as a subspecialist area. This is a very specific area where the volume of studies at each hospital were comparatively low. Volumes had been spread out across all participating radiologists, so no single radiologist had been able to build up sufficient experience while reporting these cases. The result: reporting quality was sub-optimal and reporting cases was very time consuming and inefficient for their busy radiologists.

To kick start the pilot, TMC selected a group of five radiologists (one from each hospital), for the network trial. Plans were made to send MR body study scans from the participating hospitals directly to the network for exclusive distribution to those radiologists (as opposed to the much larger group of local radiologists across all the hospitals).

Narrowing the study to this smaller group allowed them to quickly establish the necessary knowledge and experience to become MR body subspecialists while benefiting from TMC's systematic training and quality assurance.

2.2 How did we do it?

The VGR hospitals in the trial were connected via a customised hosted-solution, based on TMC's proprietary platform OPTEMIS RIS. TMC provided all workstations for network reporting at each site.

The participating radiologists and the respective radiology managers were then brought together for a set of initial workshops at TMC's offices in Barcelona.

As a first step, the radiologists reported MR body "test" cases from TMC which were then individually reviewed by subspecialists from the TMC Body MR team. Follow-up meetings were held to discuss various elements of the project, including harmonisation of scanning protocols amongst participating hospitals. Scheduling was designed to ensure that they could provide almost continuous coverage throughout the week. Routines for internal clinical sessions were also defined and agreed directly by both TMC and VGR.

From these meetings, the VGR MR Body Network Team was formed. Radiologists who had not previously known each other started to communicate more frequently and offer each other valuable support, building vital bridges and channels of communication between the previously isolated and disconnected radiology departments.

2.3 IT architecture

In the second phase, TMC introduced the IT architecture required to support future network collaboration including SECTRA MEI integration between the hospitals' own RIS and TMC OPTEMIS RIS.

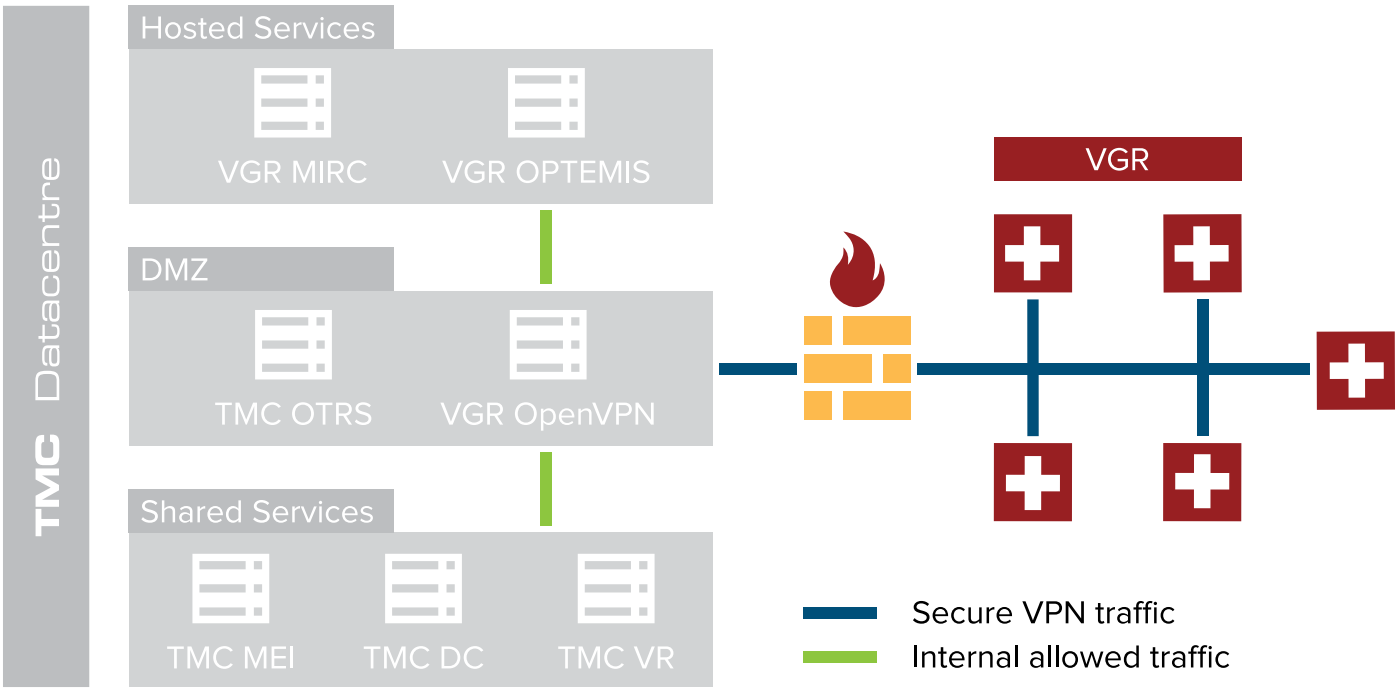

Figure 3: TMC's CDxN cloud infrastructure includes the full setup for a group of hospitals to start collaborating. OPTEMIS RIS together with the integrated systems allows a smooth integration between the hospitals and the collaborative network.

The following software components were used in the network

- RIS: TMC OPTEMIS (v1.1.17.2)
- PACS: SECTRA IDS7 (v18.2)
- VR: Nuance Speechmagic (v7, integrated in OPTEMIS)

2.4 Practical support

2.4.1 Go-live

The project went “live” in February 2016 after completion of the initial 4-month project scoping and implementation phase.

2.4.2 Managed service: network management

TMC’s experienced operations staff carried out all the network management including planning network capacity, establishing schedules for the reporting radiologists and assigning cases accordingly. Each radiologist had a personalised worklist with the appropriate amount of cases for his reporting window, thus avoiding the common practice of long global worklists. These TMC-managed services were crucial to success.

Smart network management was implemented via OPTEMIS RIS which features detailed radiologist profiles, schedules and rule-based case assignment.

2.4.3 Quality control: Prospective peer review

TMC’s OPTEMIS RIS is a reporting environment with a built-in module for second reading through prospective peer review. In the pilot phase, which lasted for about one year, all cases were first read by VGR radiologists before being assigned to TMC MR body subspecialists for a second reading. In the OPTEMIS RIS second reading environment, the second reader corrects the report (if necessary), and then decides on the discrepancy level accordingly.

In the case of potentially “clinically relevant” discrepancies, the report then goes directly back to the first reader who can review a visual comparison (with all changes clearly highlighted), allowing him/her to learn from an experienced subspecialist with every report.

This feedback is crucial for the development of internal subspecialty expertise within the group.

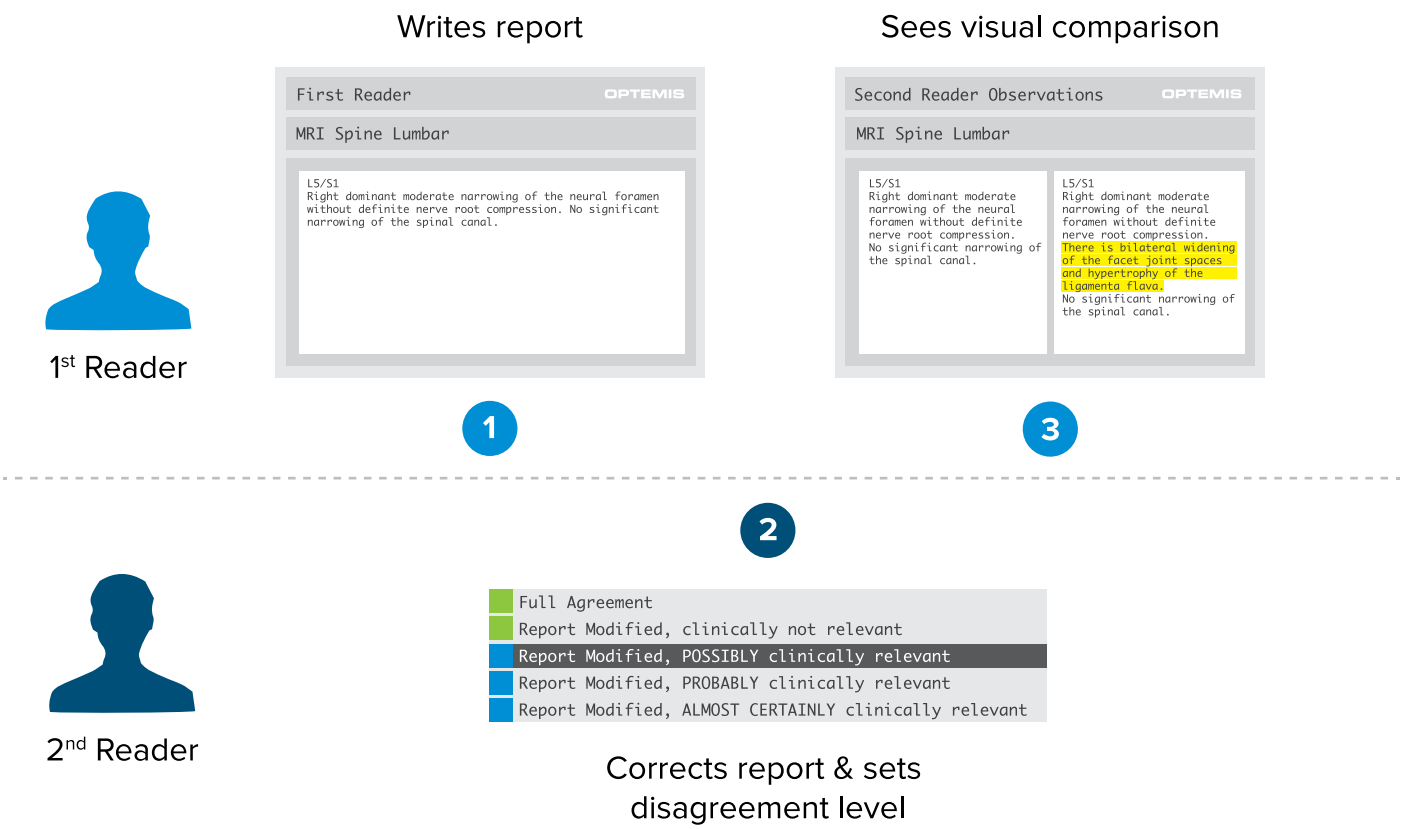

Figure 4: Prospective peer review: The second reading workflow allowed the VGR radiologists to build up their own sufficient subspecialist knowledge being second read by TMC MR body subspecialists. After the pilot phase, the VGR radiologists will take over the second reading.

The aim was for the VGR radiologists to build up sufficient subspecialist knowledge to confidently take over second readings after the pilot phase. In phase 2, the VGR radiologists will continue to “second read” each other on a pre-agreed percentage of cases.

2.4.4 Turnaround time (TAT) & backup capacity

TAT is the time between a case being introduced into the system to the time the completed report is returned to the RIS of the hospital from which it was sent. The initial target for TAT was set at 3 days, but after review, it was increased to 5 days (which was considered sufficient).

To minimise the chances of cases significantly exceeding the defined TAT, TMC made additional reporting capacity available to VGR on a “standby” basis. As a result, whenever a backlog began to build due to limited availability of VGR radiologists, the cases were sent to TMC directly for reporting.

2.4.5 Case-based training sessions

As well as second readings, the VGR radiologists also received interactive, online, case-based training sessions, run by MR body subspecialist experts, to further increase subspecialist knowledge in the field of MR body reporting.

2.4.6 Internal clinical sessions in the network

TMC organised internal clinical sessions for the VGR MR body network team. These regular case-based discussions among the VGR radiologists via videoconference further contributed to building deeper subspecialist knowledge.

Both the case-based training sessions and the internal clinical sessions used a teaching file database from the Medical Imaging Resource Community (MIRC), which was continuously updated with interesting and relevant cases from the project.

2.4.7 KPI reports for radiology managers

All radiology managers received monthly KPI reports with key statistics about network activity including:

- Volumes by sending hospital/by reporting radiologist
- Turnaround times
- Quality statistics (discrepancy rates)
- Productivity statistics

For easy access, statistics were made available in Microsoft Power BI and could be individually filtered (by month, by radiologist, etc) directly by the radiology manager.

3. Results

3.1 Volume evolution

3.1.1 Cases

The reporting volumes in the subspecialised area of this network amounted to around 100 cases per month and total case volume rose to around 1500 cases over 14 months.

3.1.2 Volume and reporting distribution

Figure 5 shows the distribution of cases sent to the network by the participating hospitals and which radiologist read these cases. Case volumes came mostly from three hospitals (as one hospital had more radiologist capacity than the others and another hospital could not send cases due to a delay of the integration with the local IT system).

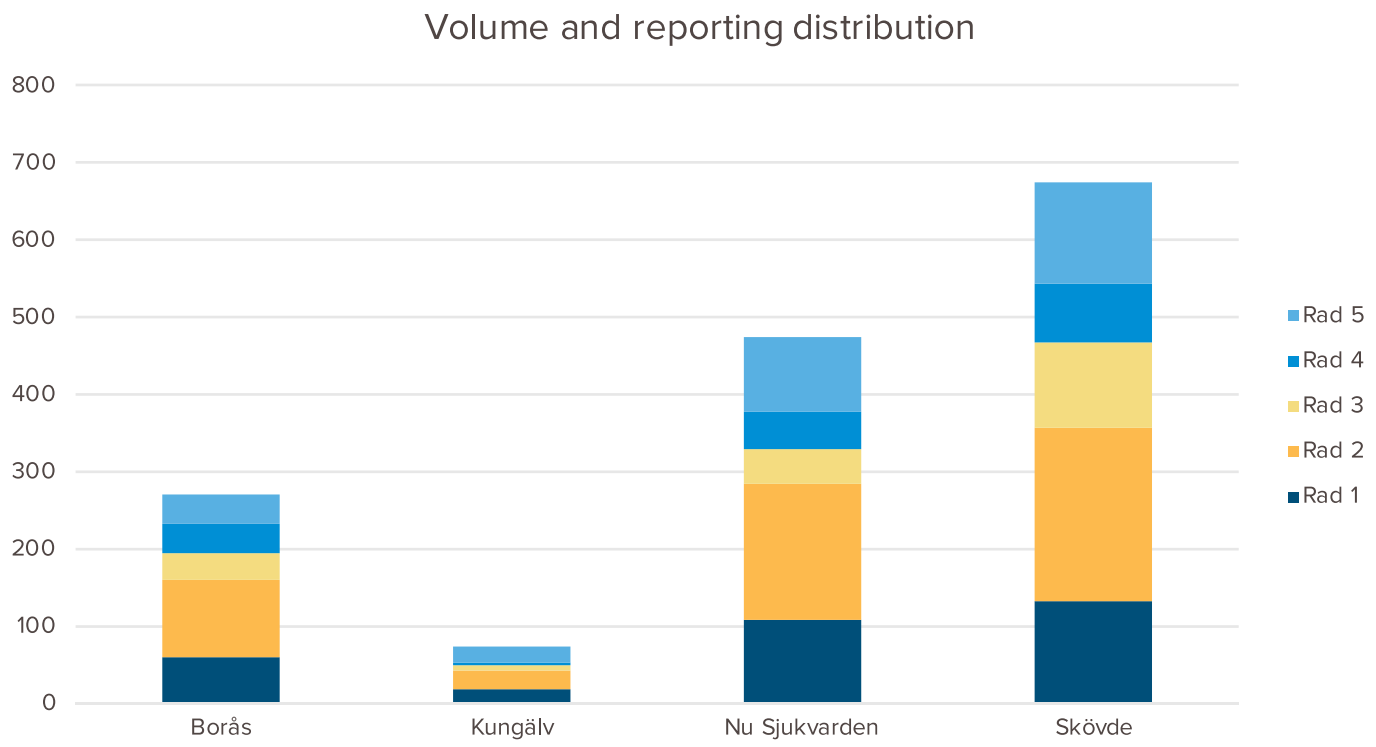

Figure 5: The distribution of cases shared in the network by hospital providing the volumes and by radiologist reading the volumes. It can be observed that all radiologists were reporting cases from all hospitals providing volumes.

3.2 Reporting efficiency

3.2.1 Rad-Units

Reporting a prostate does not take the same time as reporting a thorax.

To obtain a precise unit for the reporting effort needed for each case type, TMC created a unique system. Over a 12-month period, we measured hundreds of thousands of cases and more than 200 radiologists participated in a project to measure average reporting times per case type over that period. The result was a set of standard numerical values for all case types, otherwise known as Rad-Units (RU).

Table 1: Example of exam types and their Rad-Units.

Exam Type	Rad-Units
CT Brain	0.73
CT Abdomen	1.69
MRI Knee	1.14
...	...

Rad-Units help with precise planning of workloads and forecasting radiology capacity. They can also serve as a basis for activity based reimbursement of radiologists or for cross-reimbursement between hospitals which share resources.

Rad-Units are thus a crucial tool without which utilisation of the network will stay limited.

During the pilot phase of the project the Rad-Unit system was used for planning and monitoring reporting activity, i.e. precise volume and efficiency tracking.

3.2.2 Reporting efficiency evolution

Efficiency evolution was measured in the following way[1]. The first two months of operation were considered an introductory phase in which the radiologists got to know the software environment and trained the voice recognition software. We then compared an average of the reporting activity for the three months following the introductory phase to the last three months of the pilot phase of the project.

[1] To avoid distortion of results due to e.g. radiologists leaving the reporting editor open without reporting, cases with less than 10 seconds and more than 60 minutes reporting duration are not considered in the measurement of reporting efficiency.

Figure 6: The reporting efficiency, measured in Rad-Units per hour, shows a marked increase of 27% over the pilot project duration considering a 2-month introduction phase.

Measured in this way, the reporting efficiency of the group increased by about 27% indicating that subspecialist reporting with systematic peer review has a positive impact on reporting efficiency.

Within one year, the VGR radiologists in the project managed to reach the same average efficiency level as the TMC MR body subspecialists (6.4 RU/h)[2].

3.2.3 Efficiency vs reported Rad-Units

It was clear that there was a relatively direct relationship between total number of Rad-Units reported and the reporting efficiency per radiologist. Crucially, according to Figure 8 radiologists started to achieve higher average reporting efficiencies at around 300 reported cases.

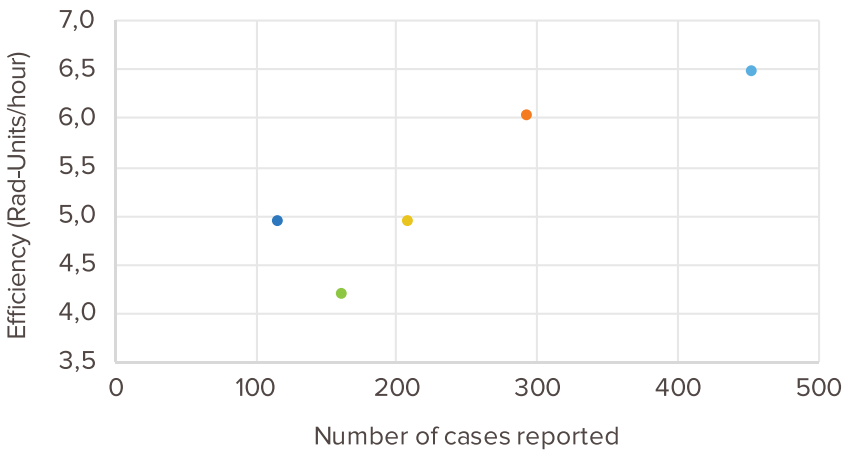

Figure 7: Radiologists with higher reported volumes were able to achieve higher reporting efficiencies.

[2] TMC subspecialist efficiency was measured in TMC's total reporting service activity from Oct 2015 to Oct 2016

3.3 Reporting quality evolution

Reporting discrepancies between the VGR radiologists and the TMC subspecialist experts' second reading were also recorded.

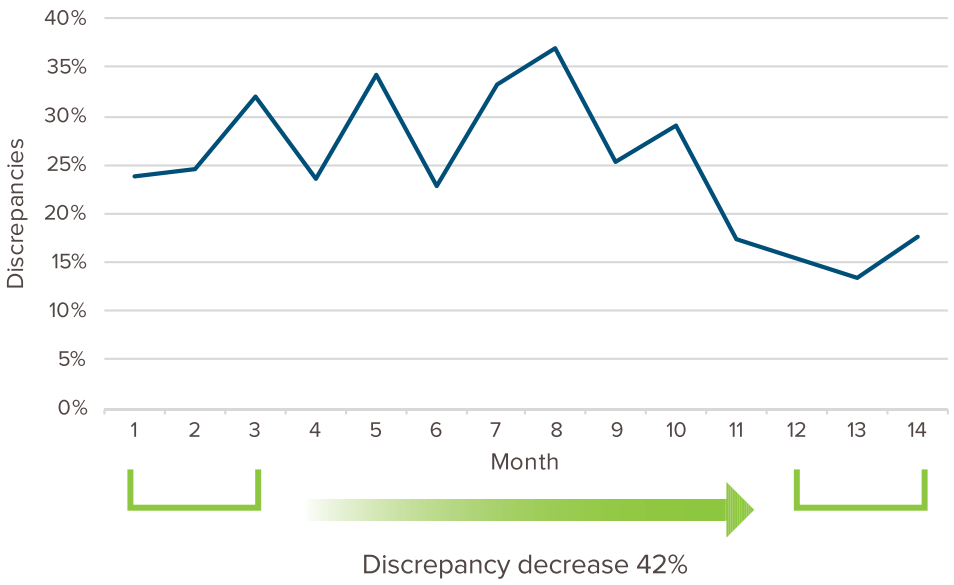

Figure 8: The discrepancy evolution month by month. Discrepancy levels showed a significant decrease of 42% over the 14 month pilot.

The chart above illustrates the discrepancies that the TMC subspecialist second reader considered important enough to mark. This could be due to either the potential clinical impact or the relevance for the learning process. In these cases, the corrected report was sent back to the VGR radiologist with clearly highlighted changes from the original to the corrected report.

Please note that the discrepancy data of this pilot project might differ from discrepancy data in a production environment due to:

- The second reading environment being used specifically for training and coaching
- The limited group size of second readers (with most of the second readings being carried out by a few TMC body subspecialists)

As Figure 8 demonstrates, there is a significant fluctuation in discrepancy levels. However, towards the end of the pilot, at around month 11 (December 2016), there is a significant improvement. The average accumulated number of cases per radiologist at that point was 212. This is a clear sign that each radiologist needs around 200 reported cases (second read by a subspecialist expert) to build up enough subspecialty expertise for measurable improvements in reporting quality.

However, these are initial findings and we will be conducting further research (including independent auditing) for a more objective analysis of reporting quality evolution during the project.

3.4 Overall feedback

The radiology managers in the participating hospitals were highly satisfied with the results. Not only were they keen to continue the project, they were also interested in expanding the network to other areas with higher volumes (such as musculoskeletal radiology).

The radiologists highlighted two specific things that they highly appreciated: the use of interactive sessions for subspecialist training in the network and the second reading environment in OPTEMIS RIS.

Dr. Katarina Whalstrom, a radiologist from Södra Älvsborg Hospital in the VGR summed it up by saying:

> "This was a great project for us. The way that it was implemented ensured minimal risk from our side and it was as if I immediately had extra colleagues (with more specific MR body experience than I had) to reach out to and to discuss cases directly with. Being able to ask them questions about real exams made my reporting more confident. Also, being at my own hospital, it was comforting to know that regardless of who was on duty, I could always reach out to a TMC expert for a discussion about the case specifics".

Conclusion

Europe has many existing radiology networks for basic image sharing. However, often these networks lack the sophisticated workflow components that feature in TMC's unique CDxN approach.

Breaking down barriers between hospitals and forming a subspecialist radiology unit through collaboration was truly innovative and resulted in significant improvements in both reporting efficiency and reporting quality.

The project exceeded expectations and has already had a tangible impact on efficiency and accuracy. Particularly the second reading training gave VGR the confidence and comfort that allowed them to gain efficiency improvements of 27% and discrepancy level reductions of 42%.

Establishing a cross-department MR body subspecialist team in this way therefore improves capacity utilisation for the participating radiology departments but more importantly results in higher reporting quality and thus better outcomes for patients.

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