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Total centralisation and optimisation of an oncology management suite via Citrix®

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Abstract. The management of patient information and treatment planning is traditionally an intra-departmental requirement of a radiation oncology service. Epworth Radiation Oncology systems must support the transient nature of Visiting Medical Officers (VMOs). This unique work practice created challenges when implementing the vision of a completely paperless solution that allows for a responsive and efficient service delivery. ARIA® and Eclipse™ (Varian Medical Systems, Palo Alto, CA, USA) have been deployed across four dedicated Citrix® (Citrix Systems, Santa Clara, CA, USA) servers allowing VMOs to access these applications remotely. A range of paperless solutions were developed within ARIA® to facilitate clinical and organisational management whilst optimising efficient work practices. The IT infrastructure and paperless workflow has enabled VMOs to securely access the Varian™ (Varian Medical Systems, Palo Alto, CA, USA) oncology software and experience full functionality from any location on multiple devices. This has enhanced access to patient information and improved the responsiveness of the service. Epworth HealthCare has developed a unique solution to enable remote access to a centralised oncology management suite, while maintaining a secure and paperless working environment.

1. Introduction

While computers have become an integral component in the Radiation Oncology department for treatment planning, recording and verification; the composition and storage of patient treatment and medical records have long been paper-based. As such, the management of patient information and treatment planning is traditionally an intra-departmental requirement of a radiation oncology service.

Epworth Radiation Oncology (ERO) is a relatively new private, not-for-profit service in Melbourne, Victoria, Australia, providing fast turn-around for patients between the initial consult appointment with their oncologist, planning CT-simulation and treatment commencement. To achieve this, a streamlined, robust and easy-to-use workflow is essential.

ERO also faces a unique challenge to support the transient nature of Visiting Medical Officers (VMOs) where the referring Radiation Oncologists (ROs) are regularly off-site. The provision of a quick planning to treatment time would be difficult to achieve in a traditional onsite, fat-client application deployed and paper-based service model. The VMOs require quick, functional and secure access to applications and information normally only available if on-site.

2. Methods

2.1. Remote Access



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The ARIA[®] and Eclipse[™] software suite is deployed over four dedicated Citrix[®] servers running Windows[®] 2008R2 SP1 (Microsoft, Seattle, WA, USA) in a data-centre instead of a traditional workstation based installation.

Staff requiring remote access download Citrix Receiver[™] (Citrix Systems, Santa Clara, CA, USA) onto the local device (computer, tablet etc.) to facilitate virtual delivery of applications and desktops. The user navigates to the Epworth XenApp[®] (Citrix Systems, Santa Clara, CA, USA) web interface URL in their internet browser where the Citrix Access Gateway[™] (Citrix Systems, Santa Clara, CA, USA) provides two levels of security. The user is prompted for their Epworth network user name and password and if confirmed, an SMS passcode is generated for the session and delivered to the mobile phone number registered to that particular user. Access is only granted once these two security measures are satisfied.

The web interface displays icons for available applications based on access rights granted to the user's profile by Epworth HealthCare IT. Once an application is selected, it is virtualised and securely delivered to the user by Citrix XenApp[®]. The application is hosted on the server but displayed to the user via Citrix Receiver[™]. Mouse and keyboard inputs update the visible screen however raw data does not leave the data-centre. Application delivery is routed through and facilitated by a Citrix Netscaler[®] (Citrix Systems, Santa Clara, CA, USA) appliance providing secure access to patient data.

2.2. Paperless Environment

To compliment the remote access and enhance its functionality, a range of paperless solutions were developed for all internal ERO processes and forms.

All medical records are maintained within the patient's profile in ARIA[®]. Patient demographics as well as radiology and pathology results are fed into ARIA[®] from the hospital patient master index via HL7 standard messaging and constantly updated.

ARIA[®] provides Microsoft[®] Word (Microsoft, Seattle, WA, USA) integration allowing for the creation of document templates. Templates were produced for all ERO documents, allowing patient details to insert automatically onto all documents, removing the need for manual data entry or ID stickers.

Integrision[®] e-pad-ink[®] (ePadLink, Simi Valley, CA, USA) electronic signature pads are used to sign any legal documents with signature fields inserted into the templates within ARIA[®]. Once signed, these fields are locked with a time and date stamp by the Integrision[®] software.

3. Results

The paperless workflow has succeeded in providing an efficient and responsive service and has been adopted by all professional disciplines in the department. The use of templates has provided consistency in structure, content and format of each document type used across both ERO sites.

The IT infrastructure has enabled users to securely access Varian[™]'s oncology software and experience full functionality across a range of devices in any location. ERO VMOs monitor their workload, contour tumours and review plans remotely with access to the patients' full medical record due to the paperless systems in place. In addition, having functional offsite access allowed for the development of a casual remote planning workforce to assist the planning team during heavy planning periods.

4. Discussion

4.1. Paperless Environment

Electronic workflow has been shown to reduce workload and increase efficiency in a Radiation Oncology Department [1,2] with our experience supporting these findings. ERO utilises a lean staff model, yet maintains a high patient throughput while offering advanced treatment techniques. The efficiency is attributed to the streamlined electronic processes and paperless solution built around ARIA[™]. The time saved in system efficiencies can be spent enhancing patient care [1,2].

ERO found the use of templated documents and forms within the electronic medical record (EMR) has not only reduced workload but also improved the consistency in content and format of our documents, as noted previously [3]. However, the production of these templates required initial investment of time and documents have undergone many variations and updates as input is received from end users or as processes are refined. Templates are easily updated in a paperless environment, promoting responsive process improvement. Version control is ensured, as the end user can only ever access the current document version and general users are unable to edit the template.

Another consideration when creating templates is the degree of freedom to grant the user. There is a balance between restricting customisability to maintain document standards and providing sufficient flexibility in the template to ensure efficient use and adequate detail of the data entered.

One of the final hurdles for implementing a truly paperless workflow is handling signatures for medico-legal documents. ERO's solution follows unpublished work presented by Fenton, Medwell and Thakar and utilises Integrisign[®] e-pad-ink[®] electronic signature pads and software.

4.2. Remote Access

Literature regarding the use of Citrix[®] to implement a truly remote access solution in radiation oncology is scarce. Belard et al. [4] have published their work on providing remote access for Walter Reed Army Medical Centre Radiation Oncologists and Physicists to participate in the planning of proton therapy. Using Citrix[®], the group provided secure remote access to proton planning software and enabled the transfer of plans to the University of Pennsylvania patient database for treatment delivery. Colonias et al. [3] discussed deploying an Electronic Health Record across an integrated radiation oncology network using a Citrix[®] server but did not, however, provide access to a planning system.

The extensive use of Citrix[®] remote solutions at ERO stemmed initially from the referral pathway of our patients. A majority of our Radiation Oncologists are VMOs who are not regularly on site. Being a private service, ERO is focused on providing a point of difference for all clients through excellent patient care, state-of-the-art equipment with advanced treatment techniques and extremely fast planning to treatment turn-around times. This has been achievable primarily through the provision of fast, efficient and secure access for VMOs to ensure that their tasks in the planning process can be completed in a timely manner from any location.

Certainly, security of data is a concern and has been raised previously in relation to the EMR [5]. These concerns could now be exaggerated by the access of data from remote locations outside of the hospital network; however the infrastructure and systems developed protect patient data on multiple levels. In addition to the hospital-network's security, each individual workstation is protected by user name and password. ARIA[®], like most patient information systems, is also protected by its own secure user name and password combination unique to each user and separate from the workstation and hospital network combination.

As outlined, there are additional security-levels applied to remotely-accessed sessions. Remote access must first be enabled on a user's profile by Epworth HealthCare IT. The IT administrators have total control over user access, and are able to monitor and log details of each session and user. The Citrix[®] web interface is protected by user name and password combination, and then by a session-unique SMS passcode. It has been suggested that security measures such as this result in patient data being far more protected in an electronic environment compared to previous physical paper files [2].

When accessing a Citrix[®] remote session, no raw data is leaving the datacentre. The applications are hosted on the server within the hospital's network and the Citrix[®] software and hardware is virtualising the Varian[™] applications and publishing them to the user who is only interacting with keyboard and mouse clicks. While this solution offers many levels of security, new concerns may be introduced regarding staff accessing patient information where they can be observed and these will need to first be identified, and then remedied.

4.3. Implementation

Moving toward a truly paperless department is a big undertaking especially for a department with established workflows and processes.

The multidisciplinary nature of a radiation oncology department means that for a paperless workflow to function efficiently and effectively, all professions must “buy in”, which has certainly been our experience. Laerum et al. [6] deduce that technology alone is not enough to provide an effective and efficient paperless environment, instead work practices need to be designed around that electronic workflow. This can create difficulties if a department was to transition to being paperless, because a new workflow may disrupt current work roles which has been shown to result in local resistance [7].

The workflow and solutions developed at ERO do not require end users to possess advanced knowledge of information technology or specialist skills, removing one of the challenges of creating an efficient paperless and remotely accessible environment. The user needs to navigate around and interact with the software easily or there will be an increased resistance to adopting electronic processes. While the infrastructure supporting our Oncology Management Suite (individual workstations, hospital network and Citrix® deployment) was developed and is managed by Epworth HealthCare IT, all of our paperless solutions were developed in-house by radiation therapists with no advanced or formal information technology training, further supporting that with a dedicated team and a clear vision, a truly paperless and remote radiation oncology department is achievable.

5. Conclusion

Epworth Radiation Oncology has developed an electronic environment around the intended service model using proven approaches as well as creating new and innovative solutions. A centralised oncology management suite within the data-centre allows secure remote access for users from any location on multiple devices. The unique combination of a truly electronic environment and remote access with full application functionality has enabled ERO to support the VMO referral pathway while maintaining rapid planning times, advanced treatment techniques and excellent patient care.

6. References

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