i.TREATSAFELY.ORG: AN OPEN ACCESS TOOL FOR PEER-TO-PEER TRAINING AND EDUCATION IN RADIOTHERAPY

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Abstract—**Limitations of current training and education delivery models result in suboptimal clinical proficiency with equipment, procedures, and techniques. Educational and training opportunities offered by vendors and professional societies are by their nature not available at point of need or for the life of clinical systems. The objective of this work is to leverage modern communications technology to provide peer-to-peer training and education for radiotherapy professionals, in the clinic and on demand, as they undertake their clinical duties. We have developed an open access web site (https://i.treatsafely.org) using Google App Engine and datastore (NDB, GQL), Python with AJAX-RPC, and Javascript. The site is a radiotherapy-specific hosting service to which user-created videos illustrating clinical or physics processes and other relevant educational material can be uploaded. Efficient navigation to the material of interest is provided through several radiotherapy-specific search tools. Videos can be rated by users, thus providing comprehensive peer review of the site content. The site also supports multilingual narration\translation of videos, a quiz function for competence assessment and a library function allowing groups or institutions to define their standard operating procedures based on the video content. The website was launched in August 2013 and has over 890 registered users from 50 countries as of August 29, 2014; 30.2% from the United States, 9.2% from India, 8.6% from the United Kingdom, 7.3% from Brazil, and 44.7% from other countries. The users include physicists (56.1%), oncologists (10.6%), therapists (9.7%) and dosimetrists (4.9%). There are over 75 videos on the site to date with narrations in languages including English, Spanish, French, Portuguese, Mandarin, and Thai. Based on the initial acceptance of the site, we conclude that this open access web-based peer-to-peer tool is fulfilling an important need in radiotherapy training and education. Site functionality will expand in the future to include document sharing and continuing education credits.**

Keywords—**Web-based, Learning, Standardization, Education, Peer-to-peer.**

I. INTRODUCTION

Radiotherapy is a technology-driven specialty with many complicated steps which, in spite of our best efforts, are prone to errors with potentially disastrous consequences for the patient [1]. Inevitably, in the complex and rapidly changing clinical environment of radiotherapy, there are gaps remaining in our understanding and proficiency in what is technologically possible and clinically realized. This is true for both basic and advanced users.

Filling these gaps is challenging because equipment and procedures are diverse and constantly changing. There are always new users. These include internal users such as rotating a therapist from the treatment machine to the CT simulator, and external users such when a new employee is hired. There are also limits to the training provided by vendors and professional societies. Professional societies' training is typically delivered at meetings and vendor training is restricted to how to use the equipment, not advice about appropriate clinical procedures or how to treat a patient. Furthermore, it is noteworthy that 3 of the 5 most downloaded papers from the International Journal of Radiation Oncology • Biology • Physics in 2012 (i.e., the Red Journal; a major *research* journal for radiotherapy) [2] were specifically related to education and training [3, 4, 5]. Those papers essentially described how to perform critical clinical processes. In other words, if the reader followed those papers, then they would increase their competence in the procedure of interest. Competence (defined as the application of knowledge, skill and attitude to the task at hand) is increasingly recognized as an essential attribute of healthcare practitioners. The purpose of a research journal should not, of course, be training and education. However, in the absence of suitable alternative vehicles this is a role that many journals have accepted.

The overall aim of education, training and competence development for health care professionals is to provide the patient with safe, high quality medical care. It is also recognized that safety and quality are both enhanced through standardization of procedures. High reliability industries, such as the airline industry, employ very standardized procedures. For example, a typical commercial flight in North America requires no fewer than 9 checklists to be completed. Similarly in healthcare, the adoption of standard operating procedures is recognized by the National Patient Safety Foundation (www.npsf.org) Hierarchy of Actions as a Strong Action for patient safety. There are indications that standardization of practice can also lead to quality and safety improvement for radiotherapy [6]. To facilitate education and training that lead to standardization in radiotherapy, we have developed a peer-to-peer education and training web site, which is described below.

II. Materials and Methods

The i.treatsafely.org site is a web-based software tool designed to deliver effective peer-to-peer education and training in radiotherapy, on demand, and at the point of need. The software system leverages newer learning models (e.g., Khan Academy) in an easy to use delivery method (YouTube–like) to facilitate peer-to-peer communication and educational collaborations. The peer-to-peer aspect means that video and document content is created and uploaded to the site by users and users can comment on the site content.

Technical Aspects

The site was created using Google App Engine and Google datastore (NDB, GQL). This environment allows for flexible expansion of content and site usage management. The web site was created using the Python programming language with AJAX-RPC and Javascript calls to the datastore. An advantage of the Google App Engine is that it leverages Google's server infrastructure so that the site can handle rapid increases in either short- or long-term usage in a cost effective way.

Content Management

Content in the form of videos and documents is supplied by actual clinicians. The site has a feature where clinicians can upload their content. Once uploaded, the content is vetted by domain experts to qualify the submitted content for inclusion in the site. The domain experts are looking for any factually incorrect statements and inappropriate practice guidance recommendations. They are not filtering for presentation style or visual quality of the videos or documents. Any questionable material is sent back to the content creator to respond and modify if it is deemed necessary.

There are two other mechanisms for site content to be vetted. One is that users can rate the content after they have watched a video or read a document. Another way is that each video and document has an icon associated with it. When used, the icon will launch a dialogue box for the user to note a suspected inaccuracy in the video or document and will also send an anonymous email to the site moderators who will then follow up on the notification. Three separate actions will be the result of the investigation: 1) the video or document will be removed from the site, 2) the content creator will modify the content to alleviate the inaccuracy, or 3) the video or document will remain unedited – if determined to be factually correct.

Peer-to-Peer Education and Training

Videos can be "pushed" to other colleagues and staff members. Enhancement of competence, at the user's pace and in the real clinical environment, is one unique feature of this tool. Each video can be associated with a quiz to test the user's understanding of the material. Comments can be left by the user about the video they just watched and those comments go directly to the video creator so the creator can respond if desired or necessary.

Several videos can also be combined to create a comprehensive learning module. This is useful as the videos tend to be short, specific learning experiences. Combining several videos into a learning module then allows the user to create a full educational session, for example, as a 'continuing medical education' lecture for credit.

Standardization and Competence Development

If they chose, groups and institutions can also adopt a subset of the hosted videos to define their approved standardized clinic practice. Such a video library, which could constitute the institution's standard operating procedures, is only available to the institution via the user's email domain. The library can then be used to standardize procedures within the clinic or across clinics for larger organizations thus enhancing quality, safety and efficiency. In the future, content could then be pushed to staff members for the purpose of ensuring competency training. The system facilitates true competence development as the videos constitute a knowledge base and repeated performance of a task under the "guidance" of a video module steadily enhances skill.

Equipment life can span decades but vendor training is usually only provided for the latest version of equipment. The i.treatsafely system provides a repository for training material that will be available for the lifetime of equipment.

III. Results and Discussion

The site is 100% free for general use and can be accessed from https://i.treatsafely.org. In order to access and contribute content, users are asked to create an account and to verify their account by responding to a validation email.

The site has over 890 registered users from 50 countries (as of August 2014); 30.2% from the United States, 9.2% from India, 8.6% from the United Kingdom, 7.3% from Brazil, and 44.7% from other countries. The users include physicists (56.1%), oncologists (10.6%), therapists (9.7%) and dosimetrists (4.9%). There are over 75 videos on the site to date with narrations in languages including English, Spanish, French, Portuguese, Mandarin, and Thai. There are over 2700 unique views of the videos on the site. A unique view occurs when a user watches any video for the first time. Multiple views of the same video by the same user are not recorded in this number. This means that, on average, each user watched at least 3 videos on the site.

An unedited sampling of user comments is provided in Table 1. This gives an indication of the innovation and impact of the i.treatsafely.org site from the users' point of view.

Table 1 Unedited user comments about the i.treatsafely.org site.

User type	Country	Comment
Physicist	USA	Found the website on Medicalphysicsweb. As a new clinical medical physicist, I intend to stay aware, learn, implement and share the best safe practices in Radiation Therapy Tx, delivery, and QA. The goals of this website seem to comply with this professional pledge that I took as a medical physicist, and so I joined.
Physicist	Germany	I know this homepage from the MedicalPhysicsWeb Newswire. I hope to learn practical things for my future job as a medical physicist. Right now I'm finishing my PhD in the same field.
Dosimetrist	USA	Found the website searching for Continued Education Credits. I'm glad for this resource in our very important and trusting medical field.
Educator	USA	Colleague at the University I work for. Intention - to provide additional instructional material for students.
Radiation Oncologist	South Africa	I am a trainee radiation oncologist and would like to get access to practical material to help enrich my training.

The i.treatsafely.org site was designed to fill a specific training need and offers a unique learning opportunity in comparison to other education and training models in radiotherapy. The site has the following attributes:

- Users of the site have access to information on demand and at the point of need using any internet connected device.
- The peer-to-peer model provides more efficient and cost effective training than traditional approaches.
- The content is tagged to specific equipment versions, techniques, or procedures so a user can easily find exactly what they are looking for.
- The system incorporates the ability for an administration component that allows content to be pushed to other health care professionals, for example, to acquire continuing medical education credits.
- The system has applicability in developing countries with limited training resources, as is evident from the initial site membership. The site also promotes training in multiple languages, providing native-language training opportunities.

IV. Conclusions

The i.treatsafely.org site has been recognized by the American Association of Physicists in Medicine through the 2014 Award for Innovation in Medical Physics Education. i.treatsafely.org represents a paradigm shift in education, training and competence development in the radiation oncology community. Standardization of procedures, with recognized benefits for quality, safety and efficiency, can be easily facilitated utilizing current or specially submitted content. Uptake has been high approaching 1000 registered users in the first year of operation.

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References

1. Bogdanich W. (2010, January 23). Radiation Offers New Cures, and Ways to Do Harm. Retrieved from http://www.nytimes.com/2010/01/24/health/24radiation.html?pagewanted=all&_r=0.
2. Klein EE. (2013) The Red Journal's Most Downloaded Physics Articles in 2012. Int J Radiat Oncol Biol Phys 86(2):222–223.
3. Ling CC, Zhang P, Archambault Y, et al. (2008) Commissioning and quality assurance of RapidArc radiotherapy delivery system. Int J Radiat Oncol Biol Phys 72(2):575–581.
4. O'Daniel J, Das S, Wu QJ, et al. (2012) Voumetric-modulated arc therapy: effective and efficient end-to-end patient-specific quality assurance. Int J Radiat Oncol Biol Phys 82(5):1567–1574.
5. Hrbacek J, Lang S, Klock S (2011) Commissioning of photon beam of a flattening filter-free linear accelerator and the accuracy of beam modelling using and anisotropic analytical algorithm. Int J Radiat Oncol Biol Phys 80(4):1228–1237.
6. Potters L, Kapur A. (2012) Implementation of a "No Fly" safety culture in a multicenter radiation medicine department. Pract Radiat Oncol 2:18–26.

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