
AFRICA RADIATION ONCOLOGY NETWORK (AFRONET): AN IAEA TELEMEDICINE PILOT PROJECT

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Abstract

In developing countries, many centres work in relative isolation with limited access to up-to-date published literature, international meetings, and expert opinion. Methods: The International Atomic Energy Agency established the Africa Radiation Oncology Network (AFRONET) as a pilot project for African countries. Through videoconferencing, cancer professionals discussed and reviewed challenging cancer cases. Monthly virtual meetings took place among radiotherapy centres in Africa. During these meetings, individual cases were presented and discussed, and a consensus recommendation for treatment was reached. The platform was also used for regularly scheduled webinars. Results: 64 monthly meetings were held and 154 cases have been discussed. The average number of participating centres was 9 per session. Central nervous system tumours were the most common and 5.2% of patients were HIV positive. The profile of diseases and comorbidities represents a window into the typical patient population of radiotherapy centres in Africa. Videoconferencing discussions strengthened clinical decision making for oncology patients. Both the case discussions and the webinars contributed to resident education in participating centres. Conclusions: This pilot experience has shown that it is feasible to use available telemedicine tools to establish a network for case discussions and education in radiation oncology in African countries.

Keywords: telemedicine; Africa; radiation oncology; radiotherapy; education; videoconference

Introduction

In Africa and in particular in sub-Saharan Africa, cancer remains a problem and few initiatives and commitments exist, whether in biomedical research, prevention, information or treatment.^{1,2} Data from the World Health Organization and the International Agency for Research on Cancer (WHO/IARC) indicates a regular increase in cancer incidence and mortality.³ Radiotherapy (RT) is a critical and inseparable component of comprehensive cancer treatment and care. For many of the most common cancers in low-income and middle-income countries, radiotherapy is essential for effective treatment. Studies provide compelling evidence that investment in radiotherapy not only enables treatment of large numbers of cancer cases to save lives, but also brings positive economic benefits.⁴

The Division of Human Health of the International Atomic Energy Agency (IAEA) has repeatedly reported on the status of radiotherapy in the African region^{5,6} and recently updated by Abdel-Wahab et al.⁷ Of 52 countries surveyed in 2013, 23 were found to have radiotherapy centres. These facilities were mostly concentrated in the southern and northern states of the continent. Cervical cancer is widespread in central and southern Africa; nevertheless, brachytherapy resources were available in only 20 of the 52 countries. South Africa and Egypt, account for roughly 60% of all radiation therapy resources in the continent.⁷

In 2014, 28 African countries did not have radiotherapy services.⁸ The coverage of radiotherapy needs at current levels was of only 28%, and 703 teletherapy machines were needed in the region as a whole, which could be broken down as 404, 251 and 48 machines required in low-income, lower-middle-

income, and higher-middle-income African countries respectively. As of January 2018, the International Atomic Energy Agency's (IAEA) Directory of Radiotherapy Centres (DIRAC)⁹ lists a total of 187 radiotherapy centres in Africa, which operate 342 teletherapy machines. Of these devices, 276 are linear accelerators, and 66 (19.3%) are Cobalt-60 units.

Although progress is being made in the establishment of radiation oncology services in some countries, a substantial need still exists, and much resource mobilisation is needed for services to keep pace with the burgeoning populations of some African countries.

Limited resources in equipment and education have an impact on access to radiotherapy and the outcomes of treatment. The limited availability of resources for radiotherapy also affects communications and access to literature resources. Traditionally, centres in low-income countries have had difficulties accessing the medical literature. Today, this has been mitigated by open access journals, Internet access, journals that provide free access to resource-limited countries and international organisations that offer technical publications and journals free of charge.^{10,11} However, the majority of radiotherapy centres, particularly in the limited-resource nations, share common obstacles in access and networking.

Given the challenges, the Applied Radiation Biology and Radiotherapy Section (ARBR) of the IAEA in collaboration with a group of oncologists from the African region, gathered in Vienna in June 2012 to outline the basics of a teleconferencing platform network for clinical consultation in radiation oncology. The aim of this paper is to describe the development of the network and present preliminary data on its use.

Methods

The objectives of the project were twofold: i) To establish an online discussion network to improve the process of decision-making on individual patients in radiotherapy (RT) departments in Africa. In this context, improvement in the quality of decision-making meant clinical decisions based on evidence, to the extent that evidence is available, ii) To strengthen the education of residents (registrars) by their active participation in the online meetings and discussions.

The primary practical objective was to establish a network of English-speaking radiotherapy centres that would connect online on a regular basis to present,

discuss and resolve patients referred for radiation therapy. The initial idea was to discuss difficult or unusual radiotherapy situations. However, the discussion led to the conclusion that routine clinical conditions should also be presented and discussed to standardise decisions based on evidence. Cases of paediatric oncology patients referred for radiotherapy were considered a priority for the discussions.

A secondary objective was educational. It was agreed that the online discussion of clinical cases through video-conferencing would be beneficial for the residents undergoing specialist training in the various centres. Therefore, their attendance and active participation was encouraged.

Virtual meetings lasting an hour to an hour and half were held monthly on a fixed date. Two to five patients were discussed during each session. In recent years webinar lectures have also been incorporated into the online meetings, an activity which has increased interest and participation.

Online meetings were attended mainly by oncologists from the various centres, IAEA staff in Vienna and experts from other regions. WebEx (Cisco WebEx[®]) was used as a platform for video conferencing and WebEx license fees were covered by the IAEA. IAEA professional staff acted as meeting facilitators. The fact that Vienna is located on the same time zone or with a difference of 1-2 time zones with most African countries was a factor that facilitated participation. The WebEx platform allows for visualisation of the participants through web cameras, audio, chat, and image sharing from a computer desktop to all participants.

Every month a WebEx invitation was sent to registered members. Each patient was presented by the corresponding centre. Centres were encouraged to use a structured template to present their cases and to send their case-presentations ahead of the meeting day so that both IAEA staff and other participants could be prepared. The template required the case presentation to end with 2-3 focused questions to the forum. These questions had to be addressed and answered during the online meeting.

The system allowed the sharing of image documents such as diagnostic and staging imaging, pathology or cytology images, reports, images of radiotherapy treatment plans, portal radiographs, dose-volume histograms or clinical pictures of patients when relevant. Following each case presentation, there was an evidence based summary update of the

disease/condition and consideration of the current levels of evidence. A general discussion followed attempting to reach a management consensus based on present published evidence, but in some cases, dissent was acknowledged and reported. The management decision had a "recommendation" nature and was by no means mandatory.

Following the online meeting, each case including the management consensus reached was entered into a database at IAEA. Cases were recorded in this database using a coding system to preserve patient confidentiality. A feedback email message was sent to all participants with a summary of the previous meeting, and the resulting recommendations for the individual patients discussed.

Patients gave oral consent to have their cases and clinical images to be shared and discussed online with other physicians. Patient anonymity was kept throughout the process.

Results

From June 2012 to December 2017, 64 online sessions took place and a total of 154 patients were discussed. A summary of the project experience and the relative distribution of tumour sites is shown in Table 1.

Table 1. AFRONET descriptive statistics as of December 2017.

AFRONET network statistics	
Number of sessions	64
Number of participating centres	16
Participating countries	14
Average centres per session	9
Number of patients discussed	154
Mean patients' age (y)	34 (2 – 83)
HIV+	8 (5.2%)
Tumour sites	
	n (%)
CNS tumours	25 (16.3%)
Sarcomas	23 (15.0%)
Breast	21 (13.1%)
Genitourinary	16 (10.5%)
Head-and-Neck	14 (9.2%)
Gynaecology	13 (8.5%)
Lung	9 (5.9%)
Lymphoma	8 (5.2%)
Other	7 (4.6%)
Gastro-intestinal	6 (3.9%)
Skin cancers	5 (3.3%)
Neuroendocrine	4 (2.6%)
Cancer of unknown primary	3 (2.0%)

Sixteen cancer centres in 14 African countries regularly participated in the meetings. These were Botswana, Cameroon, Egypt, Ethiopia, Ghana, Madagascar, Namibia, Nigeria, Rwanda, South Africa, Sudan, Tunisia, Uganda, and Zimbabwe. The discussions were strengthened by the participation of experts from outside the African region such as USA, Canada, Antigua, India, Indonesia, Bangladesh, Macedonia, New Zealand, and Romania.

The most common cancer site was tumours of the central nervous system (CNS). It is noteworthy that sarcomas - usually considered rare tumours and not included in the Globocan-2012 list of cancers - were the second most frequent type of cancer discussed in the AFRONET network (Table 1).

Mean age of discussed patients was 34 (2-84) years, which shows a trend to a younger patient population in this region. Of the discussed patients 5.2% were HIV positive and on anti-retroviral therapy, thus introducing a new element in the discussion of potential toxicities of oncology treatments in these patients.

The online meetings were of value to oncologists who either confirmed their previously decided management plan or changed it as a result of the discussion. In some cases, the group recognised that the resources needed to treat a patient optimally might not be readily available in the corresponding centre or country. For example, some patients may have been optimally treated using three-dimensional conformal radiotherapy (3D-CRT) techniques, while only 2D radiotherapy was available in a particular centre or country. Also, the discussions revealed that some centres have limited access to immunohistochemistry, pathology, endoscopy services or specialised surgery. A high proportion of patients required palliative care, including palliative radiotherapy.

Some oncologists have found it helpful to be able to tell patients/families that their case had been reviewed through this process in consultation with a group of international colleagues, particularly when informing them that the approach had to be palliative. Being in the situation of breaking bad news to patients and/or relatives, peer support for the attending oncologists was important.

In the area of education, some centres routinely joined the online conferences with their group of residents in the room. Residents were encouraged to prepare and present the cases at the meeting. The disease reviews and regularly scheduled webinars on

various topics were particularly well received by the residents.

A formal evaluation of the Project was carried out in 2013. This review was done through a survey questionnaire to the participants. The assessment revealed that all participants found added value in the experience, both for patient care and resident education, and suggested to continue the meetings. Participants considered it a useful platform for interaction with colleagues without leaving their practice. It contributed to optimising individual patient management through improving consistency, continuity, coordination, and better communications between healthcare practitioners. There was no attempt to assess the impact of the activity on patient's clinical outcome.

Discussion

Clinical decision-making in radiation oncology is a critical action that requires knowledge, experience and carries responsibility towards patient's health and life. Despite having the same disease, each patient is different due to variations in stage, histology, age, gender, comorbidities and psychology and social-economic background. The practice of oncology in Africa often implies making clinical decisions for patients who are young, present with advanced disease, may be pregnant, HIV-positive, have tuberculosis, endemic diseases or other comorbidities and whose nutritional status may be compromised. These factors make clinical decision-making more difficult.

Discussion of clinical cases with other colleagues evolved spontaneously and very early in the history of the modern medical practice. It is only natural to share knowledge and discuss experiences on diseases with other colleagues, which first led to one-to-one consultations, then to medical meetings, discussions, publications of books, journals, and more recently to different Internet resources. Multidisciplinary meetings (MDM) and tumour boards are recommended by experts and guidelines because they provide patients with the complementary expertise of a larger number of specialists, a higher likelihood of implementation of evidence-based medicine, or expert opinions when evidence is not available from clinical trials. A review in 2007 noted that MDM clinics in Ontario, Canada, improved patient outcomes, changed management plans, and were also part of standard cancer care internationally. They subsequently developed a standards document for MDM clinics, which has been

adopted by several centres.¹³ The functioning, guidelines, difficulties, and outcomes of multidisciplinary teams (MDT) have been well studied mainly in the United Kingdom.¹⁴ Studies showed that special training of MDT led to better team dynamics and communication, improved patient satisfaction, and improved clinical outcome.

Telemedicine is a rapidly evolving application of clinical medicine where medical information is transferred using information and communication technologies such as interactive audio-visual media to consult, and sometimes perform remote medical examinations or interventions (teleradiology, telepathology, teledermatology and others).^{15,16} In suboptimal settings, such as small community hospitals, rural areas, and areas with limited resources, boundaries in diagnosis and management can be overcome, or improved, with tumour boards, especially with the use of video-conferencing facilities.¹⁷ The IAEA through its Programme of Action for Cancer Therapy (PACT) has contributed to the use of online resources to create training courses for African cancer control professionals in partnership with higher learning institutions in the region.¹⁸

Telemedicine tools enable the communication and sharing of medical information in electronic form, and thus facilitate access to remote expertise. A physician located far from a reference centre can consult its colleagues remotely in order to resolve a difficult case, follow a continuous education course over the Internet, or access medical information from digital libraries or knowledge bases. These same tools can also be used to facilitate exchanges between centres of medical expertise: health institutions of a same country as well as across borders.

Telemedicine tools facilitate networking between radiotherapy centres and this in turn enhances the effectiveness and reach of existing radiotherapy resources in low-middle income countries. A teleradiotherapy network enables centres to share and optimally utilise their resources, both infrastructure and staffing. Telemedicine networks could be in the form of a three-tier radiotherapy service consisting of primary, secondary, and tertiary radiotherapy centres interlinked through a network.¹⁹ Telemedicine networks for the clinical discussion and peer review of patients are of particular value when radiotherapy centres are geographically distant.²⁰

Internet penetration in Africa is low (35.2%) compared to the rest of the world (58.4%).²¹ Measurable

parameters and overall available bandwidth all indicate that Africa is behind the "digital divide". Africa continues to be the region with the lowest information and communications technology development index (IDI) performance.²² The average value for this region in IDI 2017 is 2.64 points, little more than half the global average of 5.11.

Despite these obstacles, several groups have established telemedicine network discussions in Africa with various levels of success.²³⁻²⁶ These published experiences provide extremely useful insight into the existing obstacles and their recommendations are valuable. We agree with Shiferaw and Zolfo in that "the success or the failure of a telemedicine project does not only rely on technological factors, but on e-governance, an enabling policy environment, multi sectorial involvement of stakeholders and effective human resource management and capacity building."²⁵

The AFRONET clinical discussions assisted participating centres in strengthening their clinical decision-making process regarding their patients. They contributed to bringing awareness of the application of evidence-based medicine in routine clinical practice. The project helped to establish a network platform for discussion contributing to harmonise and improve patient care in participating centres. In these regards the objectives were met.

While other networks²⁷ focus on the review of radiotherapy treatment plans, due to the nature of oncology practice in Africa, the AFRONET network often deals with general patient management decisions, radiotherapy technique in general or combined modality treatments.

Lessons learned

In a discussion network using telemedicine tools, the platform is very much technology-dependent. Reliable broadband Internet connectivity remains challenging in some countries. The quality of the video-conference experience depends on factors such as the quality of the Internet connection and bandwidth, quality of the microphone used (sound is more important than video) and the type of device used to connect (computer vs. smartphone or mobile device). Participants must attempt to use the best technology available in their centres and count on the support of local information technology specialists.

In sub-Saharan African countries, the education of oncologists follows the "clinical oncology" model. This means that specialists are trained in both medical and

radiation oncology, and they handle both types of treatment modalities in their daily practice. Therefore, the questions raised in the AFRONET forum were not always radiation oncology questions, but also questions on general patient management, selection of appropriate modality or medical oncology questions.

Cases selected for discussion were challenging. It is frequent for oncologists in this region to manage patients with advanced disease, multiple malignancies, young age, pregnancy and comorbidities such as tuberculosis, malnutrition or HIV-disease. A high proportion of all cases required palliative radiotherapy. This profile reveals an aspect of the practice of oncology in Africa. This patient population differs significantly from that seen in many radiotherapy centres in affluent countries.

Although the initial intention was to make the online meetings multidisciplinary, in practice this was achieved only to a limited extent. In the case of the AFRONET network, future meetings will require the regular presence of other disciplines such as imaging, pathology, and surgery.

Radiotherapy plans and plan-evaluation tools such as dose distributions, dose-volume histograms (DVHs), and verification portals were shared using images pasted into a presentation template. This approach, while feasible, does not allow for the sharing and review of whole CT scan files or radiotherapy treatment plans. Review of 3D/IMRT plans requires a different sharing platform able to handle large datasets.

The AFRONET network has had a limited take-up. There are 187 radiotherapy centres in Africa and 16 participate of this exercise. The authors can only hypothesise on the possible reasons. Language may be a barrier. AFRONET sessions are conducted in English, and in many African counties English is not the daily working language. Also, the level of motivation of professionals and clinics varies when a time-consuming exercise such as teleconferencing competes with other priorities in the busy life of African oncologists. To answer this question, a focused survey should be conducted.

Building on the success of this network, the IAEA plans to expand and reproduce the AFRONET experience establishing similar networks in other regions and an additional inter-regional network dedicated to paediatric radiation oncology. Contouring software with plan review capabilities is being included to strengthen oncologists and residents skills further.

Conclusion

This 5-year pilot experience has shown that regular online meetings taking advantage of current commercially available video conferencing resources proved a useful platform to improve radiation oncology decision-making as well as an education tool in a group of African countries.

This particular network should be strengthened and expanded to other English-speaking countries in the region. A similar network in French or Arabic is recommended for other countries in Africa.

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