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Research Article

Empowering radiation therapists: The role of an African Community of Practice in developing radiation Therapist education curriculum

Yat Tsang^{a,b,*}, Kofi Adesi Kyei^c, Sandra Ndarukwa^d, Katie Wakeham^e, Abiola Fatimilehin^f, Kimyakhanim Bakhinshova^g, Lisbeth Cordero Mendez^d

^a Radiation Medicine Program, Princess Margaret Cancer Centre, Toronto, Canada

^b Department of Radiation Oncology, University of Toronto, Toronto, Canada

^c Department of Radiography, University of Ghana, Ghana

^d Applied Radiobiology and Radiotherapy Section, Division of Human Health, International Atomic Energy Agency, Vienna, Austria

^e Barts Health NHS Trust, London, United Kingdom

^f Christie NHS Foundation Trust, Manchester, United Kingdom

^g Ministry of Science and Education, The Institute of Radiation Problems, Azerbaijan



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ABSTRACT

Objectives: Supported by the International Atomic Energy Agency (IAEA), the African Regional Cooperative Agreement for Research, Development and Training (AFRA) invited African Member States (MS) with a radiation therapy facility to engage in a 3-day workshop to develop a robust road map for educational standards in radiation therapist (RTT) training. The aim of the paper was to make recommendations of how the African MS could drive forward high educational standards in RTT training and education in Africa.

Methods: A pre-workshop survey was developed and sent to the participants to gather background information on each MS's national RTT training standards. An online survey was sent to all African MS with a radiation therapy facility. Two international RTT education-training experts were tasked by the IAEA to support and facilitate the workshop, which consisted of presentations and discussions around the current RTT training schemes in African MS and aspects of modern training methodology. The agenda of the workshop was structured with the aim to simulate discussions on RTT education and training standards among participants from African MS.

Results: Sixteen African MS completed the pre-workshop survey. The median number of radiotherapy centres within a MS was 3 (range 1–15). All MS provided two-dimensional radiation therapy services as a minimum while 75 % (12/16) MS could offer three-dimensional conformal radiation therapy service. Thirty-eight percent (6/16) reported that they had no radiation therapy machine service maintenance contracts with vendors and 56 % (9/16) MS had no biomedical engineers on site for unplanned and planned machine maintenance. The median number of RTTs at national level among MS was 23 (range 7–73). Fifty-six percent (9/16) MS had a RTT specific national training programme with 75 % (12/16) MS having clinical attachments for 6 months or more. Representatives from 12 African MS attended the AFRA workshop. An African Community of Practice (CoP) in developing Education Curriculum for RTT was established as an outcome of the workshop with the aim to facilitate knowledge exchange and drive quality initiatives among participating African MS.

Conclusion: By fostering collaboration, sharing knowledge, and advocating for improved policies, the African COP in developing Education Curriculum for RTT can make significant strides toward developing a RTT education curriculum that not only meets the unique challenges of the African continent but also aligns with global standards.

* Corresponding author at: Radiation Medicine Program, Princess Margaret Cancer Centre, Toronto, Canada.

E-mail address: yat.tsang@uhn.ca (Y. Tsang).

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Introduction

Globally, new cancer cases will continue to increase in countries of all economic tiers and there is a crucial need to expand the supply of radiation therapy services [1]. With insufficient access to radiation therapy, the effect of cancer burden is worst felt in low- and middle-income countries (LMICs) [2].

Supported by the International Atomic Energy Agency (IAEA), the African Regional Cooperative Agreement for Research, Development and Training (AFRA) is established as an intergovernmental agreement for African Member States (MS) to strengthen and enlarge the contribution of nuclear science and technology to socioeconomic development on the African continent. It provides a framework for African MS to intensify their collaboration through programmes and projects focused on the specific shared needs of its members. Its activities cover a wide range of peaceful applications of nuclear techniques that contribute to the achievement of national and regional development goals.

In recent years, the field of radiation therapy has witnessed significant advancements, necessitating a dynamic and comprehensive education curriculum to equip professionals with the necessary skills and knowledge [3,4]. Radiation therapists (RTTs) play an important role in cancer patients' radiation therapy pathways, using their expert knowledge of imaging and cancer patient care for accurate, high-quality radiation therapy delivery [5]. The challenges in developing a standardized and effective education curriculum for RTTs in Africa are multifaceted. Limited resources, outdated infrastructure, and a shortage of qualified educators [4] can cause these challenges. Additionally, there is a need for a RTT training and education curriculum that reflects the diverse healthcare landscape and prevalent diseases in the region.

In June 2022, AFRA invited the African MS with a radiation therapy facility to engage in a 3-day workshop in Zimbabwe. This workshop was set up to provide a vital collaborative platform, bringing together RTT clinical practice experts, educators, and practitioners to develop a robust road map for educational standards in RTT training. A pre-workshop survey was developed and sent to the participants to gather background information on each MS's national RTT training standards in terms of equipment, resources, workforce and RTT training and education curriculum.

Against this background, this paper aimed to summarise the findings from the survey and workshop; and to make recommendations of how the MS could drive forward high educational standards in RTT training and education in Africa through the support from AFRA.

Materials and methods

Pre-workshop survey

In April 2022, an online survey was sent to the individual national RTT education/workforce experts from 18 African MS who registered for the regional AFRA workshop and were with a radiation therapy facility according to the IAEA Directory of Radiotherapy Centres (DIRAC) database. The survey assessed respondents' country; the number of radiation therapy centres; availability and type of radiation therapy treatments offered; the frequency of radiation therapy machine downtime and scheduled maintenance; the number and scope of practicing RTTs; whether RTT trainees were engaged in formal training programs; and the current state of RTT education with clinical attachments for trainees. Participants were asked to complete the survey within three weeks with a reminder email sent 5 days prior to the closing date. After the closing date, the raw data results of the survey were verified and analysed by representatives from IAEA who were experts in radiation therapy with knowledge of the status of radiotherapy services and training of radiation therapists within Africa.

Regional AFRA workshop on the development of education curriculum for radiation therapists

In June 2022, the participating African MS were invited to attend an in-person workshop on the development of education curriculum for radiation therapists in Harare, Zimbabwe. Two international RTT education-training experts from the United Kingdom and Ghana were tasked by the IAEA to support and facilitate the three-day workshop, which consisted of presentations and discussions around the current RTT training schemes in African MS and aspects of modern training methodology. The agenda of the workshop was structured with the aim to simulate discussions on RTT education and training standards among participants from African MS under the specific topics. These included Best Practice in Curriculum Development, Developing the environment: infrastructure, equipment, personnel and quality management systems, Key competencies in training and structuring work-based assessment of trainees, Student driven learning and dealing with trainees with difficulties, Consolidation and recommendation of remedial strategies as well as Recommendations on modern based training for Africa.

Results

Pre-workshop survey

Sixteen out of eighteen African MS (89 %) including Angola, Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Libya, Madagascar, Namibia, Nigeria, Senegal, Sudan, Tunisia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe completed the pre-workshop survey. The results are summarised in Table 1.

The median number of radiotherapy centres within a MS was 3 (range 1–15). All MS provided two-dimensional radiation therapy services as a minimum while 75 % (12/16) MS could offer three-dimensional conformal radiation therapy (3DCRT) services. Forty-four percent (7/16) MS were capable of delivering intensity modulated radiation therapy (IMRT) techniques and only 1 MS could offer stereotactic body radiation therapy (SBRT) to patients.

Thirty-eight percent (6/16) reported that they had no radiation therapy machine service maintenance contracts with vendors and 56 % (9/16) MS had no biomedical engineers on site for unplanned and planned machine maintenance. At the time of the survey, 3 MS had delivered no radiation therapy treatment in the past 4 weeks due to unplanned radiation therapy machine down time.

The median number of RTTs at national level among MS was 23 (range 7–73). Fifty-six percent (9/16) MS had a RTT specific national training programme with 75 % (12/16) MS having clinical attachments for 6 months or more. The commonest barrier for RTT education was lack of government support and staffing. All MS stated that African regional networks for developing RTT education and training curriculum would be valuable enablers of driving forward high educational standards in RTT training and education in Africa.

Regional AFRA workshop outcomes

In between 28th and 30th of June 2022, representatives from 12 African MS: Egypt, Ghana, Kenya, Libya, Mauritius, Namibia, Nigeria, Sudan, Uganda, United Republic of Tanzania, Zambia and Zimbabwe attended the AFRA workshop. Throughout the 3-day workshop, the international RTT education-training experts fostered an engaging environment promoting discussions among all workshop participants. With the experts' continuous engagements and facilitations, participants from all MS presented and shared their own national challenges and success stories in developing RTT training and education curricula.

A consensus was reached through the discussions that the use of professional title "Radiation Therapist" should be recommended among all African MS. The importance of continuous professional learning assessments and collaboration agreements between clinical sites and

Table 1

Summarises the results of the pre-workshop survey which was completed by sixteen African Member States.

| Country | Number of Radiotherapy Centres | Radiation Therapy Treatment Technique | With Service Maintenance Contracts with Vendors | Availability of Biomedical Engineer Onsite | Number of RTTs at National Level | With a RTT specific National training programme | Length of clinical placement |
|-----------------------------|--------------------------------|---------------------------------------|---|--|----------------------------------|---|------------------------------|
| Angola | 2 | 2D; 3DCRT | No | No | 20 | No | More than 12 months |
| Burkina Faso | 2 | 2D; 3DCRT; IMRT | No | No | 7 | No | 6–12 months |
| Côte d'Ivoire | 1 | 2D; 3DCRT; IMRT | Yes | No | 23 | No | 6–12 months |
| Ghana | 3 | 2D; 3DCRT; IMRT | Yes | Yes | 18 | Yes | 6–12 months |
| Kenya | 12 | 2D; 3DCRT; IMRT | Yes | Yes | 73 | Yes | More than 12 months |
| Libya | 5 | 2D; 3DCRT | Yes | No | 36 | Yes | 2–6 months |
| Madagascar | 2 | 2D | No | No | 10 | No | 2–6 months |
| Namibia | 2 | 2D | No | No | 8 | No | More than 12 months |
| Nigeria | 11 | 2D; 3DCRT | Yes | Yes | 34 | Yes | 2–6 months |
| Senegal | 4 | 2D; 3DCRT | Yes | No | 13 | No | 6–12 months |
| Sudan | 3 | 2D | Yes | Yes | 60 | Yes | None |
| Tunisia | 15 | 2D; 3DCRT; IMRT; SBRT | Yes | Yes | 60 | No | 6–12 months |
| Uganda | 1 | 2D; 3DCRT; IMRT | Yes | Yes | 9 | Yes | More than 12 months |
| United Republic of Tanzania | 4 | 2D; 3DCRT; IMRT | Yes | Yes | 42 | Yes | More than 12 months |
| Zambia | 1 | 2D | No | Yes | 25 | Yes | 6–12 months |
| Zimbabwe | 3 | 2D; 3DCRT | No | No | 23 | Yes | More than 12 months |

higher education institutes should be highlighted in the individual MS RTT education curriculum. As an outcome of the workshop, an African Community of Practice (CoP) in developing Education Curriculum for RTT was established with the aim to provide a forum for facilitating knowledge exchange and driving quality initiatives among participating African MS. This CoP could help in building relationships and advocating the needs for RTT profession specific education and training among participating African MS. Four work-streams were proposed to be formed under the African CoP in developing education curriculum for RTT:

- Promote recognition of RTT professional identity and academic qualification
- Identify and develop core competencies in RTT profession specific education and training (including the addition of management and leadership skills)
- Define RTT education faculty composition (including career progression and development programme for RTT trainers/educators)
- Develop and initiate peer review processes in RTT education curriculum among African MS (including setting up memorandums of understanding between higher education Institutes in different African countries)

Discussion

In Africa, cancer patients encounter formidable challenges in accessing essential care, as a result of various barriers such as inadequate radiation therapy equipment, limited human resources, insufficient education and training of radiotherapy personnel, and a lack of innovation in treatment technology [6]. Addressing these multifaceted issues is crucial to improving the overall landscape of cancer care in Africa and ensuring that patients receive the vital treatments they require [4].

In a report by the Lancet Oncology in 2015, it highlighted the insufficient radiation therapy coverage in many LMICS and projected a demand for 2,600 radiotherapy departments, 5,200 machines, and 55,800 professionals that included RTTs, by 2035 to address the growing needs [7]. Notably, Africa faces a severe deficit, with less than one external beam radiation therapy equipment available per million people, indicating the continent's limited and underdeveloped radiation therapy capacity. This is in line with our survey results suggesting that

less than half of the participating MS were capable of delivering advanced radiation therapy techniques such as IMRT and SBRT. Efstathiou et al. reported that 29 of the 54 countries in Africa lacked a functioning radiation therapy facility [8]. The reoccurring high service and maintenance costs were suggested to be the determining factor on whether a radiation therapy machine would remain operational [9]. Aligning with the findings from our study, three MS disclosed that they had not administered any radiation therapy treatments in the preceding four weeks upon concluding the pre-workshop survey, citing unplanned downtime of their radiation therapy machines. This circumstance could be attributed to the fact that nearly 40 % of the participating medical facilities did not have service maintenance contracts with vendors for their radiation therapy machines. Additionally, over half of these facilities lacked onsite biomedical engineers for both unplanned and planned machine maintenance.

Our study indicated that the median number of RTTs at national level among MS was 23. Three MS stated that there were less than 10 RTTs available in the whole country to operate two radiation therapy centres. This was deemed much lower than the minimum RTT staffing (7 RTTs per treatment unit) recommended by IAEA [10]. To tackle the human resources challenges associated with the cancer burden in Africa, it is imperative to launch training initiatives aimed at significantly augmenting the quantity and geographical distribution of RTTs across the continent. As indicated by our study's survey findings, close to half of the participating MS lacked a RTT specific national training program, with 25 % of them having clinical attachments lasting less than six months. This could be caused by the inadequate supply of expert RTT instructors in Africa; it could become a primary obstacle to effective instruction and education for RTTs. The training programs should be established to ensure that RTTs acquire a foundational understanding of radiation therapy, biology, and physics. Moreover, formal instruction in clinical radiation therapy practice should be an integral component of the RTT education and training curriculum [4].

To promote the collaborative development of a relevant and up-to-date RTT education curriculum, the African CoP in developing Education Curriculum for RTT was established as an output from the regional AFRA workshop in 2022. Experts from various African countries could contribute their insights through the CoP, ensuring that the RTT curriculum would be adaptable to different healthcare systems, cultural contexts, and emerging technologies.

Recommendations

Recognizing the importance of continuous learning, the CoP could be used as platform for supporting the professional development of RTT educators and practitioners. In addition, the CoP could play a pivotal role in advocating for improved policies and increased investments in RTT education within Africa.

The outcomes of our study reflected a consensus reached during the regional AFRA workshop, advocating for the adoption of the professional title “Radiation Therapist” across all participating African MS in the CoP. The endorsement of a standardized professional title facilitates collaboration with local government bodies and educational institutions. This, in turn, enables MS to prioritize the establishment of RTT education and training programs, fostering avenues for advocacy and professional growth.

By fostering collaboration, sharing knowledge, and advocating for improved policies, this COP can make significant strides toward developing a recommended RTT education curriculum that not only meets the unique challenges of the African continent but also aligns with global standards. Through these collective efforts, RTTs in Africa can hopefully be better equipped to contribute to the improvement of healthcare outcomes and the overall well-being of their communities.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- [1] IARC, World Health Organization International Agency for Research on Cancer (2022) GLOBOCAN 2022: Estimated cancer incidence, mortality and prevalence worldwide in 2022. <https://gco.iarc.fr/today/fact-sheets-populations>. Accessed 4 March 2024.
- [2] Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2021;71(3):209–49. <https://doi.org/10.3322/caac.21660>.
- [3] Rodin D, Longo J, Sherertz T, Shah MM, Balagun O, Wendling N, et al. Mobilising expertise and resources to close the radiotherapy gap in cancer care. *Clin Oncol* 2017;29(2):135–40. <https://doi.org/10.1016/j.clon.2016.11.008>.
- [4] Stecklein SR, Taniguchi CM, Melancon AD, Lombe D, Lishimpi K, Banda L, et al. Radiation Sciences Education in Africa: An assessment of current training practices and evaluation of a high-yield course in Radiation Biology and Radiation Physics. *JCO Glob Oncol* 2020;6:1631–8. <https://doi.org/10.1200/go.20.00350>.
- [5] Tsang Y, Harnett N. Advanced practice in radiotherapy: How to move to the next level? *Tech Innov Patient Supp Radiat Oncol* 2021;1(17):57–8.
- [6] Balogun O, Rodin D, Ngwa W, Grover S, Longo J. Challenges and prospects for providing radiation oncology services in Africa. *Semin Radiat Oncol* 2017;27(2):184–8. <https://doi.org/10.1016/j.semradonc.2016.11.011>.
- [7] Atun R, Jaffray DA, Barton MB, Bray F, Baumann M, Vikram B, et al. Expanding global access to radiotherapy. *Lancet Oncol* 2015;16.
- [8] Efstathiou JA, Heunis M, Karumekayi T, Makufa R, Bvochora-Nsingo M, Gierga DP, et al. Establishing and delivering quality radiation therapy in resource-constrained settings: The story of Botswana. *J Clin Oncol* 2016;34(1):27–35. <https://doi.org/10.1200/jco.2015.62.8412>.
- [9] Barksby R. Expanding access to radiotherapy in sub-Saharan africa. *Lancet Oncol* 2020;21(8):1019. [https://doi.org/10.1016/s1470-2045\(20\)30376-4](https://doi.org/10.1016/s1470-2045(20)30376-4).
- [10] Rosenblatt E, Zubizarreta E, editors. Radiotherapy in cancer care: facing the global challenge. Vienna: International Atomic Energy Agency; 2017.