



## Original Research Article

## Board-certified specialty training program in radiation oncology in a war-torn country: Challenges, solutions and outcomes

Layth Mula-Hussain <sup>a,\*</sup>, Akhtar N. Shamsaldin <sup>b</sup>, Muthana Al-Ghazi <sup>c</sup>, Hawzheen Aziz Muhammad <sup>d</sup>, Shada Wadi-Ramahi <sup>e</sup>, Rabbie K. Hanna <sup>f</sup>, Abdulla Alhasso <sup>g</sup><sup>a</sup> Physician in Radiation Oncology, Cross Cancer Institute – University of Alberta, Edmonton, Alberta, Canada<sup>b</sup> Consultant Medical Physicist, Ministry of Higher Education and Scientific Research, Sulaimani, Kurdistan, Iraq<sup>c</sup> Clinical Professor & Director of Medical Physics, Department of Radiation Oncology, School of Medicine – University of California – Irvine, Orange, CA, USA<sup>d</sup> College of Medicine – University of Sulaimani, Sulaimani, Kurdistan, Iraq<sup>e</sup> Biomedical Physics Department, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia<sup>f</sup> Wayne State University School of Medicine and Henry Ford Health System, Detroit, MI, USA<sup>g</sup> Consultant Clinical Oncologist, The Beatson West of Scotland Cancer Centre, Glasgow, Scotland, UK

## ARTICLE INFO

## Article history:

Received 31 May 2019

Revised 11 August 2019

Accepted 15 August 2019

Available online 19 August 2019

## Keywords:

Radiation oncology residency

War-torn nation

Developing country

Iraq

## ABSTRACT

**Background:** Residency programs leading to board certification are important for safe and competent Radiation Oncology (RO) practice. In some developing nations, there is a gap in this field. This work addresses the experience that was accomplished to establish such a program in Iraq despite all the challenges that faces a country under war.

**Methods:** Descriptive report of challenges faced in a developing country that is still reeling from war, the steps taken to overcome these challenges and outcomes after graduation of two classes.

**Results:** After over 18 months of prerequisite technical and logistical preparations, a group of local and external faculty members were invited to establish the required syllabus of a structured RO residency program in Iraq. It is comprised of a total of 100 post-graduate academic credits over a 48-months period after clinical internship. First year evaluations included regular practical assessments; seven in-house papers covering RO, cancer and radiation biology, medical physics, radiological anatomy and diagnostic oncology, tumor pathology, onco-pharmacology, and medical statistics, research methodology, and cancer epidemiology, followed by a comprehensive examination. Subsequent evaluations were on an annual bases with enrollment in the American College of Radiology In-Training examination in RO. Final assessment included logbook and skills' reviews, graduation thesis or peer-review publication, two-papers' written examination, and an exit practical examination.

**Conclusions:** Given the political, economic and social difficulties in post-war Iraq, it was a major challenge to establish a residency program in RO. Despite the significant difficulties, the first residency program leading to board certification in RO was successfully started in Iraq. The new specialists will help in addressing the shortage of radiation oncologists in the country.

© 2019 The Author(s). Published by Elsevier B.V. on behalf of European Society for Radiotherapy and Oncology. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Background

Radiation Oncology (RO) is the discipline of clinical medicine that uses ionizing radiation, either alone or in combination with other modalities, for the treatment of patients with malignant

diseases (mostly) or non-malignant conditions (occasionally). This specialty can be practiced as an independent oncology specialty or may be integrated into the broader medical practice of clinical oncology with the use of systemic therapies to enhance the effectiveness of radiation in a multi-modality setting [1].

In Iraq, the first establishment of radiotherapy services dates back to the 1920s when the Radiology Institute was established in Baghdad [2]. This institute was the only place in Iraq that was offering diagnostic and therapeutic radiation services until the late 1950s, when a deep X-ray therapy unit was installed in Mosul in 1959. The establishment of the Oncology and Nuclear Medicine

\* Corresponding author.

E-mail addresses: [LMulaHussain@AOL.com](mailto:LMulaHussain@AOL.com) (L. Mula-Hussain), [akhtar\\_samand@yahoo.fr](mailto:akhtar_samand@yahoo.fr) (A.N. Shamsaldin), [malghazi@uci.edu](mailto:malghazi@uci.edu) (M. Al-Ghazi), [hawzheen.a@gmail.com](mailto:hawzheen.a@gmail.com) (H.A. Muhammad), [salramahi92@kfshrc.edu.sa](mailto:salramahi92@kfshrc.edu.sa) (S. Wadi-Ramahi), [rabbie.hanna@me.com](mailto:rabbie.hanna@me.com) (R.K. Hanna), [abdulla.alhasso@ggc.scot.nhs.uk](mailto:abdulla.alhasso@ggc.scot.nhs.uk) (A. Alhasso).

Institute in Baghdad was in 1969, and in Mosul and in Basra, it was in 1978 [3].

Despite the early initiatives in the last century, there is still a deficiency in the number of qualified radiation oncologist physicians (ROP) in Iraq. The annual statistical report of the federal Ministry of Health in 2017 indicated that the number of all physicians in Iraq is 31,451 of whom 11,585 are specialists. Of those, 76 were clinical or ROP for approximately 38 million population (an average of 2 ROP per million population) [4]. This is 1/5 of the international recommendations on consultant staffing of 10 ROP per million population [5]. Beside this, there is shortage in the functional Mega-Voltage Machines (MVM) across the country, which is 18 MVM in total in the whole country [6] (about 35% of the minimal ideal MVM, which is about 50 in this country, based on the recommendation from the International Atomic Energy Agency (IAEA) for the need of one machine per 500 new cancer cases in any country [7] and the estimated cancer new cases in 2018 was about 25 thousands [8]).

In Iraq, the term “clinical oncologist” is used in lieu of radiation oncologist, following the British training system. The Iraqi pioneers in this field completed their specialty training programs in the United Kingdom (UK), mostly with the Diploma in Medical Radio-Therapy (DMRT) and few of them with the Fellowship of Royal College of Radiologists (FRCR). Similar to the British 2-year DMRT program, the College of Medicine – University of Baghdad established the first specialty program in Iraq (2-year DMRT) in 1985 [3].

There were attempts to establish advanced radiation/clinical oncology programs for a longer period of time culminating in board certification. The first attempt was in the late 1980s by the Iraqi Board for Medical Specializations (IBMS) but was not successful. Another attempt was also done by IBMS in late 2002, with a plan to have part of the study requirements in Iraq and part outside. An entry examination was arranged in early 2003 and the plan was to start in October 2003. Due to war in Iraq in March 2003, this did not materialize [3].

Decade after the last war, third attempt was successful in establishing the first board-certified RO specialty program in this war-torn nation. We believe that this experience is noteworthy, and it can serve as a model for other developing unstable nations.

## 2. Materials and methods

Descriptive report of the challenges, steps, opportunities, and outcomes associated with this work.

## 3. Results

### 3.1. Challenges and baseline status

#### I. Recognition of the challenges:

The challenges in establishing a board-certified RO program in Iraq can be due to, and not limited to, lack or insufficiency of, 1) qualified board-certified trainers “clinician scientists” in RO, 2) clinical training centers, 3) modern equipment with required maintenance, 4) quality assurance measures in RO, 6) academic education, accreditation and certification, 6) administrative support, 7) financial support, 8) political and security stability, 9) scientific and professional isolation, 10) cumbersome bureaucratic processes.

#### II. Baseline status of the RO center:

Zhianawa Cancer Center (ZCC) [formerly known as Slemani Radiation Oncology Center] is a public, tertiary cancer care facility dedicated for radiotherapy, established in 2009. By early-2013, it

became equipped with two modern linear accelerators, wide-bore CT simulator and a treatment planning system. ZCC services are free-of-charge and open to all Iraqis [9]. At the beginning, there were two clinical oncologists (qualified with DMRT) and 6 residents (in uncategorized service in RO). The residents were able to manage cancer patients as they gained experience gradually under the mentorship of local staff and some visitors from Italy, UK, and USA, coupled with short training courses abroad and self-studies. ZCC patients' load increased from 165 in 2009 gradually to 655 in 2012 [9]. These residents needed structured academic and practical guidance and oversight in order to proceed to practice independently.

### 3.2. Overcoming the challenges

#### PART I: Setting Up The Bases of The Structured Program:

##### I. Contract agreement with an external qualified ROP:

Due to many war-related challenges in this country (and mainly due to absence of qualified ROP and the board-certified program), the first step was to choose a person who is board-certified externally and qualified to lead the effort of establishing such a program locally. To achieve this goal, ZCC in Sulaimani (360 km north-east to Baghdad and 200 km east to Erbil. Fig. 1) started to contact external trainers during the initial years of the new millennium. Eventually, officials from the regional Ministry of Health signed a 4-year contract with an external trainer.

##### II. Accreditations:

ZCC then was accredited by the Kurdistan Board of Medical Specialties (KBMS) to be a training center in RO, which followed by another accreditation by the College of Medicine – University of Sulaimani (UoS) for its 3-year Master of Science (MSc) program in RO (for those who already have a minimum of one-year training in RO).

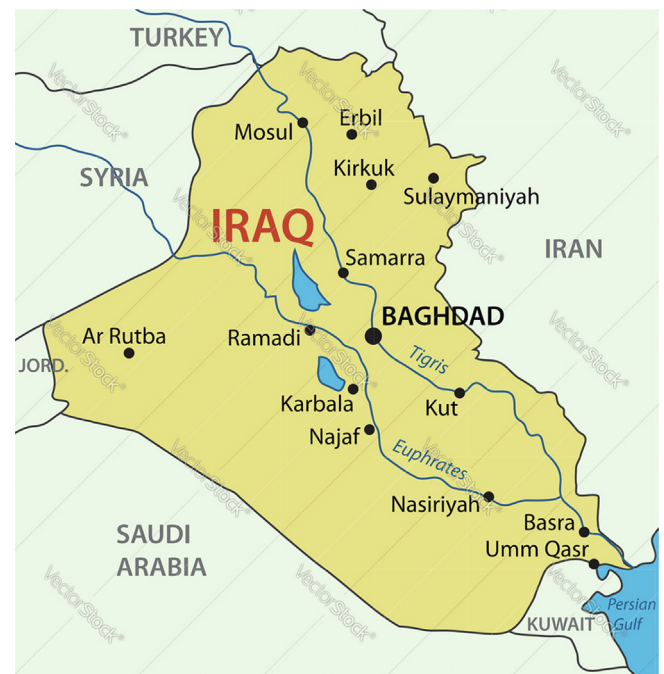


Fig. 1. Sulaimani (Sulaymaniyah) and its relation to the federal capital (Baghdad) and the regional capital (Erbil), north east of Iraq.

### III. Definition, mission and vision:

A four-year residency program, during which, the trainee acquires knowledge in oncologic science and gains clinical experience in RO [10]. Alternative pathway, is the 3-year MSc program in RO (for those who already have a minimum of one-year training in RO).

The mission is to serve patients, the public, and the medical profession by certifying that the diplomates have acquired, demonstrated, and maintained the requisite standard of knowledge, skill, understanding, and performance essential to the safe and competent practice of RO.

The vision is to have advanced safety and quality in healthcare by setting definitive professional standards for RO [10].

### IV. Training and study syllabus:

The syllabus was devised using well-structured resources in clinical RO programs, including the IAEA Syllabus endorsed by the American Society of Therapeutic Radiology and Oncology (ASTRO) and the European Society for Therapeutic Radiology and Oncology (ESTRO), the Royal College of Radiology (RCR) in the UK, Royal Australian and New Zealand College of Radiologists (RANZCR), CanMEDS Framework of the Royal College of Physicians and Surgeons of Canada (RCPSC), and the American Board of Radiology (ABR) [10].

There was a total of 10 disciplines (modules), with 100 credits over four years in the KBMS board program (and 75 credits over three years in the UofS MSc program). The credits are summarized in Table 1.

### V. Admission and academic requirements:

The main admission requirements are: Graduation from a recognized medical school, practice license by the Kurdistan Medical Syndicate, and completion of a clinical internship. Proficiency in English language and computer literacy are also required. Applicants must pass the entry examination and a personal interview [10].

Trainees must attend the assigned didactic and clinical activities as advised by the mentor and must keep training logbooks. Each trainee is required to publish a paper in a peer-review journal and/or complete a research thesis. Trainees are expected to attain

expertise in clinical skills, communication, inter-disciplinary collaboration, patient advocacy, didactic knowledge and professionalism [10].

### VI. Clinical training and rotations (major and minor):

Under supervision, residents rotate in four groups, two residents each, sequentially. Each major rotation is of three months' duration in RO and is repeated three to four times during the course of study with increasing independence granted to residents as their skills develop. These groups, color coded for simplicity, were: green team for cancers of head and neck, central nervous system and skin; purple team for gastro-intestinal, genitourinary and gynecological cancers; pink team for breast and pediatric cancers; and blue team for lymphoma, leukemia, thoracic and musculo-skeletal cancers. During each rotation, the resident pass through: new-patients' clinic, on-treatment clinic, post-treatment "follow up" clinic, simulation techniques, volumes' contouring and plan evaluation sessions [10].

Minor rotations were arranged too, each of two to four weeks duration, in diagnostic radiology, tumor pathology, medical oncology, surgical oncology, palliative care and in cancer research. The fourth year (in the KBMS board program) is flexible amongst disease sites and to finish the academic requirements and prepare for the exit examination.

### VII. Evaluation, promotion and examination:

A regular evaluation (a written examination and oral assessment) was arranged at the end of each clinical rotation and each didactic course. Annual evaluation (written examination and practical assessment) was arranged at the end of each year of training. On-campus (at the training center) and an annual report was sent to the KBMS and UofS about the promotion of the trainee to the next year. Part one examination was conducted at the KBMS and UofS head-quarters after successful completion of the first year. The final examination was conducted at the KBMS and UofS head-quarters upon successful completion of the fourth (third year for the UofS MSc). A major guideline for assessment is to see if the candidate demonstrate the ability to practice safely and independently. This examination consisted of two written exams (over two days) and an oral practical examination (by external examiners).

**Table 1**  
Academic disciplines, didactic and practical hours, and equivalent credits.

	Academic Disciplines (Modules)	Didactic hours	Practical hours	Credits* (Didactic/Practice)
1.	Cancer biology and radiation biology	45 (1st Year)	0	3
2.	Medical Physics	45 (1st Year)	135 (1st–2nd Year)	6 (3 + 3)
3.	Medical Statistics/Research Methods/Cancer Epidemiology	45 (1st Year)	0	3
4.	Onco-Pharmacology	30 (1st Year)	0	2
5.	Radiological Anatomy and Diagnostic Oncology	30 (1st Year)	45 (1st Year)	3 (2 + 1)
6.	Tumor Pathology and Laboratory	30 (1st Year)	45 (1st Year)	3 (2 + 1)
7.	Medical Oncology	30 (2nd Year)	90 (2nd Year)	4 (2 + 2)
8.	Surgical Oncology	15 (2nd Year)	45 (2nd Year)	2 (1 + 1)
9.	Clinical Radiation Oncology	75 (1st–3rd Year)	2655** (All years)	64 (5 + 59)
10.	Academic work	30 (3rd Year)	360 (3rd Year)	10 (2 + 8)
		<b>375</b>	<b>3375</b>	<b>100 (25D + 75P)</b>

#### Notes:

- \*1 Credit equals 15 didactic hours (1 h/week for 15 weeks) or 45 practical hours (3 h/week for 15 weeks);
- \*\*2655 h distributed as 500, 750, 750 & 555 annual hours during 1st, 2nd, 3rd & 4th year, respectively.
- 100 credits for the 4-year KBMS board program and 75 credit for the 3-year UofS MSc program (Similarly 375 didactic hours, with correspondingly proportionate practical hours).

### VIII. Specialty certificates:

KBMS awards successful trainees the title of “Fellow of KBMS” (post-nominal “FKBMS”) [10]. UofS awards MSc in RO.

#### PART II: Collaborative Adjunctive Opportunities:

##### I. Internal academic assistance:

RO practice is closely related to many basic and clinical sciences. Based on the syllabus [10], contact with local academics at UofS was arranged in order to cover the required subjects. All of them enthusiastically helped in covering the syllabus.

##### II. International individual assistance:

Individual contacts with colleagues in different disciplines and countries were made to arrange short professional visits to ZCC. This proved to be successful. Many colleagues (in medical physics, RO, clinical oncology, surgical oncology, and gynecologic oncology) from different countries (Jordan, Saudi Arabia, UK, USA, Canada, and Italy) visited ZCC and spent days to weeks working with the team of mentors and residents.

##### III. Global institutional networking:

Considerable efforts were made to establish external outreach with international centers and organizations. Memoranda of Understanding (MoU) were arranged with centers in Turkey, India, USA and Canada. ZCC obtained membership of the largest global umbrella for cancer control, Union for International Cancer Control (UICC), making it the first in Iraq.

##### IV. ACR-in training examination:

In an endeavor to standardize our training program in-line with international programs in developed countries, the American College of Radiology (ACR) allowed our residents to enroll in its annual ACR in-training examination in March 2017. Seven of ZCC residents sat the examination at the same day as their peers in USA. They did well in general, even one of them passed his peers' mean in USA.

##### V. Scientific meetings and courses

In order to further improve evidence-based, multi-disciplinary approaches to cancer care, ZCC was successful in arranging four international activities [9].

- Multi-Disciplinary Oncology Course series in Iraq (February 2015) covering general cancer care, 5 days course attended by 206 attendees.
- Best of ASTRO Iraq meeting (December 2015) officially licensed by ASTRO and covered best abstracts from the 2015 annual ASTRO meeting, with 197 attendees.
- Multi-Disciplinary Oncology Course series in Iraq, second course, in September 2016, covering gynecologic oncology, over two days, attended by 227 attendees.
- Best of ASTRO Iraq meeting (May 2017), officially licensed by ASTRO and covered best abstracts from the 2016 annual ASTRO meeting, and attended by 152 attendees.

In addition to attendance and benefiting from the scientific opportunities of these events, our residents presented their work and played organizational and leadership roles.

### VI. Online education and tele-medicine tools:

Some of the residents in our program were able to further improve their educational knowledge through accessing ESTRO School FALCON courses (Fellowship in Anatomic deLineation and CONtouring). One of our residents who participated in this international course in 2017, came first among all the international participants and was acknowledged by IAEA during the International Conference in Advanced Radiation Oncology in Vienna, June 2017.

### VII. Quality and safety culture:

A culture of quality and safety is fostered at ZCC. All residents, physicists, therapists and other staff are encouraged to report any incidents or accidents during daily work. An emphasis on double and triple check is the norm to improve the safety and quality of patient care. This includes, but not limited to contours and plan check, treatment delivery and the entire patient care process.

### VIII. External training opportunities:

Official encouragement and support were always available to advance the knowledge of our residents. Some of the residents participated in a palliative care course organized locally by an international expert. Other residents were able to be at international clinical attachments for weeks to months at advanced centers in the UK and USA.

### IX. Research promotion and collaboration

Simultaneously and in parallel with the education and clinical training program, research activities were supported. During the period, 2013–2018, ZCC residents and staff accomplished 2 books, 7 theses, 10 peer-reviewed manuscripts, 19 oral presentations (5 were international) and 17 poster international presentations (Table 2). ZCC hosted an international student from the University of Toronto for few weeks in 2017 to assist in the research activities of our residents.

### X. Local funding and supporting opportunities:

Civil society, non-governmental organizations, private sector and philanthropic individuals in Sulaimani and across Iraq were approached to help the training center and its educational programs and scientific activities. This proved to be helpful to ZCC in furthering its clinical and educational mission.

## 4. Discussion

This is the first detailed report of the establishment of a board-certification residency program in RO in a war-torn country, Iraq with its related challenges, solutions and outcomes. To date (2019), six residents enrolled and successfully completed its requirements (four from 2013 to 2017 and two from 2014 to 2018). Another three residents enrolled in the MSc program in RO (from 2014 to 2017). The new nine specialists in RO are currently in service. The program is still running with two ongoing residents in its path.

While there is no obvious shortage in RO services and manpower in developed countries, many of the developing countries suffer from severe shortage and those with unstable war-related countries may suffer more. Datta et al. reported in 2014 that only 4 of 139 Low- and Middle-Income Countries (LMICs) have the req-

**Table 2**  
Scientific researches of the ZCC staff and residents during the period from 2013 to 2018 (2 books, 7 theses, 10 manuscripts, 19 oral presentations and 17 poster presentations).

Books	Titles	Year, Country
1.	Wilms' tumor: survival point of view from Middle-East	2017, Germany
2.	Breast Cancer in Young Women: Extensive Review with Middle-Eastern Experience of hundred survivors from Sulaymaniyah (Kurdistan – Iraq)	2015, Germany
Theses	Titles	Year, Affiliation
1.	Trends of geriatric radiotherapy in a war-torn country: single institute experience from Iraq	2017, UofS
2.	Brain Metastases from Breast Cancer, Molecular impact and Risk factors	2017, KBMS
3.	Hodgkin Lymphoma in Childhood: Clinico-pathological features and therapy outcomes at single center facility in Developing Country	2017, KBMS
4.	Treatment outcomes of paediatric Ewing sarcoma patients in single center in Sulaimani Governorate	2017, UofS
5.	Characterizing patients with non-small cell lung cancer with brain metastases, prognostic factors and survival outcome	2017, UofS
6.	Mode of presentations of Sulaimani's laryngeal cancer patients at Zhanawa Cancer Center (6-year single radiotherapy facility experience)	2017, KBMS
7.	Survival of Wilms' tumor patients: A single institutional experience in the Middle-East	2017, KBMS
Manuscripts	Titles	Year, Journal
1.	Treatment outcomes of pediatric patients with Ewing sarcoma in a war-torn nation: single institute experience from Iraq	2018, JGO
2.	Adult Lymphoma in the Province of Sulaimani: Demography, Histology and Treatment Plans	2018, JSMC
3.	Stage Distribution and Patient Response Post Neo-adjuvant Short Course Radiotherapy in Rectal Cancer, Single center study	2018, JSMC
4.	Geriatric radiotherapy in a war-torn country: Experience from Iraq	2018, JGO
5.	Oncology in Iraq's Kurdish Region: Navigating Cancer, War & Displacement	2017, JGO
6.	Cancer in a war-torn Arab community – Iraq: description of its trends	2015, ACCESS Health Journal
7.	Undergraduate Oncology Education – mini review with single institute experience	2015, ACCESS Health Journal
8.	Treatment of contralateral axillary metastases: palliative vs curative dilemma	2014, AHO
9.	Afro Middle East Asian symposium on cancer cooperation	2014, SAJC
10.	Rights of the cancer patients in the Arab communities: Challenges & Optimisms	2013, ACCESS Health Journal
Oral Presentations	Titles	Year, Country
1.	Displaced Cancer Patients in the Kurdish Region of Iraq: War, Financial Toxicity, & Movement	2017, Lebanon
2.	Dermato-Oncology: Where do we stand?	2017, Iraq
3.	Skin and radiotherapy: benefits and toxicities	2017, Iraq
4.	Onco-Endocrinology: radiation oncology point of view	2017, Iraq
5.	Spinal tumors: radiation oncology point of view	2017, Iraq
6.	Management of genito-urinary tumors: radiation oncology point of view	2016, Iraq
7.	Gynecological cancers: palliative care point of view	2016, Iraq
8.	Management of gastro-intestinal cancers: radiation oncology point of view	2016, Iraq
9.	Improving cancer control through education – Establishing the 1st radiation oncology board program in Iraq	2016, Australia
10.	Management of pediatric malignancies: radiation oncology point of view	2016, Iraq
11.	Management of cardiovascular & thoracic tumors: radiation oncology point of view	2016, Iraq
12.	Palliative Radiotherapy	2015, Iraq
13.	Management of skin cancers: radiation oncology point of view	2015, Iraq
14.	Promoting radiotherapy quality adapted to socio-economic diversity: Experiences from Iraq	2015, Monaco
15.	Needs and Requirements of Establishing Palliative Care Facility in Kurdistan	2015, Iraq
16.	Undergraduate Oncology Education – mini review with single institute experience	2015, Oman
17.	Cancer in a war-torn Arab community – Iraq: description of its trends	2015, Oman
18.	Concepts of Palliative and Supportive Oncology	2013, Iraq
19.	Radiotherapy in the management of breast cancer "refreshing review"	2013, Iraq
Poster presentations	Titles	Year, Country
1.	Treatment Outcomes of Pediatric Ewing Sarcoma Patients in a War-Torn Country: Single Institute Experience from Iraq	2018, Japan
2.	Hodgkin Lymphoma in Childhood: Clinico-Pathological Features and Treatment Outcomes (Single Center Experience in the Middle-East)	2018, Japan
3.	Financial toxicity associated with conflict-induced cross-border travel for cancer care: Experience of Iraqi patients in Lebanon	2018, USA
4.	Wilms' Tumor in a war-torn nation: 10-year single institution experience from Iraq	2018, Spain
5.	Impact of international networking on advancing radiation oncology training in a war-torn country – experience from Iraq	2017, Austria
6.	Challenges and solutions, advantages and disadvantages of launching 1st 3-Dimensional brachytherapy in a developing war-torn country (Iraq) using Co-60 High Dose Rate (HDR) source	2017, Austria
7.	Feasibility of 27 Gray in 5 daily fractions adjuvant radiotherapy in breast cancer ladies – 1st report from an Iraqi institution	2017, Austria
8.	Challenges and solutions of establishing advanced radiation oncology services in low and middle income (LMI) countries	2017, Austria
9.	Three years of practicing Intensity Modulated Radiation Therapy (IMRT) in a war-torn country – 1st report from an Iraqi institution	2017, Austria
10.	Geriatric Radiotherapy: Single Institute experience from Iraq	2017, Algeria
11.	Palliative radiotherapy in advanced lung cancer: An Iraqi 5-year single institution experience	2015, USA
12.	Establishing postgraduate study program in radiation oncology in a war-torn country – The Iraqi experience	2015, Spain
13.	Conquering Cancer through Undergraduate Medical Education in a War-Torn Country: Initiative Experience from Iraq	2014, Australia
14.	Palliative Radiotherapy to metastatic Breast and Lung cancers in the Middle East region: 5 years' experience at a tertiary center in Iraq	2014, USA
15.	Palliative Radiotherapy in War-Torn Country: 5 Years' Experience at a Tertiary Center in Iraq	2014, Canada
16.	Palliative Radiotherapy to Bone and Brain Metastases in the Middle East region: 5 years' experience at a tertiary center in Iraq	2014, Canada
17.	Metastatic Breast and Lung cancers: radiation oncology point of view	2014, Lebanon



uisite number of tele-therapy units, and 55 (39.5%) have no RO facilities. Patient access to radiation therapy in the remaining 80 LMICs ranges from 2.3% to 98.8% (median: 36.7%). By 2020, these 84 LMICs would additionally need 12,149 ROP [11]. In Iraq, there is only 35% of the ideal RO MVM and 20% of the ideal ROP. This need in MVM and ROP will increase in the future due to population growth.

As many professionals left the country since the 1990s onward, it was thus impossible to establish an advanced (board-level) program in this field without the availability of a single board-certified ROP locally. Due to many war-related challenges in this country, the first step was to choose a person who is board-certified externally and is qualified to lead the effort of establishing such a program locally. A contract agreement of 4-year period was signed in January 2013 between a qualified ROP from abroad and the health authorities locally.

RO requires well-trained personnel. Investment in personnel should precede that in equipment, to achieve a satisfactory outcome. Based on this principle, the organizing team realized this at the start and they achieved the requirements before starting to accept the residents in the training program. Accreditation by the authorities was in place and acceptance of candidates was thorough. The program had the required checks and balances to ascertain a satisfactory outcome.

While Iraq, a member of the Arab League Council, and many of its teaching hospitals are recognized training centers by the Arab Board of Health Specializations (ABHS) in many of the medical specialties, there is no uniform residency training program in RO at the ABHS. Despite this, there are many national formal education and training programs for ROs in several countries in the Arab region (e.g. Egypt, Jordan, Lebanon, Saudi Arabia, Tunisia, Sudan, and Algeria, etc). In Iraq, RO specialty programs started in 1985 with DMRT. Board certification programs in Iraq were launched in medical oncology in 2012 by the IBMS in Baghdad, and in RO in 2013 by the KBMS in Sulaimani.

After beginning the program in 2013, new cancer cases almost doubled compared to 2012. Registry reported 1040 in 2013 (compared to 655 in 2012). This increased gradually to 1155 in 2015. In addition to baseline 3D conformal radiotherapy (3DCRT), more services started after launching the program in ZCC such as Intensity Modulated Radiation Therapy (IMRT) and High Dose Rate (HDR) brachytherapy, both for the first time in Iraq.

For the length of the structured training, we opted to make it full-time four years in RO, following the ABR and RCPSC. Due to administrative logistics and the need to increase the acceptance but keeping the quality, we designed an alternative pathway of specialty through UofS and arranged another program of full-time three years course of study leading to the MSc degree for those who already have one year of uncategorized training in RO. For the latter, we followed well-established syllabi adopted from institutions such as the IAEA<sup>1</sup>, RCR (UK) and the Tata Memorial hospital (India).

The main challenge that we faced in Iraq was the lack of qualified expertise in RO. Despite that, a special agreement with an external mentor was arranged to ensure success of the project. The success of this program was significantly driven by the high level of enthusiasm of all those involved, including trainees, as well as other personnel from the academics and leadership of the institutions involved.

Other challenges were limited administrative and financial support, and absence of educational allowances. The political situation and the terrorist activities in the near-by region (Mosul, Tikrit and Kirkuk) had also a significant challenge, by decreasing the salaries

for the staff and the residents' (at least 30% drop in monthly salaries during the period from 2014 through 2018). All of the above, in addition to the cumbersome bureaucratic processes, delays in the expansion of ZCC facilities (to satisfy patients' needs), and delays in the repair of the treatment machines. Despite all these challenges, the program continued.

## 5. Conclusions

A mountain of challenges had to be overcome in order to establish the residency program. Perseverance paid off as it became the first board-certification program in RO established in Iraq in 2013. Nine physicians (including two female doctors) successfully completed ZCC specialty programs in RO in 2017–2018. Six with the 4-year board KBMS program and three with the 3-year MSc UofS program. At present, they are serving six Iraqi governorates (Sulaimani, Erbil, Duhok, Halabja, Kirkuk and Mosul) with a combined population of over ten million.

ZCC was successful in its vision and it achieved the mission with its bridging program. ZCC staff are transitioning from being general certified ROP to being site-specific ROP, whereby each specialist is responsible for 2–3 sites to further master their expertise. The program is still running with two ongoing residents in its path.

It took a team of local professionals and a global collaboration with medical institutions dedicated to the elevation of standard of cancer care to have this success story. We believe that many countries that are similarly coming out of war can pull this effort also. This experience can be duplicated to other under-served developing countries if the minimum requirements are available.

## Declaration of Competing Interest

None.

## Acknowledgement

Many individuals and organizations contributed to the success of this project. The names are too numerous to list here. To all of them, we express our sincere appreciation.

## References

- [1] IAEA. IAEA syllabus for the education and training of radiation oncologists. 1st ed. Vienna: International Atomic Energy Agency – IAEA; 2009.
- [2] Al-Ghazi M. Cancer care in a war zone: radiation oncology in Iraq. *Int J Radiat Oncol Biol Phys* 2016;96:E413.
- [3] Mula-Hussain L. Cancer care in Iraq: a descriptive study. 1st ed. Saarbrücken-Germany: LAP LAMBERT Academic Publishing; 2012.
- [4] Ministry of Health/Environment. 2017 annual statistical report. Baghdad: Ministry of Health/Environment; 2018.
- [5] International Atomic Energy Agency. Planning national radiotherapy services: A practical tool. Vienna: International Atomic Energy Agency; 2010.
- [6] IAEA. DIRAC (Directory of Radiotherapy centres). <https://dirac.iaea.org/Query/Countries>. Updated 2018. Accessed 11/29, 2018.
- [7] IAEA. Setting up a radiotherapy programme: clinical, medical physics, radiation protection and safety aspects. Vienna: International Atomic Energy Agency – IAEA; 2008.
- [8] Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2018;68(6):394–424.
- [9] Zhihawa Cancer Center. Zhihawa cancer center. <http://www.zhihawa.org/>. Updated 2017. Accessed July/25, 2018.
- [10] Mula-Hussain L. Training handbook of the Kurdistan board in radiation oncology. 1st ed. Sulaimani: Kurdistan Board of Medical Specialties; 2013.
- [11] Datta NR, Samiei M, Bodis S. Radiation therapy infrastructure and human resources in low- and middle-income countries: present status and projections for 2020. *Int J Radiat Oncol Biol Phys* 2014;89(3):448–57.