Advances in Radiation Oncology (2024) 9, 101354

advances in radiation oncology

www.advancesradonc.org

Critical Review

Radiation Oncology in the Philippines: Current State and Future Directions

Thomas Vincent T. Vergara, MD,* Timothy Micah C. Chua, MD, Katrina Marie G. Santi, MD, Juan Martin J. Magsanoc, MD, Angela Peña-Camacho, MD, Gaudencio P. Vega, MD, and Miriam Joy C. Calaguas, MD

Department of Radiation Oncology, St. Luke's Medical Center - Global City, Taguig City, Philippines

Received 31 March 2023; accepted 7 August 2023

Purpose: As global cancer incidence continues to rise, low- to middle-income countries like the Philippines are projected to experience a disproportionate increase in cancer burden, further straining already limited resources. Radiation therapy (RT) is an essential and cost-effective modality in cancer care, both in the curative and palliative settings. In this article, we provide a brief narrative on the history of the field of radiation oncology in the Philippines and review the current challenges to effective and equitable RT service delivery in the country.

Methods and Materials: We gathered data from the official websites of the Philippine government's health and statistics agencies, the Philippine Radiation Oncology Society, and the Directory of Radiotherapy Centers of the International Atomic Energy Agency, to review available human and infrastructure resources related to RT delivery in the country. Using the 6 health care dimensions of the World Health Organization's Building Blocks of Health Systems framework, we identified barriers to access and proposed possible initiatives for development.

Results: Despite the remarkable growth of radiation oncology in the country in the past 2 decades, many challenges remain in the areas of human resources, infrastructure, policymaking, health economics, education, and service delivery. Radiation health workers and facilities are concentrated in the National Capital Region, limiting accessibility in rural areas. Out-of-pocket spending on RT-related expenditures remains high. The proper allocation of resources according to varying regional needs is impeded by the lack of a robust national cancer registry. Legislative reforms have been initiated but have yet to be fully implemented.

Conclusions: Addressing these gaps in RT access will require in-depth study and multi-sectoral commitment aimed at establishing and implementing a nationwide framework for RT service delivery that can be readily adapted to varying regional needs. Despite many complex geographic, social, and economic obstacles, efforts by private and public sectors of society to provide ready access to RT services for all Filipinos continue to gain momentum.

Introduction

By 2040, the global cancer burden is expected to rise to 28.4 million cases, an increase of 47% from 2020, with low- to middle-income countries experiencing a disproportionately greater increase in cancer incidence.[1] In the Philippines, a Southeast Asian nation comprising 7107 is-lands with a population of 112 million, the cancer burden has continued to rise. In 2020, a total of 153,751 new cases were reported. Deaths from cancer have increased from 53,601 in 2013 to 92,606 in 2020.[2,3]

Sources of support: This work had no specific funding.

*Corresponding author: Thomas Vincent T. Vergara, MD; E-mail: thomasvincentvergara@gmail.com

https://doi.org/10.1016/j.adro.2023.101354

Radiation therapy (RT) is a cost-effective and integral component of cancer services throughout the world, both in the curative and palliative settings. In 2019, the Philippines had 3.6 external beam RT machines per 10,000 patients with cancer.[4] In 2012, it was estimated that the country had an 80.5% unmet need for RT services.[5]

In this article, we aim to present an overview of the history of radiation oncology (RO) in the Philippines, discuss barriers to providing equitable access to RT services, and highlight opportunities for the growth and improvement of RT services in the country.[3]

Looking Back: A History of Radiation Oncology in the Philippines

As early as 1910, a little more than a decade after Roentgen's momentous discovery of x-rays, radiation was already being used in the Philippines for therapeutic purposes when the Department of X- Ray and Electro-therapeutics was established at the Philippine General Hospital (PGH). During those early days, a list of machines in the department included Snook x-ray tubes, Coolidge tubes, and a radium emanation room. The department's first chairman was Dr Ricardo Fernandez, who led it for more than 2 decades. In 1937, he was succeeded by Dr Paterno Chikiamco, who returned to the country after having undergone training in France under 2 pioneering giants in the field of radiobiology and RT: Claudius Regaud and Henri Coutard. Dr Chikiamco was a driving force in cancer therapy in the country pre—World War II, and went on to chair the department until 1971.[6-8]

Growing public interest and concern about cancer prompted the Philippine National Assembly in 1938 to enact legislation establishing a cancer institute, with the goal of promoting, coordinating, and regulating all activities related to cancer in the country.[9] This led to the inauguration of the Institute of X-Ray and Radium Therapy at PGH in 1941. However, it was the Manila Doctors Hospital, a private institution, which obtained the first operational Co-60 teletherapy unit in the country in 1955. Two teletherapy units (Co-60 and Cs-137 teletherapy units) arrived at the PGH in 1962.[6] The first linear accelerator was set up at the Philippine Lung Center in 1963.[8] However, as early as 1956, the Institute at PGH was already performing about 16,000 x-ray treatments in a year; by the 1970s, it was treating a total of 100 to 120 patients per day.

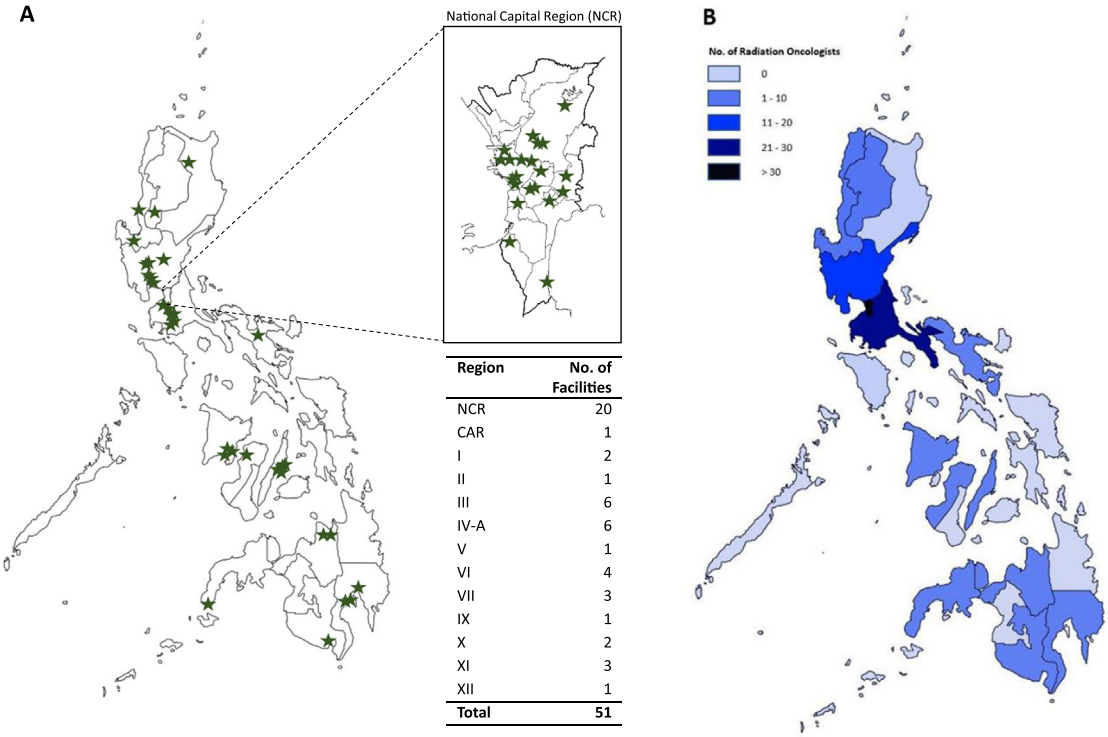
In 1948, with the country still in the process of rebuilding after World War II, 7 pioneering radiologists came together to establish the Philippine Radiologic Society. Their goal was to create an organization that would promote and strengthen the specialty field of radiology — encompassing both diagnostic radiology and RT — for future generations of practitioners. Dr Chikiamco became its first president. In 1970, the Philippine Radiologic Society was renamed the Philippine College of Radiology.[6,10]

It was in 1963 that the International Atomic Energy Agency (IAEA) sent Dr Harold Cook, a medical physicist (MP) from the United Kingdom, to train Luciano Niguidula, then an engineer in the radiology department at PGH, in radiation dosimetry and treatment planning. He went on to become the first Filipino MP.[11] In 1986, the Philippine Organization of Medical Physicists was established. It was restructured and renamed the Society of Medical Physicists in the Republic of the Philippines in 2016.[12]

From its beginnings up until the 1980s, interest in the therapeutic applications of x-ray among Filipino radiologists was limited, and there had been only a handful of practicing radiation oncologists. In 1976, this small group of practitioners formed the Radiotherapy Interest Group, which in 1988 evolved into the Philippine Radiation Oncology Society (PROS), a subspecialty society under Philippine College of Radiology. Its objectives included promoting the practice of RO and enhancing the quality of training and education in the country.[8] Through the initiatives of its leaders and members, the growth of PROS gained momentum in the 1990s and 2000s: the number of RT facilities grew, paralleled by an increase in the number of practicing radiation oncologists. A formal fellowship program in RO was established for graduates of radiology or internal medicine residency programs. By 2004, a 4-year straight residency program was introduced. At present, there are 112 practicing radiation oncologists distributed in 51 facilities throughout the country (Fig. 1A).[13]

Identifying and Overcoming Barriers to Equal Access to RT

Despite many positive milestones in recent decades, access to RT services in the country is still plagued by systemic barriers, as evidenced by an IAEA report that estimated the national RT utilization rate (the ratio of new patients treated with RT in a year to the total number of patients with cancer diagnosed in the same year) to be as low as 10.3%,[5] though approximately 50% of all patients with cancer will require radiation.[14] This is a complex, multifactorial problem related to deficits in the country's overall health care system.[15] Decision makers need to critically assess the country's current capabilities and deficiencies and then develop a well-planned national framework for RT service delivery. However, in regions where RT services are critically insufficient, urgent needs must be balanced against careful, slow resource planning. Start-up packages for basic RT services can be initiated where crucial services are unavailable, while decision makers establish a more comprehensive plan.[14] Table 1 lists the major barriers to equitable RT access and service delivery using the World Health Organization Building Blocks of Health Systems framework.[16]



Region	No. of Facilities
NCR	20
CAR	1
I	2
II	1
III	6
IV-A	6
V	1
VI	4
VII	3
IX	1
X	2
XI	3
XII	1
Total	**51**

Figure 1 Distribution of radiation therapy facilities and radiation oncologists in the Philippines in 2022. (A) Radiation therapy facility (star); nearly half of all facilities are located in the National Capital Region (inset). (B) Density of radiation oncologists by region; distinct land masses were considered separately from their respective region.

Leadership and governance

State initiatives

Two landmark legislations that have positively affected cancer care and RT services in the country were passed in 2019: Republic Act 11223,[17] the Universal Health Care Act, and Republic Act 11215,[18] the National Integrated Cancer Control Act (NICCA). The former mandates enrollment of all Filipinos in the National Health Insurance Program, and the latter addresses the need for a robust national cancer care program. The NICCA recognizes cancer as a leading cause of death among Filipinos and aims to adopt an integrated and comprehensive approach to cancer care, making cancer care more equitable for all Filipinos and improving survivorship by increasing initiatives and investments for screening, prevention, and treatment. A key provision mandates establishing a National Integrated Cancer Control Council.

These state initiatives are important steps forward in the national fight against cancer, the success of which not only depends on medical expertise and technological progress, but also on effective social mobilization and strong political will. However, 3 years into its passage, the NICCA has yet to be fully implemented.

Professional organizations

The various initiatives of the PROS aim to promote the practice of RO in the country, establish international collaboration, and enhance training and education. Its regular activities include annual certifying examinations for graduates of RO programs; accreditation of residency training programs; biannual national conventions; periodic scientific meetings and in-service examinations for residents in training; and active collaboration with local, regional, and international societies including the Federation of Asian Organizations for Radiation Oncology and the South East Asian Radiation Oncology Group. Through active leadership and engagement with policymakers, the PROS can play a pivotal role in the national fight against cancer, by strengthening its advocacy for and involvement in the creation of a comprehensive nationwide RT service delivery framework.

Health workforce

There exists a general shortage of radiation health workers in the country that will only be amplified as more regional cancer care centers are established. Academic and training institutions must anticipate and be ready to supply growing demands in the workforce. Those willing to render services in remote locations can be given priority for acceptance in training positions and offered attractive incentives. Another crucial challenge is improving retention rates among workers through better compensation and benefits, to counter the "brain drain" resulting

Table 1 Barriers to access and proposed initiatives

Health care dimension*	Barriers	Possible initiatives
Health workforce	Shortage of radiation health workers	Strengthen recruitment initiatives
		Standardize training for RO, MP, RTT
	Training	Increase the number of training institutions
		Broaden health worker capabilities/skills
		Subsidies for training of radiation health workers
	Compensation	Revise, update, and standardize compensation schemes for radiation health workers
Medical products and technologies	Inadequate RT facilities	Establish regional cancer care centers as provided in RA 11215
	Uneven geographic distribution of specialized or advanced RT technology	Perform a national audit of RT services and regional needs assessment
		Establish a comprehensive nationwide RT service delivery framework and plan
		Create a streamlined referral network among RT facilities and cancer centers
Health care financing	Inadequate population coverage under the NHIP	Increase population coverage under the NHIP as mandated by law (RA 11223)
	High out-of-pocket expenditure	Expand benefit packages and update case rates under the NHIP
Information	Lack of a national cancer registry	Establish national and hospital-based cancer registries, as mandated by law (RA 11215)
		Public investment in health IT systems and medical records for data gathering
	Limited public awareness on cancer: stigma and fear of radiation	Intensify public cancer awareness programs through education initiatives/campaigns
	Lack of knowledge and undervaluing of RT among other health care professionals	Greater presence of RO in undergraduate medical curricula
		Increase opportunities for clinical exposure to RO and RT during undergraduate training
		Intensify continuing medical education initiatives
	Lack of national CPGs for many common malignancies	Advocacy and engagement in developing, updating, and promoting CPGs for common malignancies
		Active collaboration of PROS with guideline-issuing bodies
Leadership and governance	Lack of a robust national cancer control program	Thorough implementation of RA 11215 National Integrated Cancer Control Act
		Active involvement and advocacy of PROS in consultations with policy-makers
Service delivery	Uneven distribution of RT facilities	Establish regional cancer care centers as provided in RA 11215 (see Medical products and technologies)
	Complicated health care system	Establish a national patient navigation program/system for patients with cancer

Abbreviations: CPG = clinical practice guidelines; IT = information technology; MP = medical physicist; NHIP = National Health Insurance Program; PROS = Philippine Radiation Oncology Society; RA (Republic Act) 11215 = National Integrated Control Act; RA 11223 = Universal Health Care Act; RO = radiation oncology/oncologist; RT = radiation therapy; RTT = radiation therapist.

* World Health Organization Building Blocks of Health Systems

from migration of these professionals to countries offering better opportunities.

Radiation oncologists

The number of certified ROs in the country increased by more than 70% between 2015 and 2022.[8] Each of the 9 residency training programs produce an average of 1 to 2 graduates per year. The newest training program, accredited in 2019, is the first training institution located outside the National Capital Region (NCR). The prescribed basic curriculum for residency training aligns with the IAEA Syllabus for the Education and Training of Radiation Oncologists endorsed by American Society for Radiation Oncology and European Society for Radiotherapy and Oncology.[19] Despite encouraging growth, there are only 0.1 Filipino ROs per 100,000 population, far fewer than the recommended 1 per 100,000.[20] Furthermore, more than half of all ROs spend all or part of their clinical practice in NCR (Fig. 1B), paralleling the distribution of RT facilities in the country. As a result, it is not unusual for 1 RO to practice in 3 to 5 facilities to meet the demands of the workforce. Despite increased interest in residency training in RO among medical graduates and strong competition for positions, most training institutions accept only 1 to 2 applicants each year because of the limited number of operational RT facilities that can accommodate the graduates of their programs. As more regional cancer care centers open in succeeding years, residency training institutions need to evaluate and adjust their programs to meet increasing demands.

MPs

The shortage of radiation oncology medical physicists (ROMPs) is another crucial constraint. There are 103 working ROMPs in the country presently. A recommended number of MPs for basic RT services is 3 to 4 per center.[20] Assuming equal distribution among all facilities in the country, there are only 2 MPs available for each facility. Furthermore, there are no more than 20 MPs who are certified by the board of medical physics. A requirement to be a certified medical physicist in radiation oncology medical physics (CMP-ROMP) is a masters-level degree in medical physics. Only 1 educational institution in the country offers this degree at present. The demand for CMP-ROMPs, which is expected to grow further in the next decade, can only be met by strengthened recruitment and retention initiatives, increased training capabilities—including the development of more undergraduate- and graduate-level programs in medical physics—and close collaboration between professionals, the government, the academe, and health care institutions.

RT technologists and RO nurses

RT technologists (RTT) are required to have an undergraduate degree in radiologic technology and to pass the licensure examination issued by the board of radiologic technology. Although there are regulations setting the minimum number of RTTs per facility based on the number of machines,[21] the distribution and workload of the estimated 200+ active RTTs in the country need to be studied. At present, no formal certification for radiologic technologists specializing in RT exists, although RTTs are required to have undergone 6 months of training in a therapeutic x-ray facility under the supervision of a senior RTT and CMP-ROMP.[21] The formalization of standards for the education, training, and certification of RTTs, as distinct from diagnostic radiologic technologists, must be prioritized. Likewise, no formal training or professional organizations exist for Filipino RO nurses, and their role as an important resource remains unexplored and untapped.

RT infrastructure and technology

There were 61 Megavoltage (MV) units (56 linear accelerators, 4 Co-60 teletherapy units, 1 gamma knife radiosurgery unit) distributed in 51 RT facilities around the country in 2022 (Fig. 1A). The number of RT facilities has more than doubled since 2015, when there were only 22.[8] Thirty-seven facilities (73%) are intensity modulated RT (IMRT)—capable, while only 12 (24%) and 9 (18%) centers perform Stereotactic Radiosurgery (SRS) and Stereotactic Body Radiation Therapy (SBRT), respectively. Twenty six facilities (51%) offer High Dose-Rate (HDR) brachytherapy. Eighteen of these (69%) can perform 3-dimensional imageguided brachytherapy. Three facilities can perform Intra-Operative Radiotherpy (IORT).

The majority of facilities are situated in highly urbanized centers. In fact, 40% are located within the NCR, when it comprises only about 10% of the national population. Four of the 17 administrative regions that comprise the country do not have a single regional RT facility or in-house RO (Fig. 1A and 1B).

Limitations in RT infrastructure can only be adequately addressed if national and regional needs are assessed, a strategic national plan is formulated, and resources are carefully allocated. Furthermore, rapid technical and scientific progress threaten to widen the gap in RT accessibility between developed and developing nations and also within developing countries where rural areas often have little to no access to even the most basic services.[15] Decision makers should adopt a framework that ensures that advanced RT technologies and techniques that may benefit Filipinos are made available in spite of the resource-limited setting.[22]

Health financing and economics

Health care in the country is provided through a dual health delivery system comprising the public and private sectors. The country's current health expenditure (CHE)

reached $17.13 billion in 2020, 12.6% higher than in 2019.[23] Although government expenditure for the health sector has increased consistently since 2005, it has been eclipsed by private sector funding sources, which have grown rapidly with the country's economy. Furthermore, the majority of RT facilities are located in private facilities, where health care is generally paid for through user fees at the point of service. Although enrollment in the National Health Insurance Program under the Philippine Health Insurance Corporation or PhilHealth has been reported to be as high as 92%, its share in health care expenditure averages only 30%, and out-of-pocket payments remain an important source of health financing in the country.[24] In 2020, 44.7% of CHE came from out-of-pocket payments. In the same year, the country spent $891.59 million on cancer health care (5.2% of CHE), a dramatic increase from previous trends (annual health spending on cancer averaged $336.33 million in 2014-2019, representing 2.78% of CHE during the same period). This represents a growth rate of 140.8% from 2019 to 2020,[23] likely attributable to the stimulus offered by the passage of the NICCA in 2019. This law ensures greater allocation of funds from the national budget to the Department of Health's cancer program and establishes a cancer assistance fund. It likewise mandates health maintenance organizations to cover genetic counseling and testing, cancer screening, diagnostics, palliative care, and certain therapeutics for member employees. In 2021, the Philippine government allocated $13.3 million of its annual budget for its cancer control program, which includes $2.94 million for the cancer assistance fund.

As of 2022, PhilHealth coverage is about $57 per fraction for 3D-Conformal Radiotherapy (3DCRT) and $109 per fraction for IMRT. However, private facilities can charge up to $189 per fraction of IMRT. Costs exceeding PhilHealth coverage are paid out-of-pocket, on top of other expenditures such as doctors' fees, transportation, medicines, and so forth.

Though tasked to address important issues in national health care financing through full implementation of the Universal Health Care Act, PhilHealth has in recent years been beset with alleged financial mismanagement and bureaucratic inefficiency.[25] Furthermore, to keep up with ever-rising costs, its cancer benefit packages need to be regularly expanded and updated to increase coverage and reduce out-of- pocket spending for basic and advanced RT services.

Information and education

National cancer registry

Establishing a nationwide cancer registry, as mandated by the NICCA, will ensure that public policy, fund appropriation, infrastructure development, and manpower distribution are based on actual national and regional needs. Investment in health information technology systems and medical records for data gathering is vital.

Awareness

Public awareness of cancer must be increased through intensified educational initiatives. Cancer screening and preventive measures are vital and cost-effective strategies in the success of any national cancer program. A lack of knowledge or undervaluing of RT among health care professionals because of limited educational and/or clinical exposure to RO can be a barrier to prompt referral of patients.[14,26] In the academe, advocacy for a stronger presence of RO in undergraduate medical curricula is crucial. Greater opportunities for clinical exposure to RO during the undergraduate training of physicians, MPs, and RTTs can mitigate ignorance about the field and increase interest among potential recruits. The creation of multidisciplinary teams and active involvement of ROs in them will facilitate better awareness of the role of RT among non-ROs and improve the overall quality of cancer care.

Practice standards

The creation and promotion of up-to-date, evidence-based, local clinical practice guidelines on the management of common malignancies, taking into account the unique Philippine health care context, can be an important initiative of the PROS in collaboration with other cancer specialty societies. These can promote best practices within the field and efficiently improve the overall quality of RT services. Policy and planning must be grounded on evidence, and establishing evidence-based standards of care prevents the inappropriate and wasteful allocation of already limited resources.[14]

Service delivery

Shortages in RT infrastructure and manpower are complicated by the uneven geographic distribution of resources, putting at a disadvantage low-income Filipino patients in rural areas, for whom even the cost of transportation to urbanized centers with RT facilities is often prohibitive, on top of their actual health care expenditure. Referral networks that link all levels of health care to RT services can be created to minimize the current gaps in the infrastructure. A streamlined referral system among existing RT facilities and cancer centers is crucial in providing RT services in far-flung regions. The potential of telemedicine as a first step for triaging and initial assessment must be maximized. Those receiving treatment away from home should be provided access to transportation and housing assistance, when necessary.[26] Finally, patients may find the bureaucratic health care infrastructure in the country too complicated to navigate themselves, putting them at a further disadvantage. A national patient navigation service for patients with cancer must be made available.

Conclusion

From humble beginnings, the field of RO in the Philippines has grown to be an integral component of cancer care for Filipinos. Despite many barriers, efforts to provide quality RT services by private and public sectors of society continue to gain momentum. In a country where basic primary health care still remains out of reach for a significant number of citizens, inequalities in access to specialized services like RT are even starker. The road to bringing adequate coverage for RT services to Filipinos is beset by complex geographic, economic, social, and political obstacles. Addressing these issues will require in-depth study and multisectoral commitment to the establishment and implementation of a nationwide framework for RT service delivery that guarantees that advances in the field of cancer care and RT become accessible to all Filipinos.

Disclosures

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.

References

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2021;71:209-249.
2. Department of Health, Epidemiology Bureau. The 2013 Philippine health statistics. Available at: https://doh.gov.ph/sites/default/files/publications/2013PHScompressed_0.pdf. Accessed May 26, 2022.
3. International Agency for Research on Cancer. Cancer today: Data visualization tools for exploring the global cancer burden in 2020. Available at: https://gco.iarc.fr/today. Accessed May 16, 2022.
4. World Health Organization. Cancer Philippines 2020 country profile. Available at: https://www.who.int/publications/m/item/cancer-phl-2020. Accessed May 16, 2022.
5. Rosenblatt E, Fidarova E, Zubizarreta EH, et al. Radiotherapy utilization in developing countries: An IAEA study. *Radiother Oncol*. 2018;128:400-405.
6. Monzon O, Manalaysay L, Villacorta E, Nievera E, Danguilan J, eds. *The Filipino as a radiologist: The story of a profession, the history of an organization*. Quezon City: Philippine College of Radiology; 1999.
7. University of the Philippines College of Medicine. Radiology. Available at: https://cm.upm.edu.ph/p/radiology/. Accessed May 26, 2022.
8. Cañal JPA, Limkin EJC. Radiation therapy in the Philippines: A challenge in resourcefulness. *Int J Radiat Oncol Biol Phys*. 2016;94:7-10.
9. GOVPH. Commonwealth Act No. 398. Available at: https://www.officialgazette.gov.ph/1938/09/07/commonwealth-act-no-398/. Accessed May 26, 2022.
10. Philippine College of Radiology. About us. Available at: https://philippinecollegeofradiology.org.ph/about-us/. Accessed May 17, 2022.
11. Peralta A, Rodriguez L, San Juan BC. Medical physics in the Republic of the Philippines. *Med Phys Int J*. 2020;8:51-55.
12. Wong JDH, Ng KH, Haryanto F, et al. South-East Asian Federation of Organizations for Medical Physics (SEAFOMP) — Celebrating 20th anniversary of formation. *Med Phys Int J*. 2020;8:32-38.
13. International Atomic Energy Agency (IAEA). Directory of radiotherapy centres. Available at: https://dirac.iaea.org/Query/Countries. Accessed May 19, 2022.
14. Atun R, Jaffray DA, Barton MB, et al. Expanding global access to radiotherapy. *Lancet Oncol*. 2015;16:1153-1186.
15. Calaguas MJC, Gubat JA. South East Asia, differing socioeconomic factors, differing access to radiotherapy: The Philippines, a microcosm. *Semin Radiat Oncol*. 2017;27:176-183.
16. World Health Organization. Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies. Available at: https://apps.who.int/iris/handle/10665/258734. Accessed May 26, 2022.
17. GOVPH. Republic Act No. 11223. Available at: https://www.officialgazette.gov.ph/2019/02/20/republic-act-no-11223/. Accessed May 26, 2022.
18. GOVPH. Republic Act No. 11215. Available at: https://www.officialgazette.gov.ph/2019/02/14/republic-act-no-11215/. Accessed May 26, 2022.
19. International Atomic Energy Agency. IAEA syllabus for the education and training of radiation oncologists, training course series no. 36. Available at: https://www.iaea.org/publications/8159/iaea-syllabus-for-the-education-and-training-of-radiation-oncologists. Accessed May 26, 2022.
20. International Atomic Energy Agency. Planning national radiotherapy services: A practical tool, human health series no. 14. Available at: https://www.iaea.org/publications/8419/planning-national-radiotherapy-services-a-practical-tool. Accessed May 19, 2022.
21. Department of Health. Requirements for the operation of a therapeutic x-ray facility utilizing medical linear accelerators, admin. ord. 2013-0031 (Oct. 11 2013) (Phil.). Available at: https://www.fda.gov.ph/administrative-order-no-2013-0031-requirements-for-the-operation-of-a-therapeutic-x-ray-facility-utilizing-medical-linear-accelerators/. Accessed May 26, 2022.
22. Brown DW, Shulman A, Hudson A, et al. A framework for the implementation of new radiation therapy technologies and treatment techniques in low-income countries. *Phys Med*. 2014;30:791-798.
23. Philippine Statistics Authority. 2020. Philippine health accounts. Available at: https://psa.gov.ph/publication/philippine-national-health-account. Accessed Aug 31, 2023.
24. Dayrit MM, Lagrada LP, Picazo OF, Pons MC, Villaverde MC. The Philippines health system review. *Health Syst Transit*. 2018;8.
25. Philippine Daily Inquirer. PhilHealth hike amid corruption. Available at: https://opinion.inquirer.net/153095/philhealth-hike-amid-corruption#ixzz7UGEC5zCF. Accessed May 25, 2022.
26. Elmore SNC, Grover S, Bourque J-M, et al. Global palliative radiotherapy: A framework to improve access in resource-constrained settings. *Ann Palliat Med*. 2019;8:274-284.