

Medical Physics in Nepal: A Narrative on its Development

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Abstract — As mentioned by International Organization of Medical Physics, Medical physicists are professionals with education and specialist training in the concepts and techniques of applying physics in medicine. Medical physicists working in clinical environment are health professionals, with education and specialist training in the concepts and techniques of applying physics in medicine, competent to practice independently. The ratio of medical physicist in Nepal is less than 0.65 per million inhabitants and still does not have medical physics education and training program. Since 2008, after obtaining a membership of IAEA, the turning point of recognition of role and responsibilities of medical physicists ensued in Nepal. The main accomplishments include Radioactive Materials Uses and Regulatory Act has materialized effective as of July 2020. This has created a path for recognition, role and responsibilities of medical physicists in Nepal.

Keywords— Act, Medical Physicist, Radioactive Materials,

I. INTRODUCTION

Federal Democratic Republic of Nepal, is landlocked, and borders with China in the north and India in the south, east and west, a country in South Asia. It is also known as a country of Himalayas. Demographic information of Nepal is shown in Table 1.

Table 1. GDP per capita, number of MPs, population and MPs per million populations in Nepal

Area	GDP	Per Capita income	Population in million	No. of MPs	MPs per million
1,47,516 Sq km	\$29.813 billion (in 2019)	USD 1,048.00	29.0	19	0.65

In Nepal, radiological services with first X-ray was started way back in 1923. Similarly, first radiation therapy was started in 1976 with Brachytherapy service (Radium Needle). In 1988, CT scan and Nuclear Medicine as the first such technology of its kind was introduced at the NAMS, Bir Hospital. That was the beginning of introduction of medical physicists in Nepal. History of Radiation emanating used in Nepal is shown in Table 2.

Table 2. History of Radiation Equipment in Nepal

Year	Equipment	Center
1923	First X-ray	Tri-ChandraElectroMedical.
1976	First Brachytherapy(Radium)	Paropakar MaternityHospital.
1988	First CT scan	NAMS, Bir Hospital
1988	First Nuclear Medicine	NAMS, Bir Hospital
1991	First Radiotherapy(Cobalt60)	NAMS, Bir Hospital
2002	First Linear Accelerator	B.P.K.M. Cancer Hospital
2002	First HDR Brachytherapy	B.P.K.M. Cancer Hospital
2015	First Blood Irradiator	Civil Servent Hospital

In 1987, Dr. Gauri Shanker Pant, medical physicist from All India Institute of Medical Sciences (AIIMS), Delhi was sent to Nepal to start and run the nuclear medicine imaging service at NAMS, Bir hospital by the Indian government. Later Dr. Pant was also volunteered in establishing Cobalt-60 and trained Nepal’s first medical physicist Mr. P.P Chaurasia, who was recruited for the job of Medical Physicist. In 1989, first medical physicist post was created at Bir Hospital, just before introducing first radiation therapy service unit with a Tele Cobalt-60 machine in Nepal. This means, we are celebrating thirty years of medical physics in Nepal.

In 2002, B.P. Koirala Memorial Cancer Hospital introduced first Linear Accelerator and HDR Brachytherapy service in the country, which has paved the way for more medical physicist positions in the country. In 2004, 2005 & 2006 NAMS, Bir hospital, has been assigned different projects to find out status of radiation protection and inventory of radioactive sources being used in Nepal by then Ministry of Science & Technology of Nepal, under the secretary-ship of Dr. Kanchan P Adhikari, medical physicist. Final report of those projects has recommend to the government of Nepal to acquire a membership of International Atomic Energy Agency (IAEA) and to establish radiation regulatory system in the country.

In, 2009, Nepalese Association of Medical Physicist (NAMP) was established to improve medical physics practice with a goal of patient safety for the medical use of radiation in radiology, nuclear medicine and radiation therapy. Since then, NAMP was affiliated to International Organization for Medical Physics (IOMP) and Asia-Oceania

Federation of Organizations for Medical Physics (AFOMP). In 2010, NAMP became one of a charter member organizations of the International Medical Physics Certification Board (IMPCB). Members of NAMP have been involved as a committee member of AFOMP's and IMPCB's various committees. Around ten members of NAMP has been awarded travel grants from IOMP/AFOMP to attend IOMP/AFOMP conferences or seminars till date. Current executive committee members of the Nepalese Association of Medical Physicists (NAMP) is shown in table 3.

Table 3. Professional Society Establishments

Year Established	First President	First Secretary General	Members Male/Female
2009	Pradhuman Pd. Chaurasia	Dr. Kanchan P Adhikari	18 Male 0 Female

II. PRESENT STATUS & ISSUES

The ratio of medical physicist in Nepal is less than 0.65 per million inhabitants. At present, Nepal has seven radiotherapy centers; three public, one semi-public and three private that accommodate almost all the physicists.

Table 4. Distribution of Medical Physicists

Discipline	Total
Radiotherapy	17*
Nuclear Medicine	0
Radiology /Academic	1
Private Company	1
Total	19

*including three physicists from India, working at two private centers.

Nepal has yet to have any official data regarding the number of radiation emanating equipment being used at different facilities in the country. Reliable records of the number of the radiological facilities in operation were lacking, until a few years ago, when the Ministry of Education, Science & Technology (MoEST) provided an opportunity to a few professionals including this scribe to make an inventory of radiation emanating equipment being used in Nepal. The number of diagnostic and therapeutic

equipment being used in Nepal are shown in Table 5.

Table 5. Medical Imaging and Radiation Therapy Equipment

Equipment	Total	Equipment Per million inhabitants
Cobalt-60	2	0.07
Linear Accelerator	5 (+1)	0.21
HDR Brachytherapy	6 (-2)	0.14
X-ray	1000 +	35.60
CT Scan/ CT Simulator	100 +	3.56
MRI	46	1.59
Mammogram	15 +	0.53
Gamma Camera	3	0.11
PET/CT	2	0.07
Blood Irradiator	1	0.03

In Nepal, medical physics professional is yet to be regulated by government/competent authority. We still do not have licensing and registration system for medical physicist. There is also lack of medical physics position in government system. Ministry of Health & Population of Nepal has yet to create medical physics positions. Though Medical physicists are one of the key components in radiation oncology and plays a vital role in improving cancer cure through technology, the rules and regulation regarding medical physics services are still lacking. About 60% of the cancer cases worldwide occur in low and middle income countries but however, the existing infrastructure is far behind to cope successfully with the increasing threat not only to public health but also national economies. Modern radiation therapy treatments require trained and qualified professionals and big capital investment. However, Nepal does not benefit from this advancement due to lack of sufficient number of radiotherapy machines and insufficient number of specialized medical physicists.

III. EDUCATION AND TRAINING

Nepal still does not have medical physics education and training program. Efforts have been done to start post graduate course in medical physics in Nepal but the desired result is yet to be seen. One IAEA expert mission was conducted in Nepal under IAEA / RAS project entitled RAS6088 Non-Agreement Project - Strengthening Education and Clinical Training Programmes for Medical Physicists. Prof. Kwan Hoon Ng was the expert and visited Nepal on June 2019 to recommend the further steps to be taken to

materialize proposed academic program in Nepal. NAMS, Bir Hospital is the counterpart institution with a MD Program in Diagnostic Radiology and Radiation Oncology. NAMS, Bir Hospital also runs graduate and post graduate program in medical imaging technology for radiological technology. SWOT analysis was carried out to give balanced perspective of this initiative. Physicists from government centers have been participating in fellowship and education and training program in various IAEA/RCA projects which includes strengthening education and training program of medical physics. Nepal is Participating various on IAEA/RCA Regional Projects which is focused on Medical Physics in the Asia Pacific Region which includes

1. RAS6077 RCA Project - Strengthening the effectiveness and extent of medical physics education and training
2. RAS6087 RCA Project - Enhancing Medical Physics Services in Developing Standards, Education and Training through Regional Cooperation
3. RAS6088 Non-Agreement Project - Strengthening Education and Clinical Training Programmes for Medical Physicists

In the meantime, IAEA is also supporting Nepalese candidates to peruse Post Graduate course on Advanced studies in medical physics program from International Center for Theoretical Physics (ICTP), Trieste, Italy. Until now, four candidates have been graduated and currently one candidate is studying at ICTP under IAEA fellowship program. Currently, one medical physicist is pursuing PhD in medical physics through sandwich program.

IV. WAY FORWARD

Since 2008, after obtaining a membership of IAEA, the turning point of recognition of role and responsibilities of medical physicists ensued in Nepal. The main accomplishments include Radioactive Materials Uses and Regulatory Act has materialized effective as of July 2020. The finalized draft for minimum standards required for operating diagnostic radiology and nuclear medicine facility has already been completed through Ministry of Education Science & Technology (MoEST) with an active participation of medical physicist. Once it is carried out, role and responsibilities of medical physicists and NAMP will be increased. Since 2012, Nepal has been involved in various Technical Cooperation (TC) projects associated with the IAEA with an active involvement of medical physicist from project designing to successful implementation of project as a national project counterpart (NPC). Therefore, the future of role and responsibilities of medical physicist as well as

NAMP in Nepal mainly depends on the infrastructure of a strong regulatory system and sustainable safety culture of radiation users. Despite all the challenges inherent, the author remains confident that recognition, role and responsibilities of medical physicists in Nepal will be enhanced and NAMP could play its active role in promoting this field.

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