

# MEDICAL PHYSICS IN BANGLADESH: EDUCATION, PROFESSION AND TRAINING

M. Akhtaruzzaman<sup>1</sup>, H. A. Azhari<sup>2, 3</sup>, G. A. Zakaria<sup>2, 3, 4</sup>

<sup>1</sup>Department of Medical Physics, Labaid Cancer Hospital, Dhaka, Bangladesh

<sup>2</sup>Department of Medical Physics and Biomedical Engineering, Gono Bishwabidyalay, Dhaka, Bangladesh

<sup>3</sup>South-Asia Centre of Medical Physics and Cancer Research, Dhaka, Bangladesh

<sup>4</sup>Department of Biomedical Engineering, Faculty EMW, Anhalt University of Applied Sciences, Koethen, Germany

**Abstract-** *The commencement of medical physics in Bangladesh has started in mid 90s. Over the last two decades, there has been an encouraging development. This paper includes a narrative discussions of medical physics education, profession and clinical training.*

**Keywords—**Medical Physics, Education, Profession and Training

## I. INTRODUCTION

Medical Physics in Bangladesh starts its journey in the mid-90s in cooperation with the Task Group 16 “Medical Physics in the Developing Countries” of the German Society for Medical Physics (DGMP). Five seminars/workshops were organized by the Task Group between 1996 and 2000 with 70-80 participants (physicists and radiation oncologists) every year at the Bangladesh University of Engineering and Technology (BUET) [1]. These were the beginning approach to introduce medical physics subject in Bangladesh by Bangladeshi born German Professor Dr. Golam Abu Zakaria. Since then he was trying to open a department in the public universities. However, it was not possible to open such a department in public universities for different reasons. Eventually, Gono Bishwabidyalay (GB) - a private university came forward to open a “Department of Medical Physics & Biomedical Engineering (MPBME)” in the collaboration with Germany in 2000. Later, Dhaka University and Khwaja Yunus Ali University started their M.Sc course in 2014.

For the professional development, a society called BMPA (Bangladesh Medical Physics Association) is formed in 1998. As BMPA is nonregistered society, so during process of registration a new name (society) instead of association is suggested from the government authority. Then, Bangladesh Medical Physics Society (BMPS) is formed and registered in 2009. However, BMPA also has been continuing its activities.

Medical physicists working in clinical environment are health professionals and training is mandatory to get competency. Medical physicists in Bangladesh has been trained through vendors, International Atomic Energy Commission (IAEA), collaboration with Germany etc.

South Asia Centre for Medical Physics and Cancer Research (SCMPCR) established in 2018 and has also been providing accredited hands on workshops and in-service training (2-3 per year) for the Medical Physicists.

In this article, academic programme, professional development and clinical training for Medical Physicists are discussed.

## II. ACADEMIC PROGRAMME

At present, three are three universities are offering medical physics education in Bangladesh. The details of educational structures are given in Table 1.

Table 1 Academic Programme offering by the universities

University	Course/Degree	Course Duration	Establishing Year
Gono Bishwabidyalay	MSc	2 Years (120 Credit Hours)	2000
	BSc	4 Years (192 Credit Hours)	2005
Dhaka University	MSc	1 Year (32 Credit Hours)	2014
Khwaja Yunus Ali University	MSc	1.5 Year (48 Credit Hours)	2014

However, the Gono Bishwabidyalay is the pioneer and playing vital role in this field. It offers M.Sc course in medical physics and biomedical engineering since 2000. This was the first attempt to develop full-fledged master course of international standard in GB in Bangladesh. It was quite difficult to find the students in this field in M.Sc course as this is a new field and also no governmental position in the hospitals. Considering this situation, B.Sc (Hons) course in medical physics and biomedical engineering is established in 2005. At present the total number of students is 250. The syllabus of these courses is based on the documents of DGMP, AAPM and IAEA [2]. The syllabus covered all areas of medical physics to have the possibilities for the students to work in hospitals as well as research institutes.

In the last semester of B.Sc (8 Semesters) and M.Sc (4 Semesters) has designed as project work (15 credits, duration 6 months) and thesis (30 credits, duration 6 months) respectively which are done in the hospitals and university. Project and thesis are supervised by academic and clinical supervisors and the defense examination is held at the university by an external examiner.

The department has collaboration with multiple institutions nationally and internationally. Since the inception of the department, the main obstacle was to find the faculty member in this field. So from the beginning of this department had a fruitful cooperation with German Cancer Research Center (DKFZ), Heidelberg University and Mannheim Medical Centre of Heidelberg University, Germany [1] through teacher and student exchange program with the financial support of DAAD (2003-2006 and 2014-2021). Collaboration with different institutes are shown in Table 2.

Table 2 Collaboration with the International Institutes

Institute	Country	Period
German Cancer Research Center, Heidelberg University	Germany	2003-2006
Manheim Medical Center, Heidelberg University	Germany	2014-2021
Anhalt University	Germany	Since 2002
Saroj Gupta Center and Research Institute	India	Since 2011
North Bengal Oncology Center	India	Since 2011
Jiliang University	China	Since 2016
Zhejiang Cancer Hospital	China	Since 2016

MPBME department has own laboratories for physics, IT, electronics, medical physics and biomedical engineering. However, some practical classes are held in different government & private hospitals and nuclear medicine centers. The department is frequently arrange seminars workshop, training with Bangladesh Atomic Energy Commission (BAEC) and Bangladesh Atomic Energy Regulatory Authority.

The MPBME department has received HEQEP (Higher Education quality enhancement project) jointly funded by Government and world bank implemented by University Grant Commission (UGC) for two years (2014-2016). Through this project this is the first time in Bangladesh Treatment Planning System (TPS) is installed in an university for teaching purpose and Quality Control (QC) Equipment) for different imaging technique like fluoroscopy, radiography, mammography, CT are purchased in the department. Also modernization of the class room, Laboratory Room and IT Room has been established.

### III. PROFESSIONAL SCOPE AND ACTIVITIES

Bangladesh, officially the People's Republic of Bangladesh, is a country in South Asia. It is the eighth-most populous country in the world, with a population exceeding 160 million people. Demographic information of Bangladesh is shown in Table 3 [3].

Table 3 GDP per capita, number of MPs, population and MPs per million populations in Bangladesh

Area	GDP	Per capita income	Population in million	No. of MPs	MPs per million
148,500 km <sup>2</sup>	\$317.8 billion (2020)	\$1,887.97	163 (2019)	83	0.51

The number of cancer patients equals 2000 out of 1,000,000 inhabitants per year. According to WHO, we need total 160 Centers, 320 LINACS, 600 Medical Physicists in RT sector for treatment of cancer and even more considering diagnostic centers [4]. However, the present situation is very far from the goal. The current status of medical imaging, nuclear medicine and radiation therapy equipment are illustrated in Table 4.

Table 4 Medical Imaging, Nuclear Medicine and Radiation Therapy Equipment

Equipment	Total	Equipment/Million population
Co-60 Teletherapy	11	0.067
Linear Accelerator	24	0.147
Brachytherapy	16	0.098
Simulator (X/CT)	19	0.116
Computed Tomography	340	2.08
Magnetic Resonance Imaging	270	1.65
Fluoroscopy/IR	530	3.25
General Radiography	1090	6.68
Mammography	9	0.055
SPECT/CT	10	0.061
Gamma Camera	50	0.306
PET-CT	8	0.049

In order to promote to establish medical physics, BMPA is formed in 1998. The main aim BMPA was to motivate physicists to become medical physicists. However, since its formation, there was no remarkable activities because of lack of medical physicist in Bangladesh at that time. Therefore, BMPS was formed and registered in 2009. Since its inception, BMPS has been playing the main role in various diversities such as medical physics education, professional standard, clinical training, creation in the hospital, organization of different national and

international organization of different national and international scientific conferences, workshop with collaboration with different institutions and societies, awareness in public sector etc.

BMPS arranges annual conference (ACBMPS) every year. It also organizes international seminar (every two years) in Radiation oncology and Imaging (ICMPROI), which were already occurred in 2011, 2014 and 2018. In addition, BMPS celebrate 7 November in each year by publishing e-newsletter (Voice of BMPS), rally, scientific seminar etc. Furthermore, a group of BMPS members involved in IOMP project titled "e-Encyclopaedia of Medical Physics and Multilingual Dictionary". Some examples of the international scientific events organized by the BMPS from 2011-2020 are shown in Table 5.

Table 5 Examples of international scientific events organized by the BMPS from 2011 – 2020

Date	Scientific Events	No. of Delegates
11-13 March 2011	1 <sup>st</sup> International Conference on Medical Physics in Radiation Oncology and Imaging	200
27 March 2012	International Workshop on Quality Control of CT-Simulator	20
22-26 June 2013	International Workshop on Radiation Oncology	25
20-22 August 2014	2 <sup>nd</sup> International Conference on Medical Physics in Radiation Oncology and Imaging	300
9 July 2015	International Seminar on Regulatory Aspects and Quality Control in Diagnostic Imaging and Radiotherapy Facilities	30
22 March 2016	International Seminar on Role of Medical Physicist in Cancer Treatment	40
28 Dec 2016- 31 Jan 2017	International Workshop on Radiation Therapy Treatment Planning and Quality Control of X-ray Imaging	40
10-12 March 2018	3 <sup>rd</sup> International Conference on Medical Physics in Radiation Oncology and Imaging	350

At present there is no any accredited hospital/ institute for residency program in all areas of medical physics i.e. radiotherapy, nuclear medicine, and diagnostic radiology in Bangladesh. According to the requirements of IOMP guidelines and IMPCB, two years professional training is required for certification programs. There is need of establishment of a training center or recognition of existing hospital/ institute for residency program.

International Medical Physics Certification Board (IMPCB) start their journey on 23<sup>rd</sup> May 2010, which is very promising to the countries like us where MPs are in the initial stage [5]. BMPS has already been started certification program to mark the achievements of clinical medical physicists as we have

sufficient candidate who have fulfilled the requirements in education and training in specific areas (RT/NM/DR). With that aim, BMPS was organized IMPCB part-I and part-II examinations on 13-14 March 2018 just after ICMPROI 2018. BMPS has accomplished the goal of the infrastructure, requirements and examination procedures for the certification of medical physicists by forming Bangladesh Medical Physics Certification Board (BMPCB) in accordance with the requirements of IMPCB guidelines. Certification programme for medical physicists will be started from 2021 with help of IMPCB.

Post creation and establishment of unified recruitment rules is a lengthy process. Post creation in the government hospitals are mandatory as newer technology radiotherapy machine, diagnostic equipment are purchased by these hospitals. In the meantime, BMPS quiet successful to make understand the present government about the importance and necessity of medical physicists in our country. Therefore, 12 positions have already been created in three different public hospitals and post creation for other public medical college and hospitals is in progress.

Public awareness can play a major role to accomplish the goal for continuous medical physics development. Regarding this many articles in newspapers, magazine are published in regular basis. Moreover, talk show, seminars are arranged in different schools, colleges for acquaintance with this subject.

#### IV. CLINICAL TRAINING AND CONTINUOUS PROFESSIONAL DEVELOPMENT

The MPBME department of GB has been playing a promising role for the clinical training and professional development as the medical physicists are produced mainly from here. After getting B.Scand M.Sc degree, students are placed for 3-6 months in different areas of Medical Physics at different hospitals in home and abroad. Under cooperation between Gono University, DKFZ and Heidelberg University, a considerable number of teachers, medical physicists have already been trained and more people will follow. Alternatively, 15 German teachers visited MPBME department to conduct courses.

Medical Physicists working in the hospitals are also get training through the vendors (as per contracts during procurement), IAEA etc. However, the country still experience a significant shortage of Qualified Medical Physicists (QMP) to run the established centers equipped with modern treatment facilities. This shortage has arisen due to the lack of structured residency program with clinical training, absence of accredited hospitals for the residency program and government policies for appointing clinical Medical Physicists.

South Asia Centre for Medical Physics and Cancer Research (SCMPCR) is a centre for Continuous Professional Development (CPD) and Training to fight against cancer in South Asia region. The main goal of SCMPCR is the capacity building of cancer professionals by the hands-on training program with the highly experienced international trainer [6]. SCMPCR organizes a series of International Organization of Medical Physics (IOMP) and European Board for Accreditation in Medical Physics (EBAMP) accredited hands on workshops and in-service training (2-3 per year) in collaboration with the several national and international organization and hospitals for cancer team professionals (Doctors, Medical Physicists, Nurses, and other providers). Until now, SCMPCR was arranged five hands-on training and E-learning programs for the cancer professionals of South Asia region (4 for medical physicists, 1 for radiation oncologists) as shown in Table 6. Also SCMPCR regularly publish newsletter twice a year [7].

Table 6 Examples of scientific events organized by the SCMPCR

Date	Scientific Events	No. of Delegates
4-6 October 2018	Hands-on Training: Dosimetry and Treatment Planning	20
17 November 2018	Hands-on Training: Target Volume Definition, Treatment Planning and Evaluation	17
7-9 March 2019	Hands-on Training: Basic and Advanced Treatment Techniques of the commissioning of a Linear Accelerator	20
2 - 4 October 2019	Hands-on Training: Dosimetry of Small Fields in External Beam Therapy: Reference and Relative Dose Determination	20
June-July; October 2020	E-learning: on Radiotherapy, Radiology	70

The trainers of those training programs came from Germany, Japan, India, Canada and Taiwan and Bangladesh. The training program of SCMPCR maintains the international standard and accredited by the international organization.

## V. CONCLUSION

Combination of Gono University, BMPS and SCMPCR has made a solid background for the medical physics education, profession and training in Bangladesh. However, for this highly populated country, other universities and organizations should come forward to build up more manpower and training facilities. Internal efforts supported by international cooperation, Bangladesh could attend a sustainable development in medical physics in the near future.

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## VII. REFERENCES

- [1] HasinAzhariAnupama, Golam Abu Zakaria, G. H. Hartmann (2008) Medical Physics Education in Bangladesh and Cooperation with Germany. WC IFMBE Proceedings 25/XII: 173–176.
- [2] G. H. Hartmann and G. A. Zakaria (2009). Status and Perspectives of Qualification in Radiation Oncology Physics in Bangladesh. O. Dössel and (Eds.): WC 2009, IFMBE Proceedings 25/XII, pp. 162–165.
- [3] [www.wikipedia.org](http://www.wikipedia.org)
- [4] [www.thedailystar.net/news-detail-205022](http://www.thedailystar.net/news-detail-205022)
- [5] [www.impcb.org/CM140712.htm](http://www.impcb.org/CM140712.htm)
- [6] [www.scmpcr.org](http://www.scmpcr.org)
- [7] <https://scmpcr.org/scmpcr-newsletter/>

*Corresponding author*

**MdAkhtaruzzaman, PhD**  
*General Secretary, BMPS*  
 &  
*Senior Medical Physicist*  
*Labaid Cancer Hospital*  
*Dhaka, Bangladesh*

*Email: akhzam@gmail.com*