

THE INTERNATIONAL MEDICAL PHYSICS CERTIFICATION BOARD (IMPCB): OBJECTIVES, HISTORY AND ACHIEVEMENTS IN THE FIRST DECADE

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Abstract— The International Medical Physics Certification Board (IMPCB) was formed in 2010 by eleven Charter Member Organizations to support medical physicists all over the world by defining minimum professional standards for, and improve the practice of, medical physics using international standards and guidelines provided by organizations such as IOMP and IAEA. This is to be achieved by establishing an accreditation program for national or regional Medical Physics Certification Boards and a certification scheme for individual medical physicists from or working in countries where no such boards exist.

IMPCB has accredited three national programs in the Asia Pacific region to date with an additional one imminent.

To achieve certification, individual candidates will be expected to have a degree in physics or equivalent, a higher degree in medical physics (or equivalent) and at least two years of clinical training in one of the medical physics specialties. The examination is conducted in three parts consisting of assessments in general medical physics, specialized medical physics (e.g., radiation oncology, diagnostic radiology or nuclear medicine physics) and an oral examination. By submission date more than 160 candidates have commenced their journey through the examination process with 25 candidates having been awarded full certification in radiation oncology medical physics and 2 in diagnostic imaging medical physics.

IMPCB offers a pathway to individual certification for medical physicists who have no other options. For existing certification boards it provides independent evaluation and accreditation with the assurance that the board's procedures and graduates are meeting international standards.

Keywords— Medical Physics, Accreditation, Board Certification, Standardization, Harmonization.

I. INTRODUCTION

Medical Physics is an increasingly important aspect of healthcare as medicine continues to benefit from advanced technology and techniques. This can be seen by the ever increasing number of medical physicists in the workforce(1) and the inclusion of Medical Physicists in the International Standard Classification of Occupations (ISCO-08) of the International Labor Organization (ILO) (https://www.iomp.org/wp-content/uploads/2019/02/iomp_guidance_on_isco-08.pdf).(2)

However, it continues to be difficult for non-medical physicists to identify persons who have the appropriate skills and competencies to work in one or more subspecialties of medical physics. This does not only affect services to patients but also impacts on careers and recognition of medical physicists. Not surprisingly, many countries and regions have established certification boards to define attributes that characterize medical physicists and standards by which they should operate. (3-6)

Internationally, the International Organization for Medical Physics (IOMP) has developed policies for roles of physicists and their education. (https://www.iomp.org/wp-content/uploads/2019/02/iomp_policy_statement_no_1_0.pdf; https://www.iomp.org/wp-content/uploads/2019/02/iomp_policy_statement_no_2_0.pdf)

In collaboration with IOMP, the International Atomic Energy Agency (IAEA) developed and published Guides on roles and responsibilities of medical physicists (7) and developed a syllabus for relevant academic (8) and clinical training programs for three major specialties in medical physics(9-11)

Linked to these developments the International Medical Physics Certification Board (IMPCB) was formed in 2010

by eleven Charter Member Organizations located in four continents. It was set up to support medical physicists all over the world by defining and assessing minimum professional standards for medical physics with the view of improving medical physics practice. This was made specifically in support of colleagues from countries where Certification schemes and Boards do not exist. The IMPCB activities are based on international standards and guidelines provided by organizations such as IOMP, ICRP and IAEA.

The present paper sets out to report on the first 10 years of IMPCB and its achievements to date. It also explores its role within the international field of medical physics in health care.

II. HISTORY

A brief sketch of the history of IMPCB is given in table 1. IMPCB was formed on May 23rd 2010. However, as one can see from the table, there were several important meetings and discussions held even before IMPCB was founded. Many of these activities originated in the US where similar discussions about the medical physics profession were held a few years earlier.(12, 13)

IMPCB was set up to define minimum professional standards for, and improve the practice of, medical physics using international standards and guidelines provided by organizations such as IOMP and IAEA. In particular, IOMP helped the formation of IMPCB by tasking the Professional Relations Committee (PRC) chaired by Kin Yin Cheung to study the feasibility of doing certification. As a result the PRC facilitated several meetings, which provided the impetus for the Charter Member Organizations to fund the formation and incorporation of IMPCB.

The involvement of IOMP became formalized in 2015 when a memorandum of understanding (MoU) was signed between IOMP and IMPCB at the IOMP Council meeting during the World Congress 2015 in Toronto. IOMP was designated the Principal Supporting Organization and it was agreed that three board members of IMPCB are to be elected by IOMP.

IMPCB objectives also include recommending infrastructure and procedures for accreditation of medical physics certification programs offered by national or regional certification boards as well as establishing the examination procedures for the certification of individual medical physicists by conducting examinations all over the world to assess competence of candidates in countries where no other certification boards exist. The latter is achieved by conducting examinations to test the competence of candidates and award certificates to deserving candidates.

Relatively early IMPCB developed a model program for certification (<https://www.impcb.org/model-program/>), which can serve as an example for a workable certification program and can guide others who would like to develop such a program. It specifies minimum requirements for persons to be certified in terms of

Education: graduation from an accredited college or university with an advanced degree (Masters or Doctorate) in physics, medical physics or an equivalent degree in an appropriate physical or engineering science discipline, and

Professional training: at least one year full-time equivalent training preceding the date of application for examination. Two years of clinical training are required for sitting the oral part of the examination and achieving full certification; however, IMPCB admits candidates with only one year of training to commence the process by sitting the first part of the exam. Training should be carried out under the supervision of a Certified Medical Physicist (CMP) specializing in the same sub-field or under the supervision of a qualified individual with a level of professional experience and expertise equivalent to that of a CMP.

Table 1 IMPCB time line

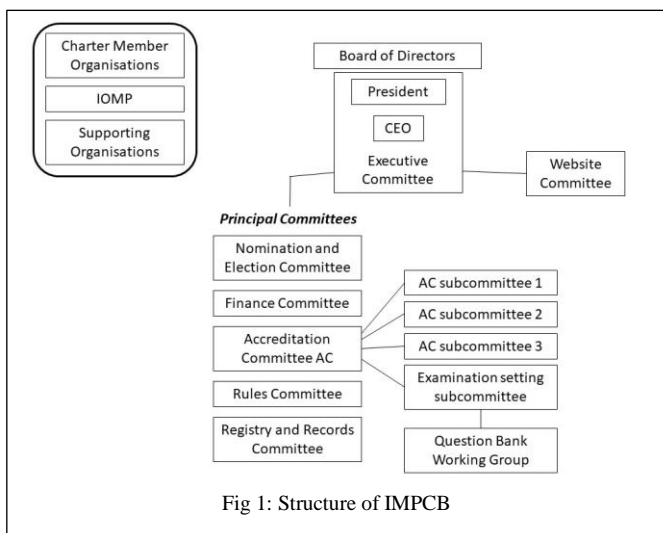
Year	Occasion	Event/Activity	Comment
2008	ACMP meeting, Seattle	Symposium: Certification of Experienced Clinical Medical Physicists	
2009	ACMP meeting, Virginia Beach	Symposium: Creating an International Medical Physics Certification Board	
2009	IOMP World Congress, Munich	IOMP task group to investigate establishment of an IMPCB	
2010	ACMP meeting, San Antonio	Establishment of IMPCB May 23, 2010	11 Charter Members: ABFM, ACMP, ACPSEM, CSMP, CSMPT, FMOFM, HKAMP, IMPS, KSMP, LAMP and NAMP
2011		Model certification program adopted	
2012		Bylaws adopted	
2014		Officers commence work	
2015		MoU between IOMP and IMPCB	Strengthening links between organizations
2015	Seoul, Korea	November 2015: first accredited certification board: KMPCB	Korean Medical Physics Certification Board
2017	ICTP, Trieste, Italy	April 2017: first written examinations for individuals	
2017	ICTP, Trieste, Italy	December 2017: first fully IMPCB certified individual	

The model program is based on a three-part examination:

- Part I Written Examination (General Medical Physics)
- Part II Written Examination (Medical Physics Specialty)
- Part III Oral Examination (Medical Physics Specialty) which requires candidates to have successfully passed Parts I and II

The model program also indicates the level of competence and rigor of examination expected of certification boards seeking accreditation from IMPCB which are reflected in a requirements document (https://www.impcb.org/wp-content/uploads/2017/01/IMPCB_requirements_V10b.pdf).

Figure 1 shows the structure of IMPCB. Five principal committees support the objectives of the organization with the Accreditation Committee (AC) being responsible for many of the actions, which will be described later in the manuscript. The AC itself is supported by four subcommittees, the first three of which are dedicated to the three parts of the examination program. The fourth, the Examination Setting Subcommittee is responsible for vetting the examination papers and linking to the candidates. The Examination Setting Subcommittee is itself supported by the Question Bank Working Group, which is the custodian of the actual questions used in the exam.



IMPCB’s remit is towards certification of individuals and accreditation of national or regional certification boards only. In parallel an accreditation scheme of medical physics academic and educational programs was developed by and is now offered by IOMP (<https://www.iomp.org/accreditation/>). IMPCB is working on making it a prerequisite of IMPCB accreditation of certification boards.

III. ACCREDITATION OF CERTIFICATION BOARDS

One of the underlying principles of IMPCB is that every suitably qualified medical physicist across the world should have access to a certification program that attests to others that they are competent to practice. As physics is identical all over the world, many if not most components of a certification program can also be expected to be the same. Based on this IMPCB offers an accreditation program for certification boards.

Applications for accreditation can be made at any time by existing national or regional certification boards or boards that have just been established. IMPCB is also providing support and advice to individuals who consider establishment of a board in their jurisdiction.



Fig 2: Celebration on the occasion of the IMPCB Accreditation of the Korean Medical Physics Certification Board in the National Assembly, Seoul, November 2015

An application for accreditation would include a detailed description of the certification body including terms of reference, structure and governance, requirements for examinations, all relevant documentation and list of office bearers with terms of office. IMPCB will also consider links to professional organizations, any other accreditations (such as IOMP) and the number of certified persons in each specialty. Whilst the legal/regulatory status of the national or regional certification (e.g., is it required to practice?) is not necessarily relevant for IMPCB accreditation, it is of considerable interest as it helps to promote the status of medical physics.

The evaluation panel consists of the members of the IMPCB Accreditation Committee plus the CEO of IMPCB. IMPCB will identify any conflicts of interest and if other outside expertise (relevant to such issues as contents, language and culture) is required to assess the application. Panel members will be asked to assess the application against the guidelines of the International Organization for

Medical Physics (IOMP), the contents of the model program, the requirements document and other applicable guidelines. The process will take approximately 3 months.

IMPCB has accredited three boards at present (Korean Medical Physics Certification Board (KMPCB), Hong Kong Institution of Physicists in Medicine (HKIPM) board and Hong Kong Association of Medical Physics (HKAMP) board) with two additional ones in progress. Figure 2 shows the celebration after accreditation of KMPCB in the National Assembly Hall in Seoul in November 2015.

IV. CERTIFICATION OF INDIVIDUALS

Certification of individuals commenced in April 2017 with an examination session at the International Centre for Theoretical Physics in Trieste (<https://www.ictp.it/>). ICTP runs jointly with the University of Trieste a Master of Advanced Studies in Medical Physics Program (accredited by IOMP) for medical physicists that is particularly aimed at low and middle income countries. This creates an environment that is attractive for IMPCB to offer examinations in and IMPCB has held examinations every year in Trieste.



Fig 3: Group photo taken during the IMPCB part I exam in Riyadh, February 2019

The certification examination for individuals follows the IMPCB model program with prerequisites of a Masters degree and at least two year practical experience, under the supervision of a qualified medical physicist. The examination is conducted in three parts as outlined above. The first two parts each consist of a hundred multiple choice written questions that allow for coverage of a broad range of topics in a standardized format. IMPCB has held 13 written examination sessions in 9 locations over three years. Figure 3 shows a group photo of candidates, local organizing committee and IMPCB examiners at the part I exam held in Riyadh, February 9, 2019.

In addition to the exams held at ICTP in Trieste, IMPCB aims to hold exams in conjunction with major conferences

to reduce costs. Applications for the examination were received from 47 countries representing 6 continents with African and Asian countries most frequently represented. Four countries had more than 10 applicants, three of them were hosting examinations. To date, 163 candidates have sat

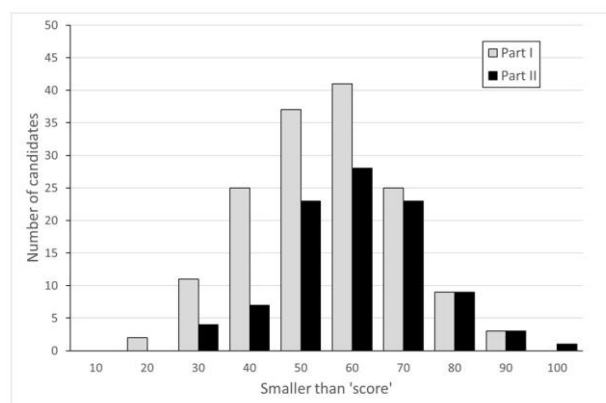


Fig 4a: Distribution of marks for IMPCB written examinations part I (n = 153) and part II (n = 98)

part I of the examination and 109 part II.

Figure 4a shows the distribution of scores in the two parts of the exam. As the examination consists of 100 multiple-choice questions, the maximum number of correct answers is 100. Given that each question has five possible answers the probability of getting half the answers correct by chance is considerably smaller than 1 in 1,000,000. The results in both parts of the examination are close to normally distributed with the results for part II being slightly better than part I. This may be due to the fact that many practicing medical physicists would be more familiar with questions relating to their specialty.

Figure 4b shows the correlation between the scores in part I and part II taken by the same candidate. There is a reasonable association between the scores ($r^2 = 0.48$). Several candidates who failed part I have repeated the exam. Figure 5 shows the results of the second attempt as a function of the first. As can be expected, the second attempt typically yielded a higher score and several persons passed the examination in a repeat examination.

The third part of the examination is oral and specific to the various medical physics' specialties. It must be taken no less than 3 months after the written examinations. To date only Radiation Oncology and Diagnostic and Interventional Radiological medical physicists have completed all three parts of the examination. In total 27 colleagues are now fully certified by IMPCB, 25 in radiation oncology and 2 in diagnostic radiology medical physics.

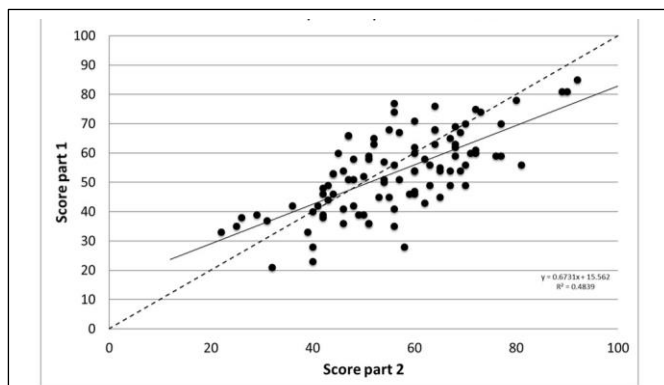


Fig 4b: Scores for candidates who sat both part I and part II of the IMPCB examination as a function of each other

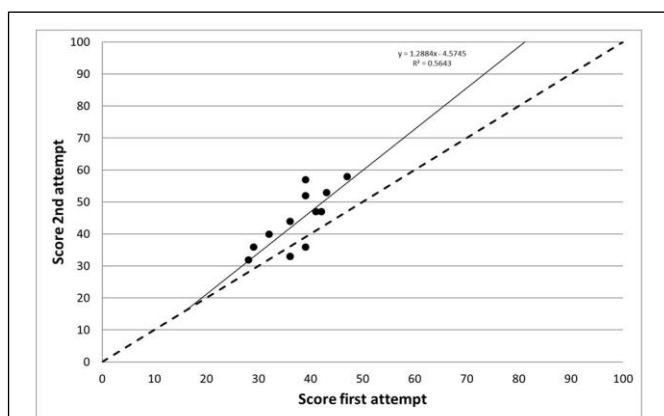


Fig 5: Comparison of the scores achieved by candidates in the second attempt to the ones achieved in the first (failed) one

V. FUTURE PLANS

The need for medical physicists in the workforce is increasing due to many factors ranging from increasing levels of technology in medicine, better quality standards and safety awareness to the need for reduction of population doses in high dose diagnostic procedures and the general problem of aging populations which require more services (14, 15). This is particularly important in low and middle income countries that are the focus of IMPCB activities (16).

It is therefore possibly not surprising that the services provided by IMPCB, in particular the certification of individuals, are in demand. All IMPCB work is voluntary and pro bono. Charges for accreditation or certification are solely invested in maintaining the services and the organization. After 10 years of operation, IMPCB is becoming sustainable. As certification is becoming a more integral part of the medical physics profession, the IAEA is

currently developing document on certification of medical physicists, which will be endorsed by IMPCB.

However, accreditation and certification is only a starting point. IMPCB is in the process of establishing a registry of IMPCB certified individuals, which will also list persons certified by IMPCB accredited boards. This registry will be accessible by stakeholders serving the public by furnishing lists of medical physicists who have been certified by the Board. The next important step is the development of a process for maintaining certification. From an operational point of view this may be done by regular re-certification or through linking registration to participation in a continuing professional development (CPD) scheme. In any case CPD and a code of ethics will be central to such a program.

One limitation of IMPCB is that all business is conducted in English. It is appreciated that this may limit its scope and that it could make it more difficult for candidates from non-English speaking countries to achieve full IMPCB certification. However, as most medical physics literature is in English and several other international organizations such as IOMP conduct their business in English this was the most practical way forward. Examinations in other languages may be considered at a later stage. In any case, accreditation by IMPCB does not require the use of English by the National or regional board.

VI. CONCLUSIONS

IMPCB offers a pathway to certification for individual medical physicists who have no other options. For existing certification boards it provides an independent evaluation and accreditation with the assurance that the board's procedures and graduates are meeting international standards. IMPCB aims to be an important instrument to support the work of medical physicists world-wide with the objective to ensure that all suitably qualified medical physicists have access to a certification process that can attest to their internationally recognized credentials.

ACKNOWLEDGMENT

The support of international organizations such as IOMP, IAEA and ICTP is greatly appreciated.

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