

## NURTURING A GLOBAL INITIATIVE IN MEDICAL PHYSICS LEADERSHIP AND MENTORING

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**Abstract**— This paper aims to present on the establishment of the “Medical Physics: Leadership and Mentoring Programme” and its achievements to date. The objectives of the programme are to develop leadership roles among young medical physicists and to provide guidance and support for young medical physicists by creating an atmosphere of openness where meaningful communication and trust can exist. Since its formation in 2016, the programme has expanded and kept growing to offer a platform for the young medical physicists to equip with leadership values. The group applies an e-mentoring method, which offers an innovative way of mentoring despite geographic constraint. Tele-mentoring sessions have also been organised to enable the mentors to share their experiences with mentees. Throughout its 4 years of operation, the group has accomplished four important achievements: worldwide professional network establishment, tele-mentoring sessions with guest mentors, scientific collaborations and publications as well as information dissemination. A questionnaire survey to study the key impacts of the programme on mentees shows that the majority of the mentees agreed that this programme has been beneficial in their career pathway. There is a need to further strengthen and expand the programme to become a more structured programme. It is envisaged that the programme could be considered as a training model for other

**medical physics groups in future.**

**Keywords**— Mentoring, leadership, medical physics, professional development, personal development.

### I. INTRODUCTION

The word mentoring originated with the character of Mentor in Homer’s Odyssey in Ancient Greek mythology. When Odysseus, the king of Ithaca, was away fighting at the Trojan War, he entrusted the care of his young son Telemachus to his trusted friend named Mentor [1]. According to the Cambridge dictionary, mentoring is the activity of supporting and advising someone with less experience to help them develop in their works [2]. It is the relationship between a mentor and a mentee. A mentor is a person who has the expertise, experience or knowledge and has the role of providing guidance, motivation, encouragement, support, and education to a mentee. On the other hand, the mentee has the role of learning from the mentor’s knowledge, asking for help when needed,

maintaining the contact and learning new things from mentors to achieve the goals [3-5]. However, it is important to note that mentors can also benefit significantly from the relationship through fresh ideas and questions that can bring out new aspects of known relations.

The high quality of the mentor-mentee relationship is one of the key factors to establish successfully in their professional career. For traditional mentoring, the mentor and mentee are typically working at the same organisation, however, the e-mentoring or online mentoring is the new way occurring due to the globalisation that is easier to communicate from the e-mail, online chats with different platforms, or virtual meeting conferences [6-7]. The mentor and mentee from different institutes or even countries can bring new perspectives and ideas free from obligations and direct professional relations.

Mentoring has become highly popular nowadays in several professions including medical physics. Mentoring and leadership have been discussed in several studies on training, education and research in medical physics. For example, the European Federation of Organisations for Medical Physics (EFOMP) introduced the Mentoring in Research Programme to support early-career medical physicists in setting up a research project [8]. Woods et al. described a multimodal mentoring model by integrating medical professional competencies into bio-engineering and medical physics graduate training [9]. The American Association of Physicists in Medicine (AAPM) announced the Diversity Recruitment through Education and Mentoring (DREAM) programme to increase the number of underrepresented groups in Medical Physics [10]. Caruana et al. applied a 'strength-weakness-opportunity-threat (SWOT)' analysis method in a medical physics leadership training programme through EFOMP-EUTEMPE collaboration, known as mini MBA for medical physicists [11-13]. Medical Physics for World Benefit, a not-for-profit organisation is also formalising a mentoring partnership programme recently to support medical physicists in need [14].

Medical Physics: Leadership and Mentoring Programme is a newly established platform that connects regional young medical physicists to the global mentoring group. This mentoring community is a system under which senior or experienced medical physicists support, inspire, advise, guide, assist or lead the juniors in medical physics work environment to achieve the goals [15]. This paper aims to report on the establishment of this programme and its achievements to date. It also reports the mentees' experiences with regards to online conferences participation, bridging the gap and foster international ties beyond local medical physics communities.

## II. HISTORY OF DEVELOPMENT

The Medical Physics: Leadership and Mentoring Programme was formed in late 2016, led by Professor Dr. Kwan Hoong Ng (Professor Ng, University of Malaya, Malaysia). The objectives of this programme are (i) to develop leadership roles among the young medical physicists, and (ii) to provide guidance and support for young medical physicists by creating an atmosphere of openness where meaningful communication and trust can exist. The pioneer mentee group consisted of 12 mentees and currently, it has expanded to 23 members, who are involved in the medical physics area such as clinical medical physicists (44%), postgraduate students (26%) or young academic (17%) and research staff (13%) from Asia, Latin America and Africa. Most of them are graduated with a master degree (57%), followed by a PhD (30%) and bachelor degree (13%). The mentees were mostly recruited during scientific events (Fig. 1) or scientific visits of the mentor to the research groups at universities.

As a mentor, Professor Ng is strongly motivated by his desire to encourage young people to succeed in their studies, career, or life choices by providing support and guidance. His work was inspired in a great experience he had as a mentee, having the late Professor John Cameron from the University of Wisconsin USA as a mentor. Professor Ng reported the desire of continuing the legacy of his mentor John Cameron: "It's time to initiate a programme that will allow young medical physicists to benefit from more organised, conducive interaction and mutual support from mentors" [16].



Fig. 1 Photographs of the mentee-mentor meetings in scientific conferences. Top: South East Asia Congress of Medical Physics 2018 (Kuala Lumpur, Malaysia); Middle & bottom: Brazilian Congress on Medical Physics (Florianopolis, SC, Brazil)

### III. OPERATIONS AND PRACTICES

Coordinating and engaging members from different time zones with variable cultural and working background pose a practical challenge. Hence, the e-mentoring method which connects mentor-mentee electronically offers an innovative way of mentoring to ease the communication between the mentors and mentees despite geographic constraint. The group has utilised mobile instant messaging application (WhatsApp), Voice over Internet Protocol (VoIP) technologies (Skype or Zoom) to communicate. These free-of-charge applications enable real-time group communications, information sharing as well as a teleconference. Other online applications such as Google Classroom (Google, California, USA) and Asana (Asana, California, USA) have been utilised to collaborate in ad-hoc projects among volunteers and to archive related data.

Teleconferences have been organised periodically to enabling the mentors to share their experiences with mentees in an hour's online meeting. A volunteered mentee will organise and moderate the sessions under a mutual agreement with the guest mentor. During the session, active participation and two-way communications are highly encouraged. The first online meeting was held on 14<sup>th</sup> February 2017 to kick-off the programme, 'ice-breaking' amongst mentor-mentees as well as to mutually set the scene for the programme, under the guidance of Professor Ng and Professor Robert Jeraj (University of Wisconsin, USA). Since then, multiple online meetings took place to provide motivation, encouragement, aimed in nurturing leadership skills among the mentees. Nowadays, in addition to the meetings, the group is a space to explore and cultivate new ideas and possibilities to work and learn together (e.g. writing papers, planning activities, managing website and preparing and sharing educative materials in social media).

### IV. GROUP ACHIEVEMENTS

Medical Physics: Leadership and Mentoring group throughout its four years of the foundation has reached four important achievements:

#### A. Worldwide professional network

A worldwide network of professionals in the area of medical physics with different levels of expertise has been formed. This has been achieved by gathering young medical physicists from several Latin American and Asian countries, and most recently from the African continent, in academic events and connecting them with more experienced professionals. The invited mentors consisted of world top researchers to leaders in professional and clinical medical physics. The group also invited non-medical physicist to

share with the leadership values from other perspectives. The list of mentors is tabulated in Table 1.

Table 1 List of mentors

Mentor	Affiliation
Prof. Dr. Kwan-Hoong Ng (KHN)	University of Malaya, Kuala Lumpur, Malaysia
Prof. Dr. Robert Jeraj (RJ)	University of Wisconsin, Madison, USA
Prof. Dr. Tomas Kron (TK)	University of Melbourne, Victoria, AUS
Prof. Dr. Eva Bezak (EB)	University of South Australia, Adelaide, AUS
Prof. Dr. John M. Boone (JMB)	University of California, Davis, USA
Prof. Dr. Marialuisa Aliotta (MA)	University of Edinburgh, Edinburgh, UK
Prof. Dr. Virginia Tsapaki (VT)	General Hospital of Athens, Athens, Greece
Prof. Dr. Perry Sprawls (PS)	Emory University, Atlanta, USA
Prof. Dr. Emico Okuno (EO)	University of São Paulo, São Paulo, Brazil
Prof. Dr. Ho-Ling Liu (HLL)	The University of Texas MD Anderson Cancer Center, Texas, USA
Prof. Dr. Slavik Tabakov (ST)	King's College London, London, UK
Prof. Carmel J. Caruana (CJC)	University of Malta, Malta
Prof. Renato Padovani (RP)	International Centre of Theoretical Physics, ICTP
Associate Prof. Jamie Trapp (JT)	Queensland University of Technology, AUS
Dr. David Yoong (DY)	DYLiberated Learning Resources, Malaysia

Fig. 2 shows the distribution of both mentors and mentees around the world. The climate of trust and cooperation has been built amongst the group members, which offers positive synergy to enhance leadership skills, teamwork and personal growth. Fig. 3 illustrates the core values of leadership that, in the opinion of the mentees, a leader should possess. An interesting aspect of the programme is that it also helps to promote gender equity. While male colleagues are more represented amongst the mentors, there is gender balance within the mentees. This has the potential to create an even better leadership group for the future.

#### B. Tele-mentoring

Online mentoring sessions have been organised with guest mentors to learn about their experiences, listen to their advice and provide guidance (Fig. 4). These meetings cover topics such as personal experiences of the mentors, advice to develop leadership skills and updating on topics of interest in particular medical physics and leadership. Fig. 5 shows the list of guest mentors and their topic of talks.



Fig. 2 Distribution of the mentors and mentees around the world

*C. Scientific collaborations and publications*

One of the major accomplishment through this mentoring programme is the joint effort in article writing and conference presentations. Two peer-reviewed articles were published [15,17] and several presentations have been carried out to report the formation and activities of the group in the regional or international conferences such as IUPESM World Congress of Medical Physics and Biomedical Engineering 2018, XXVI Brazilian Congress of Medical Physics 2019 and AFOMP Monthly Webinar 2020. These exercises provide a platform for the current mentor-mentee to share their experiences in the mentoring programme as well as outreach to more prospective young medical physicists and potential mentors to join in this programme. It also highlights the mutual benefits through the creation of the mentor-mentee relationship.



Fig. 3 Core values of leadership



Fig. 4 Online mentoring session

*D. Information dissemination*

To bring programme information to the group members, young professionals and the general public, a website and several social media accounts were created. They have been designed to share the information about the online meetings, scientific materials and relevant video productions [18] of mentees throughout this mentorship. According to the Pew Research Center for Journalism and Media, 68% of Americans stay informed about world news through social media [19]. The mentoring group has been made visible in social media platforms to allow publicity of the group at no cost and to engage potential ‘followers’ in the different topic of interests.

MENTORING SESSIONS	
<b>Group Formation</b> 2016	<b>Introduction and self-evaluation</b> Prof. Kwan Hoong Ng 14/02/2017
<b>Research needs in medical physics</b> Prof. Tomas Kron 28/02/2017	<b>Medical physicist accreditation</b> Prof. Robert Jeraj 25/09/2017
<b>Qualifications for the future Medical Physicist</b> Prof. Tomas Kron 08/11/2017	<b>How to develop and improve leadership skills</b> Prof. Eva Bezak 13/12/2017
<b>The essential skills to have a successful experience in clinical Medical Physics</b> Prof. Robert Jeraj 20/03/2018	<b>Stepping Stones to Academic Success: A Personal Journey</b> Prof. Marialuisa Aliotta 17/09/2018
<b>Breast CT technology and Leadership in Medical Physics</b> Prof. John M. Boone 06/11/2018	<b>Leadership in Medical Physics</b> Dr. Virginia Tsapaki 29/03/2019
<b>The Sprawls Resources</b> Prof. Perry Sprawls 14/05/2019	<b>Radiological Accident in Goiania, Brazil</b> Prof. Emico Okuno 01/08/2019
<b>Transition and Transformation: Experience from a Diagnostic Medical Physicist</b> Prof. Ho-Ling Liu 20/09/2019	<b>Making career decisions</b> Prof. Slavik Tabakov 04/06/2020
<b>The activities of the international organisations</b> Prof. Slavik Tabakov 28/07/2020	<b>An introduction to strategic and robust leadership in Medical Physics</b> Prof. Carmel Carauna 17/08/2020

Fig. 5 List of guest mentors and topics of discussion during the online mentoring sessions between 2017 and August 2020

For instance, the group has created a simple animation to educate the public about the digital infrared thermometer and its health effects on the human body during the Covid-19 pandemic [16]. The animated infographic was published on the website and social media (Fig. 6) where the operation of the digital thermometer was explained simply in 25 commonly spoken languages around the world population, to reduce the fear of general public about the myth of harmfulness of digital infrared thermometers. The Physics World has also recently featured the global mentoring programme in its weekly research update [20]. This has further publicised the latest development of the programme.



Fig. 6 (Top)Animation about the digital infrared thermometer and its health effects published on the (bottom) website and in social media

## V. THE KEY IMPACT OF THE PROGRAMME

It is of particular interest to quantify and briefly analyse the impact of the on-going leadership and mentoring programme. A questionnaire survey was carried out to study the initial impacts and experiences of mentees who joined the programme. On the mentoring side, the survey allows mentees to express how they feel about the need for mentorship and enlist the aspects they feel the need to consult about as early-career medical physicists.

According to the survey results, all mentees have gained experience in leading various scientific activities as shown in Fig. 7. They also reveal that there was a variety of activities, across which their leadership experience has spanned. Majority of the mentees (73.4%) considered themselves to be good leaders, while 66.7% thought that they needed improvement. Most of the mentees (93%) stated that joining the group changed their perspective on leadership, while all of them unanimously claimed that joining the group changed the way they lead a team/project in their daily professional activities.

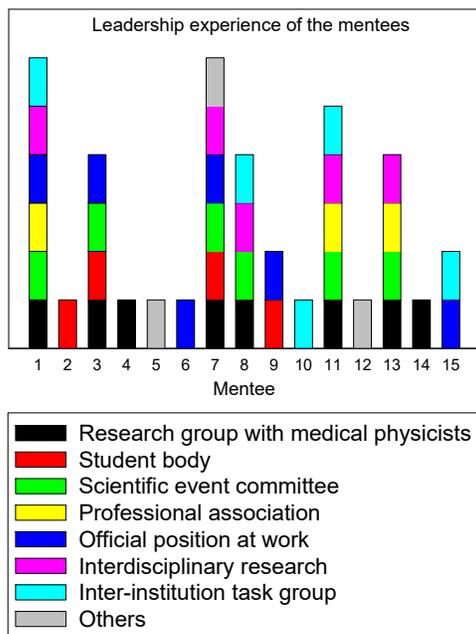


Fig. 7 Mentees' leadership experiences

In this study, all mentees have expressed the importance of a mentor in their career pathway. According to Table 2, of the three top aspects having the most need to be discussed with a mentor(s) are (1) organisational skills (including leadership), (2) technical/scientific aspects, and (3) paper writing. The discussed information was useful not only to reflect the impact or success of the group activities but also to plan for the future by addressing the mentee's need to fulfil the aims of the programme and ensure the beneficial nature of the activities.

While no similar survey has been performed amongst the mentors, it has been generally acknowledged that the preparation for lectures, the opportunity to communicate and particularly the questions of the mentees provided significant stimulation and benefits to the mentors as well. For instance, the general comment from one of the mentor mentioned: "I am grateful to have the opportunity to chat with young and talented medical physicists like you and others in the group.

I think this programme is an excellent platform for students, trainees and young faculty in medical physics to broaden their views by interacting with more senior ones with varied experience and practice in different regions and institutions".

Table 2 Mentoring aspect required by mentees

Aspects	Overall Percentage (%)
Organisational skills	80
Technical/scientific	60
Paper writing	47
Career choice	40
Office politics	40
Teaching	28
Personal life	12

## VI. CHALLENGES AND OPPORTUNITIES

These achievements would not be accomplished without the cooperation and dedication of the mentees and mentors, who voluntarily support and guide each other along with this collaboration. The programme provides insightful advice and 'real-time' support whenever needed. Topical group discussions via online meetings guided by some of the world medical physics leaders were inspirational and offered a global view of the profession. Recently, we have carried out a SWOT analysis to examine the current status of the programme as shown in Table 3 [15].

Table 3 SWOT analysis of the programme

### Strengths

- Mutual agreement of programme establishment and implementation
- Virtual programme with no cost involvement
- Mentors are world leaders or experienced practitioners in the field
- Lively group meetings or discussions in real-time using an online platform

### Weaknesses

- Limited 'meeting' time creates virtual 'barrier' among the mentee-mentee and mentee-mentor
- Different time zones (from GMT +10 to GMT -5)
- Extra work in addition to the existing workload
- Heterogeneity of the group and different working background and style
- Not a structured or time-specific training programme
- Mentees only from several countries of different continents
- A low number of mentors compared to mentees

### Opportunities

- Able to expand networks and scientific collaborations
- Current market needs of medical physicists in leadership development
- Able to learn in diverse ways collectively and excel in career

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**Threats**

- Large time gaps between group meetings
  - Medical physics roles take over by other professions
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In general, medical physics proved to be a good field for the set-up of an international mentoring programme as there are a shared purpose and common terminology. Being science-based, it also allows building on a common culture with problems, tools and solutions similar all over the world. Use of mathematics, diagrams and graphs further enables communication even if most of the participants (mentors and mentees) did not share the same mother tongue.

**VII. PLANS**

No doubt nurturing leadership values among the professionals could offer added values to healthcare services. Based on the SWOT analysis, this programme could be considered a training model, which is flexible enough to be adopted and adapted locally, regionally or globally, to create the critical mass of high-quality medical physics leaders in the future job market. With that in view, there is a need to further strengthen and develop the programme to maintain its relevancy and to expand its functionality.

Firstly, it is important to expand the network of the group by recruiting more mentees from different part of the world such as Africa and Europe and engage more medical physics leaders as mentors. The wider the range of group members, the wider the variety of knowledge and experience sharing, enabling thus resource sharing and complementing each other, especially when it comes to limitations such as language barriers and skills. Collaboration with international organisations such as the International Organization for Medical Physics (IOMP) and the Medical Physics for World Benefit may be considered to establish the mentoring partnership programme. Individual mentoring may be considered for developing one-on-one relationships between mentor-mentee and tailor the mentee's need along with the mentoring programme.

Secondly, the programme should be enhanced to become a systematic and structural training programme for optimising its efficiency and sustainability. Related professional associations, agencies or individuals should be approached to widen its network and build potential collaborations. More research work and scientific publications which could benefit the services can be achieved. Further publicity and information dissemination could be carried out.

**VIII. CONCLUSION**

The initiative of global medical physics leadership and mentoring programme offers a new platform to nurture the future leaders of medical physics. This voluntary programme gathers worldwide enthusiastically medical physicists to communicate and collaborate, as well as excel their leadership skills through interaction with the mentees and mentors. Positive impacts have been witnessed among the mentees were several early achievements have been accomplished and created added values to the field of medical physics. With that in view, it is hoped that the programme can be outreached across the globe and expanded locally to build up the capacity of medical physics leaders to fill the gap of the evolving healthcare industries.

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