GLOBAL REPRESENTATIVES' INITIATIVE OF THE AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE

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Abstract— **New initiatives in the international relations of the American Association of Physicists in Medicine include determining the most imminent needs of low- and middle-income countries. A global needs survey was designed by members of the newly formed Global Needs Assessment Committee, Global Representatives Subcommittee and Equipment Donation Committee. To better understand the current needs and optimal ways of addressing them, we created a network of global representatives that serve as consultants on our committees. In addition, our members participated in several regional conferences with direct interaction with attendees from low- and middle-income countries. Based on the determined needs, we are suggesting new ways to address training of our colleagues overseas, providing them with better equipment and facilitating interactions with industry.**

Keywords— **American Association of Physicists in Medicine, International Programs.**

I. Introduction

The burden of noncommunicable diseases (NCD) is steadily increasing in low- and middle-income (LMIC) countries across the world [1-3]. For example, it has been projected that the majority of cancer deaths will occur in LMIC's by 2030 [4, 5]. Medical physicists play a critical role in the management of NCD's [6], both diagnostically and therapeutically. A number of international organizations such as the International Organization of Medical Physics (IOMP) and the International Atomic Energy Agency (IAEA) have been very active in the global application of medical physics for decades.

The American Association of Physicists in Medicine (AAPM) was formed in 1958 [7] and is the principal organization of medical physicists in the United States [8]. Despite its nominal association with the United States, the AAPM is actually an international organization with nearly 20% of its membership body residing outside the US in nearly one hundred different countries [9]. The AAPM has collaborated with a number of global stakeholders in the radiological sciences in the production of various medical physics guidance documents, such as the European Society for Therapeutic Radiology and Oncology (ESTRO) [10], the European Federation of Organizations for Medical Physics (EFOMP) [11], and the International Atomic Energy Agency (IAEA) [12]. The AAPM has been invested in global medical physics nearly since its inception. In 1963, the IOMP was formed [13], and the AAPM was one of its original charter members. An International Affairs Committee of the AAPM was formed in 1970 to promote cooperation with international organizations, facilitate the donation of both equipment and educational material to LMIC's [14]. Since 2006, the International Education Activities Committee has been coordinating the AAPM's international educational activities [15].

In 2020, the AAPM established an International Council (IC) with the aim of more effectively coordinating its international efforts. The justification for the establishment of this council were threefold. Firstly, international partnerships strengthen the AAPM and its membership. Additionally, international collaborations strengthen the education, science, and practice of medical physics domestically. Finally, international collaborations can contribute to improving quality and safety in healthcare on a global scale [9]. Within the AAPM IC, there are six committees: the Global Clinical Education and Training Committee (GCETC), the Global Data and Information Exchange Committee (GDIEC), the Global Liaisons Committee (GLC), the Global Medical Physics Education and Training Committee (GMPETC), the Global Research and Scientific Innovation Committee (GRSIC), and the Global Needs Assessment Committee (GNAC).

The GNAC has multiple charges. It seeks to develop, implement, and maintain processes for performing comprehensive quantitative assessments of medical physics needs and resources within a region or regions when such data are not available from other sources. Using the developed processes, it seeks to perform routine assessment of medical physics needs and resources in each region. It seeks to collaborate with the GDIEC to develop and maintain a database of contact information for leaders and other

representatives of key stakeholder organizations, especially international, national, and regional medical physics organizations in each region. It seeks to collaborate with the GMPETC to advance education and training of medical physicists. Lastly, it seeks to collaborate with the GCETC to advance resource-stratified education and training in the clinical practice of medical physics.

Under the GNAC, two formal subcommittees have been established: the Equipment Donation Program Subcommittee and the Global Representatives Subcommittee (GRSC). The GRSC is attempting to establish a global network of regional medical physics representation in all areas of the world. The purpose of the network is to keep in touch with our colleagues and sister societies for awareness of their progress, determining their possible needs, establishing professional collaboration, assisting in the dissemination of education materials, arranging teaching courses, donating equipment, creating task groups and other possible ways of collaboration.

II. WAYS OF COLLABORATION

Global Representatives Network and its role in the communication process.

Communication is an indispensable aspect of human interaction that allows individuals to convey thoughts, ideas, and emotions. It serves as the foundation for building relationships, sharing knowledge, and fostering understanding between people. Through various channels and methods, communication processes facilitate the exchange of information and contribute to social, cultural, and personal development. In an interconnected world and, specifically, the field of Medical Physics, effective communication has become crucial for the exchange of ideas, collaboration, and problem-solving on a global scale.

The GRSC has established a global network of regional representatives in all areas of the world with the goal of developing and maintaining a database of contact information for leaders and other representatives of key stakeholder organizations from different regions of the world.

The first step was to identify the countries and regions. Using data from The World Bank [16], 135 countries were identified in the category of low- and middle-income countries. The LMICs were grouped into six regions, following the World Health Organization (WHO) definitions: (1) African Region, (2) Region of the Americas, (3) European Region, (4) Eastern Mediterranean Region, (5) Western Pacific Region, and (6) South-East Asia Region. Each region was aligned with the correspondent Regional Organization provided by the IOMP. To facilitate the communication channels, each region was then divided into sub-regions. For example, the Region of the Americas was divided into the Caribbean, Central America, North America, and South America; the Western Pacific Region was divided into Pacific Islands, Mainland Asia, and South China Sea.

The second step consisted of identifying global liaisons. The members of the GRSC were assigned one or more regions. Each member identified contacts in the medical physics organizations in the assigned region and created the connections. The contacts from each region were invited to join the GRSC as international consultants. At that point, the Global Representatives Network (GRN) was established and started the discussion of needs.

The creation and maintenance of the GRN has positively impacted the communication process between the AAPM and LMICs. The GRN plays a pivotal role in enhancing understanding among global representatives. By bringing together individuals from diverse backgrounds, the network has created opportunities for cross-cultural communication and exchange of perspectives. Through dialogue and interaction, representatives have gained valuable insights into different worldviews and needs from the LMICs. This enhanced understanding has fostered empathy, tolerance, and appreciation for the richness of human diversity. Consequently, we have been able to navigate complex cultural landscapes with sensitivity, promoting effective communication and avoiding misunderstandings that can hinder cooperation.

One of the most significant roles of the GRN lies in addressing global challenges through effective communication. Our network has served as a space for representatives from LMICs to discuss and deliberate on pressing issues, including equipment, educational and research needs. By fostering open and inclusive dialogue, the GRN enabled representatives to raise awareness about global challenges, mobilize public support, and advocate for policy changes at local, national, and international levels.

The GRN functions as a valuable platform for information sharing among global representatives. In a rapidly evolving world, staying informed is crucial for effective decision-making and problem-solving. By disseminating information across the network, representatives have been able to bridge information gaps, and address some of the needs.

The Global Representatives Network plays a vital role in the communication process, acting as a facilitator for understanding and cooperation on a global scale. Through its emphasis on cross-cultural communication, the network enhances understanding among representatives from diverse backgrounds, fostering empathy and tolerance. By promoting cooperation, the GRN enables stakeholders to collaborate effectively, leveraging their collective resources to address global needs. We are planning to further develop our Global Representatives Network to facilitate better communication between AAPM and sister societies.

Global Needs Assessments: Surveys and Structured Interviews.

The charges of the GNAC include developing, implementing, and maintaining processes for performing comprehensive quantitative assessments of medical physics needs and resources within the global regions. Global needs

assessments will serve as a catalyst for future work of the AAPM IC, provide a snapshot of the current status of global needs, establish baseline metrics, serve as a guide for identifying key deliverables by the IC committees, and afford assessment of the progress of the work of the IC using the baseline metrics. Some of the methods of needs assessment that the GNAC will utilize are surveys and structured interviews.

The GNAC has initially identified a strategy of performing three different needs assessments. The first is a survey to be completed by institutional and departmental leaders in radiation oncology and radiology departments. The purpose is to provide a broad view of institutional activities, available infrastructure, and needs. Second, a survey will be completed by medical physicists working in LMICs. The purpose of the second survey is to gather information about the frontlines of medical physics practice, education, and research. Third, a needs assessment of industry partners will be conducted through structured interviews. The purpose of the third needs assessment is to obtain information about the unique challenges of providing and maintaining equipment and services in low-resource settings.

To date, the GNAC has completed the survey of institutional and departmental leaders and is in the process of submitting the results as a manuscript for publication. The IRB-approved survey was developed with input from all IC committees and in collaboration with a survey design and analysis consultant. The survey was deployed using a web-based platform and distributed through multiple channels including email, the AAPM website, social media postings, global contact lists, and regional conference presentations. The forty-six-question survey consisted of six sections: Introduction, Infrastructure, Education, Research, and General. Survey responses were received from all six global regions with the most responses from the African Region and the least responses from the Western Pacific Region. The survey was analyzed to identify trends, specific needs, and potential for collaboration. Furthermore, the survey data were analyzed with respect to the six global regions, practice specialty, and practice-specific needs. Recurring themes in the results were needs for training, equipment, and qualified personnel. We look forward to sharing detailed results in our impending publication.

The survey of medical physicists is in the final stages of development and will consist of six sections of the same categories as the initial survey. Lessons learned from the initial survey will be incorporated to streamline and improve the analysis process. The structured interview process is in the development stage and will provide valuable insight into the specific challenges of this our industry partners when working in low-resource settings.

The GNAC will conduct needs assessments through surveys and structured interviews. The first global survey has been developed, conducted, and analyzed. The results are being finalized and will be submitted to an open-access international journal so that the results will be freely available to everyone. The second survey and the structured interview process are in the final stages of development. The results of all needs assessments will provide valuable information for the international work of the AAPM and other organizations.

AAPM/IOMP Equipment Donation Program.

The International Equipment Donation Program is a joint program between the IOMP and the AAPM. The Equipment Donation Program Subcommittee (EDPSC) exists within the AAPM as a subcommittee of the GNAC and within the IOMP as a subcommittee of the Professional Relations Committee (PRC). Prior to the creation of the AAPM International Council, the EDPSC reported to the AAPM International Affairs Committee.

The program has been in existence for many years and the scope of the program has evolved over time. The current scope includes the donation of functional, sustainable, and site-appropriate medical physics quality assurance (QA) equipment. Recent donations include calibrated ionization chambers and electrometers, image quality phantoms for various imaging modalities, CTDI phantoms, triaxial cables, connectors, and linear accelerator mechanical QA devices.

Members of the EDPSC include medical physicists that specialize in both imaging and therapy and have a range of experience from graduate students to late career professionals. Many of the members have international connections and speak multiple languages. All members are enthusiastic about international work and devote time and effort to the donation of much needed medical physics equipment to low resource settings.

International equipment donation is a challenging endeavor. The World Health Organization (WHO) estimates that 80% of health-care equipment in some countries is donated or funded by international donors or foreign governments [16]. However, in some global areas, up to 70% of equipment is not in use due to issues related to equipment acquisition, user training, and technical support. The AAPM/IOMP EDPSC works diligently to ensure that donations are successful. The program follows WHO guidelines to ensure donations meet the needs of recipients, that end-users receive training, and that the equipment is maintained over time.

The program fully embraces the concept that we can do more together than we can do alone. The EDPSC seeks collaboration with other groups with the aim of reducing duplication of effort and bending silos that exist within the international arena. To date, the EDPSC has collaborated with the AAPM Global Clinical Education and Training Committee (GCETC), Radiating Hope, and Medical Physicists for World Benefit (MPWB) and hopes to collaborate with additional groups in the future.

The Equipment Donation Program also seeks to work with medical physicists in all global regions. The EDP has completed projects in the African Region, the Region of the Americas, and the Eastern Mediterranean Region. Current ongoing projects are located in the African Region, the Region of the Americas, and the European Region.

Additional information about the program can be found at https://www.aapm.org/international/EquipmentDonation.asp. If you would like to request equipment from the program, please go to the website and complete Form B. If you have equipment that you would like to donate to the program, please complete Form A. The website also includes a list of recommended equipment for donation.

In conclusion, the AAPM/IOMP Equipment Donation Program is a joint program between the AAPM and IOMP. The scope of the program includes medical physics QA equipment. The EDPSC follows WHO guidelines to ensure that donations are successful. The program pursues collaboration with other groups and organizations and seeks to complete projects in all global regions. Please see the program's website for additional information and details about requesting and donating equipment.

Conference Participation as a Way of Promoting Collaboration with LMIC.

Recognizing the importance of maintaining clear communication channels with medical physicists worldwide, the GNAC assigned the GRSC to establish a global network of regional representatives in all areas of the world. One way of promoting global partnerships with LMICs is through participation in international conferences. Conferences facilitate networking and collaboration opportunities for medical physicists around the world. Through their sessions, discussions, and social events, conferences offer a platform for participants to share their work with a global audience, receive feedback, exchange ideas, identify potential collaborators, and develop joint initiatives. Collaboration is playing an increasingly important role in advancing global health, where addressing the world's most complex problems requires the expertise and resources from interdisciplinary and multi-institutional efforts. This is becoming more attainable as we can now learn about each other's work through online publications or recorded presentations, as well as work together through virtual meeting platforms. Such opportunities and visibility may be more difficult for medical physicists in LMICs to establish. However, these challenges can be mitigated with ongoing participation from all regions of the world.

Several of the IC's committees are focused in disseminating training and expertise in areas of clinical practice, medical physics education, and innovative research. Knowledge sharing is a key benefit of conference participation, as attendees exchange and gain insights into emerging trends, stay updated with evolving regulatory standards and guidelines, and learn about available resources or funding opportunities to help support their work. Medical physicists may also observe a diverse range of practices and challenges from different healthcare systems worldwide, enriching their perspectives and incorporating best practices from around the globe. Furthermore, conferences expose participants to a diverse range of backgrounds, fostering cultural understanding and encouraging inclusive collaboration to address global challenges.

Global outreach and collaborations were established through presentations by GNAC members at various medical physics conferences, including those hosted by regional organizations of the IOMP. Speakers presented on the need for global outreach, the mission of the AAPM's IC, and the efforts of the AAPM's GNAC. Members also presented the development of the global needs assessment survey and invited participants to assist with disseminating the survey to increase response rates and future collaborations.

With the COVID-19 pandemic, the 19th South-East Asian Congress of Medical Physics (SEACOMP) was adapted from a face-to-face meeting to a hybrid meeting in October 2021, where local members and IT staff were onsite in Thailand to organize the online congress, and the remaining 231 attendees from 16 countries participated virtually. Three GNAC members presented sessions virtually. While the virtual format and time zone limited involvement and communication with attendees, the GNAC received many survey responses from the southeast Asian region, reflecting the value of networking and presenting the survey at the congress. In March 2022, another GNAC member also presented on the committee's efforts in a virtual meeting organized by the Pan American Health Organization (PAHO) aimed at discussing gaps in radiation therapy in Caribbean countries. The member established new connections, learned about regional needs, was invited to speak at a future meeting, and received commitment for future collaborations.

Conferences have since returned to in-person formats, and GNAC members were invited to deliver their presentations onsite. In June 2022, two GNAC members attended the 4th Meeting of the Latin American Medical Physics Association (ALFIM) in Brazil. Their fluency in regional languages and physical presence enabled significant networking and collaboration opportunities, establishing key contacts from various Latin American countries. In addition, both members were invited to present their scientific and clinical expertise in upcoming national conferences. In November 2022, three GNAC members presented at the 1st Regional Conference of the Federation of African Medical Physics Organizations (FAMPO) in Morocco. Despite being spread across the world, the conferences covered similar topics, including the importance of recognizing medical physics as a healthcare profession, lack of pathways for providing standardized certification and accreditation, updates about medical physics education and training in different regions, new quality assurance requirements, and challenges faced by women in medical physics.

In July 2022, the GNAC invited and sponsored for the President of FAMPO, Christopher Trauernicht, to attend the AAPM's 64th Annual Meeting held in Washington DC and speak on the medical physics needs in Africa, along with six other GNAC members who presented on addressing global medical physics needs.

A GNAC representative also attended the Greater Horns of Africa Oncology Summit (GHOS) that took place in Dar es Salaam, Tanzania in September 2022. This conference had

participants from all over the world including, Turkey, Nepal, Jordan, USA and Canada. African countries represented at the conference included Ethiopia, Ghana, Kenya, Tanzania, Rwanda, Zambia, South Africa and Uganda. Even though this was just a medical Physics conference it brought together various specialties such as medical oncology, radiation oncology and medical Physics. The GNAC representative presented on AAPM initiatives and had the face-to-face interactions with other physicists.

Our committee members attended conferences in both virtual and face-to-face formats. It is important to note conferences can be expensive and inequitable, with LMIC attendance limited by systemic barriers including high travel costs and visa restrictions. The COVID-19 pandemic has accelerated transitions to online or hybrid conference formats, which offers benefits such as reducing expenses, improving accessibility, and facilitating dissemination of digitally archived sessions. However, virtual meetings may lack opportunities to network socially due to digital meeting fatigue, a loss of casual "hallway" conversations, and challenging time zones. These challenges may be mitigated by applying technology to meet these challenges, relocating conferences to visa-friendly countries, providing travel scholarships, and developing mentorship programs to enable LMIC researchers to participate in global conferences.

By bringing together diverse expertise and facilitating international partnerships, conferences can pave the way for transformative collaborations. The GNAC's presence at various conferences strengthened global networks, emphasizing the significance of conference participation in driving innovation and addressing complex challenges on a global scale.

Regional Perspectives of the global medical Physics Collaboration

The global shortage of qualified medical is especially noticeable in low- and middle-income countries[17]. In a recent paper by Tsapaki et al.[17], the African continent reported to have only 697 medical physicists for a total population of approximately1.3 billion, with countries like Cameroon reporting only 2 medical physicists. This type of shortage of medical physicists creates isolation for the clinical physicists and lack of proper expertise for the patient care. In many cases, the solo physicist does not have a benchmark or oversight on the work quality or standard of care. Such situations can be improved by creation of regional associations having a critical mass of qualified physicists. Some associations are covering large geographical regions and with multiple countries. Such regional associations will be more versed with the local problems and issues and be in a better position to advocate for better roles and responsibilities of clinical physicists. This concept is supported by the IOMP [18, 19]. As of 2022, the IOMP acknowledges 6 regional organizations, namely: European Federation of Organizations for Medical Physics (EFOMP), Asian-Oceania Federation of Organizations for Medical Physics (AFOMP), Latin American Medical Physics Association (ALFIM), Southeast Asian Federation for Medical Physics (SEAFOMP), Federation of African Medical Physics Organizations (FAMPO), and Middle East Federation of Organizations for Medical Physics (MEFOMP) [19]. The GNAC is using connections to these regional associations as a way to establish the needs of the global medical physics community.

Regional associations in low- and middle-income countries can play a vital role in increasing access to various medical physics technologies, training, and expertise. One of the examples was the creation of a West African medical physics education program serving multiple countries. However, regional solutions to limited resources confront regulatory, institutional, and economical barriers. In addition, regional solutions must overcome language barriers as well. While English is the main communication language globally, not all physicists can understand it. So, the regional associations can be instrumental in creating local content for standard of care in a language that can understood by most of its membership.

III. CONCLUSIONS

Significant effort of newly created committees of the AAPM International Council is only the beginning of the process of establishing long-term relations between American medical physicists and their colleagues overseas. It is extremely important that these relations resemble a two-way street, where the communication efforts were coming from both sides and the physicists from low- and middle-income countries could directly express their needs and keep direct communications not only with the committees but also with individual physicists in the US and Canada. We will be continuously monitoring the process and working towards seamless integration of the physicists overseas into the global structure of medical physics.

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