International Organization for Medical Physics

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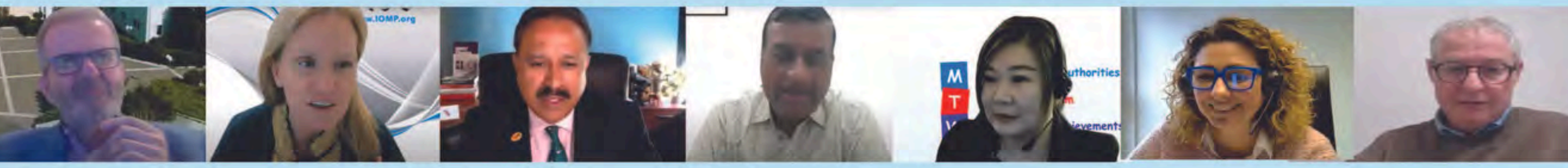
INTERNATIONAL MEDICAL PHYSICS WEEK (IMPW)
22-26 APRIL 2024



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Chai Hong Yeong, PhD

Editor-in-Chief of IOMP e-Medical Physics World (eMPW)

CHAI HONG YEONG

Editor of IOMP eMPW

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"Detailed reports on IDMP 2023 global celebration activities are compiled in this issue, and I extend my gratitude to all members who submitted reports along with beautiful pictures"

Dear Colleagues,

I am delighted to present to you the latest issue of the eMPW, Vol. 40, No. 1, June 2024. This edition represents a significant milestone in our ongoing commitment to keeping our members informed and engaged with the latest developments in medical physics worldwide.

In this issue, we bring you comprehensive updates on the activities and achievements of the IOMP ExCom from January to June 2024. Additionally, you will find reports from the Medical Physics International (MPI) journal, the IOMP History Sub-Committee, and the IOMP Women Sub-Committee, highlighting their valuable contributions.

Magdalena Stoeva, IOMP Secretary, provides a detailed report on the successful celebration of International Medical Physics Week (IMPW) held from 22-26 April 2024, with webinar recordings accessible on the IOMP website and YouTube channel.

I would also like to congratulate the Jamaican Association for Physics in Medicine (JAPM) on their successful conference, "Quality Assurance in Radiation Medicine for Sustainable Healthcare," held from 13-17 November 2023 at ROK Hilton, Kingston Jamaica. A detailed conference report is included in this issue.

In honor of the IDMP 2023 theme "Standing on the Shoulders of Giants," the faculty and alumni of the Abdus Salam ICTP Master of Advanced Studies in Medical Physics (MMP) prepared a tribute to Professor Luciano Bertocchi for his significant contributions to the field.

Pirchio Rosaa, Secretary of the IOMP MPWB committee, contributes an engaging article on the inspiring life of Marie Curie, aligning with the IDMP 2023 and 2024 themes of "Standing on the Shoulders of Giants" and "Inspiring the Next Generations of Medical Physicists."

Editorial

Chai Hong Yeong, PhD

Editor-in-Chief of IOMP e-Medical Physics World (eMPW)

This issue also features an article by Nyaradzo Juliana Jaji Murwira, a recent graduate of the ICTP MMP program from Zimbabwe, who shares her journey and aspirations as a young medical physicist seeking opportunities in the field.

Furthermore, we present three insightful articles covering diverse topics: "Dosimetry for Nuclear Medicine Therapy Agents" by Michael Stabin, "Precision Radiotherapy and AI Innovation: India's Battle Against Cancer Amidst Global Challenges" by C. Senthamil Selvan, and "The Use of Shields on Patients" by Daniel E. Andisco. Each article offers valuable insights into nuclear medicine, radiotherapy, and radiation protection in diagnostic imaging.

As we navigate these dynamic times, I encourage you to delve into the wealth of information within this issue of eMPW. Whether you are a seasoned professional or a student beginning your journey in medical physics, you will find valuable content and perspectives. I extend my heartfelt gratitude to our dedicated Editorial Board members and contributors whose unwavering commitment has made this publication possible. Your efforts in advancing medical physics are truly commendable.

Last but not least, I would like to encourage all of you to celebrate the International Day of Medical Physics (IDMP) 2024 with a meaningful theme ***"Inspiring the Next Generation of Medical Physicists"***, proposed by our esteemed IOMP President. Please remember to share your reports and photos of the celebrations for inclusion in the upcoming December 2024 issue of eMPW.

Thank you for your continued support and readership. Together, let us push boundaries and inspire the next generations of medical physicists.

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President's Message

John Damilakis, PhD

President of IOMP

JOHN DAMILAKIS

President, IOMP
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“During the first six months of 2024, the IOMP has made remarkable efforts to promote medical physics through scientific events, educational resources, online platforms, and collaborative events"

During the first six months of 2024, the IOMP has made remarkable efforts to promote medical physics through scientific events, educational resources, online platforms, and collaborative events, aiming to inspire and support the global medical physics community.

The **International Day of Medical Physics (IDMP)** is an annual celebration dedicated to highlighting the vital contributions of medical physicists to healthcare. This day provides an opportunity to acknowledge the hard work and achievements of medical physicists, while also inspiring the next generation of medical physicists. IDMP also fosters a sense of community and collaboration among medical physicists worldwide. Supporting the young generation of medical physicists is crucial for the advancement of the field. These professionals bring fresh perspectives, innovative ideas, and a dynamic approach to solving challenges in medical physics. We need to invest in their education, provide mentorship opportunities, and facilitate their involvement in research and professional activities. Supporting the next generation is an investment in the future of medical physics. The theme for the IDMP 2024 is "Inspiring the Next Generation of Medical Physicists." The focus is on attracting young talent to the field through strategies like mentorship programs, research projects, and networking events. The aim is to inspire and prepare future medical physicists to advance the field and enhance patient care. Please also note that there is a call for poster designs for IDMP 2024, under the IDMP theme. The winning design will be used in promotional activities and gain international exposure.

IDMP 2024 theme:

"Inspiring the next generations of Medical Physicists"

President's Message

John Damilakis, PhD

President of IOMP

The International Medical Physics Week (IMPW) is a globally recognized event designed to celebrate and promote the field of medical physics. During this week, the IOMP host a series of webinars to highlight the latest advancements, research, and innovations in medical physics. The IOMP celebrated the IMPW this year by organizing five online webinars on scientific, professional, and educational topics. IMPW took place from April 22-26, with regional organizations hosting webinars. Each session included a 45-minute presentation followed by a 15-minute discussion. All webinars were very successful. This collaborative effort underscores the importance of uniting diverse expertise from around the world.

Organizing international scientific events on medical physics is of paramount importance as they serve as a platform for the exchange of cutting-edge research, innovative technologies, and best practices among professionals from around the globe. These meetings foster collaboration and networking, enabling medical physicists to stay abreast of advancements in the field, which is crucial for improving patient care and outcomes. IOMP organizes the International Conference on Medical Physics every 3 years. We are also working with the International Federation for Medical and Biological Engineering (IFMBE) to organize the IUPESM World Congress. We invite you to join us for the **IUPESM World Congress 2025** in Adelaide, Australia. The Congress will bring together researchers who are leading international efforts to shape the future of medical physics and biomedical engineering. Moreover, IOMP has invited bids to host the **28th International Conference on Medical Physics in 2026-2027**. We are anticipating enthusiastic participation and innovative proposals to make this event a resounding success.

Medical Physics International (MPI) used to have a tradition of publishing the 'book of abstracts' from congresses as an annex to a standard issue. Recently, however, we have decided to launch a dedicated 'MPI Proceedings series' specifically for the publication of abstracts. This new approach will simplify the process for individuals seeking specific event information, making it more accessible and easier to locate. I take this opportunity to remind you that MPI is dedicated to advancing the field of medical physics by disseminating high-quality articles. By publishing in MPI you will join a global community of experts committed to enhancing the role of physics in medicine. Your work will reach a wide audience of professionals and academics. Submit your manuscripts today and contribute to the continuous improvement of healthcare through medical physics.

The IOMP **sponsors and endorses** scientific events organized by its member organizations. These endorsements and sponsorships are crucial as they signify the IOMP's commitment to fostering excellence in research, education, and professional practice. By supporting these events, the IOMP ensures that they meet high standards of scientific relevance, promoting the dissemination of high quality knowledge and innovative practices. This support not only enhances the credibility and visibility of the events but also encourages collaboration and networking among professionals worldwide.

Vice President's Message

Eva Bezak, PhD

Vice President of IOMP

EVA BEZAK

Vice President, IOMP
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"I am pleased to report that we are aiming to run an IOMP School on the Intensity Modulated Radiation Therapy, from October 5-8, 2024, at the National Cancer Centre in Putrajaya, Malaysia."

Dear IOMP Colleagues,

I hope this message finds you well. I wanted to provide an update on several key activities and initiatives that I have been involved in on behalf of IOMP.

International Medical Physics Week: Our IMPW webinars were highly successful with a strong participation across the world. Presentations by regional organizations were particularly beneficial, providing professional, as well as inclusive and informative content.

IOMP School: I am pleased to report that we are aiming to run an IOMP School on the Intensity Modulated Radiation Therapy, from October 5-8, 2024, at the National Cancer Centre in Putrajaya, Malaysia. The school will precede the regional medical physics congresses, namely the 24th Asia-Oceania Congress of Medical Physics (AOCMP) and the 22nd Southeast Asia Congress of Medical Physics (SEACOMP) that will be held in Penang, Malaysia (https://www.aocmp2024.com/) from 10 to 13 October. This will allow the interested participants to attend both the IOMP school as well as the regional medical physics congress. Abstracts will close on 30 June. I will be presenting multiple sessions at AOCMP/SEACOMP 2024 and delivering a 30-minute public lecture on DEI, underscoring our commitment to inclusivity and diversity.

Collaborations: IOMP has been officially notified by the WHO that its Executive Board decided to maintain IOMP's official relations with the WHO for the period 2024-2026. This decision of the WHO further strengthens IOMP's position as a non-state actor representing the global medical physics community and opens further opportunities for collaboration between IOMP and the WHO. A recent meeting with WHO on specific projects was productive, with agreements reached on collaboration topics of mutual interest. Last year I was also engaged in the 74th Session of the WHO Regional Committee for the Western Pacific. Themes around sustainable healthcare and climate-resilient health systems were discussed, aligning

Vice President's Message

Eva Bezak, PhD

Vice President of IOMP

with the UN's declaration of 2024-2033 as the International Decade of Sciences for Sustainable Development.

In 2024 I will be working with ICRP as an observer on **ICRP Task Group (128)** on Individualisation and Stratification in Radiological Protection: Implications and Areas of Application.

From the 12th-16th of February, I and the University of South Australia hosted the **International Atomic Energy Agency (IAEA) Course on Novel Diagnostic Radiology Techniques and Optimization**. The workshop brought together radiologic technologists, nurses and radiologists from across Oceania, including representatives from Papua New Guinea, Samoa, Palau, Tonga, Fiji and others. These participants use medical radiation daily; however, they experience a deficiency in radiation resources and formal training. In collaboration with Professor Ioannis Sechopolous, Dr Virginia Tsapaki and local medical physicists, we delivered lectures and hands-on practical sessions to improve knowledge and skills relating to radiation safety and quality assurance.

Conference Preparation: IOMP has a currently open call to host the 28th International Conference on Medical Physics (ICMP) in 2026-2027 (https://www.iomp.org/invitation-to-bid-for-icmp-2026/). Please consider hosting this event and submit your bid by 3rd November 2024.

The International Union for Physical and Engineering Sciences in Medicine (IUPESM) World Congress on Medical Physics and Biomedical Engineering 2025 (Adelaide, Australia) preparations are under way. Please visit https://wc2025.org/. The exhibition and sponsorship package has also been launched (https://wc2025.org/sponsor-exhibitor/). Abstract submissions for WC2025 will open in September 2024, with 26 determined tracks. The accommodation package is finalized, with efforts underway to include student-friendly options. We are actively seeking sponsors for participant travel, leveraging various partnerships to gain travel grants for the participants. As per the Local Organizing Committee KPIs, we aim to have 30% of participants from low to middle income countries and 25% student participants. We are hoping to have as many of our IOMP colleague to attend the WC2025 as possible, hopefully finally overcoming all the travel difficulties imposed by COVID restrictions at the last WC2022.

In conclusion, I would like to express my gratitude for your continued support as we strive to advance our mission.

Treasurer's Report

Ibrahim Duhaini, PhD

Treasurer of IOMP

IBRAHIM DUHAINI

Treasurer, IOMP
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"By following this comprehensive workflow, the finance committee of IOMP can effectively manage the organization's finances, ensure compliance with regulations, and support its mission and objectives."

A. Here are the Finance Subcommittee members:

1. Ibrahim Duhaini, Chair
2. Shigekazu Fukuda, Asia
3. Sanchez Palmer, Africa
4. Ana Maria Marques da Silva, Latin America
   Ex-Officio:
5. John Damilakis, President, Europe
6. Eva Bezak, Vice President, Australia

B. During the period from March 2024 till June 2024, the following activities have been executed:

1. Reviewing and approving ExCom expense claims, invoices, bills, and other incidentals:
   - This involves a thorough examination and approval process for all expenses incurred by the Executive Committee (ExCom). This could include individual expense claims, invoices from vendors, bills related to organizational activities, and other miscellaneous expenses. The goal is to ensure transparency, accuracy, and compliance with financial policies.

2. Sending membership fees letters to all NMO (National Member Organizations):
   - This task involves communicating with NMOs regarding membership fees. It includes the creation and distribution of letters or notifications that outline the details of membership fees, payment instructions, and any relevant deadlines. This ensures that all NMOs are informed and reminded to fulfill their financial obligations to the organization.

3. Following up and processing transactions of the IOMP Company Account:
   - This activity focuses on monitoring and managing transactions related to the IOMP Company Account. It includes tracking incoming and outgoing funds, reconciling bank statements, and ensuring that financial transactions align with the organization's financial goals and guidelines. The follow-up aspect implies resolving any discrepancies or outstanding issues promptly.

Treasurer's Report

Ibrahim Duhaini, PhD

Treasurer of IOMP

4. Performing other related duties with the ExCom members, IOMP Accountant, and Administration Office:

- This is a broad category that encompasses various additional responsibilities. Working collaboratively with ExCom members suggests active engagement in strategic discussions and decision-making processes. Collaborating with the IOMP Accountant involves coordinating financial activities, and interacting with the Administration Office suggests involvement in general administrative tasks that contribute to the smooth functioning of the organization.

C. Current work flow for the finance committee

Managing a workflow for the finance committee involves several key steps to ensure effective financial management and decision-making. Here's the workflow:

1. Budget Planning:

- Start by gathering input from various departments and committees within IOMP to determine budget needs for different activities and projects.
- Analyze previous financial data and performance to inform budget allocations.
- resent draft budget proposals to the finance committee for review and approval.

2. Financial Reporting:

- Establish regular reporting periods (e.g., monthly, quarterly) to review financial performance.
- Compile financial statements including income statements, balance sheets, and cash flow statements.

3. Expense Approval:

- Establish a process for reviewing and approving expenses incurred by various departments and committees.
- Implement controls to ensure expenses are within budget and aligned with organizational goals.

4. Revenue Generation:

- Explore and implement strategies for diversifying revenue streams, such as membership fees, donations, grants, and sponsorships.
- Evaluate the effectiveness of existing revenue generation efforts and identify opportunities for improvement.

5. Financial Policies and Procedures:

- Develop and maintain financial policies and procedures to ensure compliance with regulatory requirements and best practices.
- Regularly review and update financial policies to reflect changes in the organization's operations or external environment.

Treasurer's Report

Ibrahim Duhaini, PhD

Treasurer of IOMP

6. Risk Management:
- Identify potential financial risks and vulnerabilities facing the organization.
- Develop strategies for mitigating risks, such as establishing reserves, obtaining insurance, or implementing internal controls.
- Monitor and assess risk factors regularly and adjust strategies accordingly.

7. Audit and Compliance:
- Arrange for regular audits of the organization's financial records to ensure accuracy and compliance with applicable laws and regulations.
- Review audit findings and recommendations with the finance committee and take appropriate actions to address any issues identified.
- Maintain documentation of audit processes and outcomes for transparency and accountability.

8. Strategic Financial Planning:
- Participate in strategic planning processes to align financial goals with organizational objectives.
- Evaluate long-term financial sustainability and develop plans to support future growth and stability.

9. Communication and Transparency:
- Foster open communication and transparency regarding financial matters within the organization.
- Provide regular updates to stakeholders, including board members, staff, and donors, on financial performance and key initiatives.

10. Continuous Improvement:
- Solicit feedback from committee members and stakeholders to identify areas for improvement in financial management processes.
- Regularly evaluate the effectiveness of financial policies, procedures, and systems, making adjustments as needed to enhance efficiency and effectiveness.

By following this comprehensive workflow, the finance committee of IOMP can effectively manage the organization's finances, ensure compliance with regulations, and support its mission and objectives.

Education and Training Committee's Report

Arun Chougule, PhD, FIOMP, FAMS

Chair of IOMP Education and Training Committee

ARUN CHOUGULE

IOMP Education & Training Committee Chair

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" I request all of you to kindly take advantage of the IOMP accreditation facility to get accredited medical physics education programs, residency programs, CPD accreditation of conferences/ workshops/training, as well as CME points."

The Education and Training Committee [ETC] of IOMP is entrusted with development of programs related to education and training of medical physics, to promote internationally sponsored education and training programs, consider application from national and regional organisation for IOMP endorsement and funding, to harmonise and standardize medical physics education program, accreditation of educational, residency and CPD program. The member of ETC and Accreditation Board [AB] are working hard to fulfilling the aims and objectives of ETC and contributing for betterment of medical physics education & training in IOMP member countries.

1. ETC IOMP has reviewed **3 applications** received from the **conference organizers/scientific activity** for IOMP endorsement and/or funding and submitted report to IOMP EXCOM.

2. ETC IOMP has reviewed the **IAEA draft document "Safety Report on Education and Training for Building and Maintaining Competence in Radiation Protection in Medicine"** and given its recommendation for IOMP endorsement of the IAEA document.

3. IOMP Accreditation board [AB] has reformatted and **updated the accreditation manuals and forms**, they are now available on the IOMP website.

4. IOMP AB has created **IOMP visit report templates** for standardisation and documentation and are now on IOMP website.

5. The IOMP accreditation board [AB] undertook the evaluation of IOMP accreditation application for accreditation of its postgraduate medical physics education program from **Hong Kong Polytechnic University** and completed the site visit during 2-3 May 2024. The program is now accredited for 3 years w.e.f. 1 June 2024. IOMP has received US$ 3000 as accreditation fees.

Education and Training Committee's Report

Arun Chougule, PhD

Chair of IOMP Education and Training Committee

6. IOMP accreditation board has received an application from **National University of Colombia**, Bogota , Colombia for accreditation of Masters in Medical Physics program. It is being evaluated.

7. IOMP AB is providing guidance and support to establish a **residency program at Kalli, Colombia** and also helping to improve and formalize residency program from Karbala, Iraq.

8. ETC IOMP has encouraged medical physicists from Colombia to take **IMPCB certification examinations** and over 50 medical physicists from Colombia are taking IMPCB certification examinations in November 2024.

9. ETC IOMP has provided guidance and support to take initiatives in establishing the **national Certification Board in Colombia** and soon they will establish it.

10 Accreditation application from **Gurve Radiotherapy Services, Caracas, Venezuela** for accreditation of residency program evaluated and accredited. IOMP has received US$ 3000 as IOMP accreditation fees.

11. Communications are in progress with a few more programmes.

12. IOMP ETC has taken active participation in IOMP activities and supported **IMPW2024** and **IOMP webinars**.

13. Looking to the increasing work for IOMP AB, **three more members**, one each from SEAFOMP, EFOMP and ALFIM, IOMP regions were included.

The details of IOMP accredited medical education programs, CPD accredited activities and accreditation of residency programs up to 31 May 2024 are on the IOMP website.

The detailed information regarding accreditation board activities, the relevant manuals/forms and the accredited programs so far are available at https://www.iomp.org/accreditation/

I request all of you to kindly take advantage of the IOMP accreditation facility to get accredited medical physics education programs, residency programs, CPD accreditation of conferences/ workshops/trainings, as well as CME points.

For further details or any query, please contact: Chair of ETC and Chairman of Accreditation Board at arunchougule11@gmail.com

Awards & Honours Committee's Report

Kwan Hoong Ng, PhD

Chair of IOMP Awards & Honours Committee

KWAN HOONG NG

IOMP Awards & Honours Committee Chair

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"We strongly encourage eligible candidates to submit nominations for the IUPAP 2024 Early Career Scientists Prize in Medical Physics and IDMP 2024 award"

The committee is composed of:

Name	Position	Country	email
Kwan Hoong Ng (Chair)	Emeritus Professor	Malaysia	ngkh@ummc.edu.my
Erato Stylianou Markidou (Vice Chair)	Medical Physics Expert – Radiotherapy	Cyprus	eratostylmark@gmail.com
Jeannie Wong (Secretary)	Associate Professor	Malaysia	jeannie.wong@ummc.edu.my
Meshari Al Nuaimi	Radiation Physicist	Kuwait	Mesh.Alnuaimi@gmail.com
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Awards & Honours Committee's Report

Kwan Hoong Ng, PhD

Chair of IOMP Awards & Honours Committee

The committee members are writing two articles for **Medical Physics International (MPI)** about recognising the contribution of female medical physicists and the importance of clinical trials in medical physics research and practise.

Two award calls have been announced. **The IUPAP Early Career Scientist Prize in Medical Physics 2024 nomination** call has been announced on June 11, 2024 (https://www.iomp.org/awards-honours/).

The call for the **IDMP award 2024** was made on 2 March 2024 (https://www.iomp.org/call-for-nomination-2024-idmp-award/). The nomination will be closed by August 9, 2024.

We strongly encourage eligible candidates to submit nominations.

To encourage collaboration and fraternization, the committee members are currently striving to bring together various categories of past award winners.

Professional Relation Committee's Report

Simone K Renha, PhD

Chair of IOMP Professional Relation Committee

SIMONE K RENHA

IOMP Professional Relation Committee Chair

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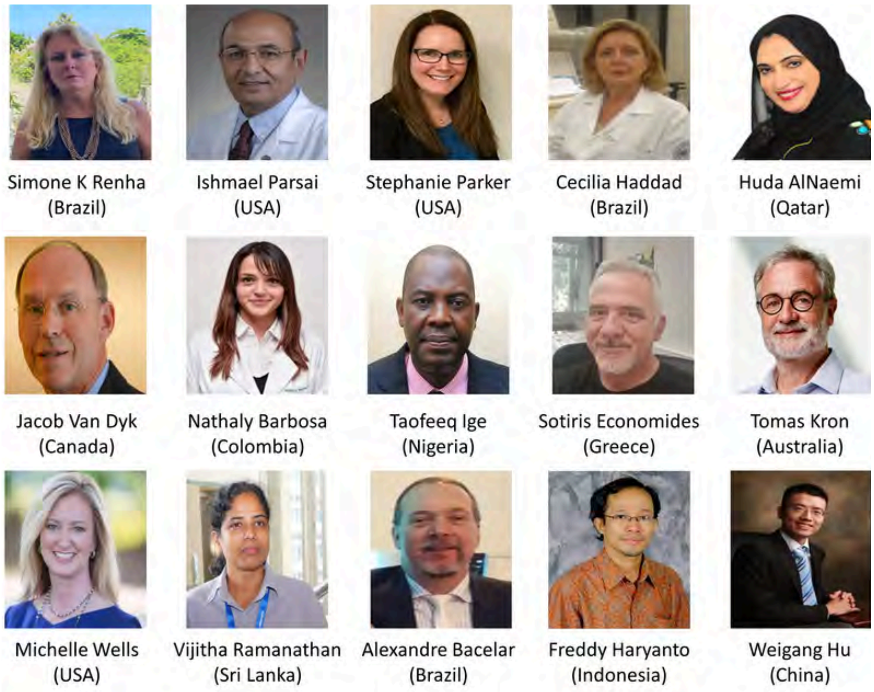
"In an era that champions equity, it is disheartening that the populations of least-developed countries and some developing nations continue to grapple with inadequate access to technologies and qualified health professionals, particularly medical physicists."

IOMP PRC MEMBERS (2022-25):



The **global recognition** of the fundamental role of medical physicists in departments utilizing ionizing radiation has been on the rise. Numerous initiatives have been launched to optimize the benefits of medical radiation applications while enhancing radiological protection and safety. However, in an era that champions equity, it is disheartening that the populations of least-developed countries and some developing nations continue to grapple with inadequate access to technologies and qualified health professionals, particularly medical physicists. This disparity hampers healthcare progress in these regions and directly affects the lives of patients who need these services.

The publication of the **global assessment of imaging and nuclear medicine resources** by the Lancet Oncology Commission highlights significant shortages in equipment and workforce, emphasizing the need to improve patient access to diagnosis and treatment, particularly in low-income and middle-income countries (LMICs). This report also underscores the considerable gap between low-income

Professional Relation Committee's Report

Simone K Renha, PhD

Chair of IOMP Professional Relation Committee

and high-income countries (1). However, it presents an opportunity for change, offering a chance to bridge this gap and provide better healthcare for all, regardless of economic status.

According to the International Atomic Energy Agency database, the availability of medical radiation technologies in **low-income countries** is very limited. Of the 29 countries classified as low-income, only 15 have a radiotherapy center, and the equipment per million population is only 0.056, compared to 7.708 in high-income countries (2). In nuclear medicine, 134 out of 195 countries have nuclear medicine facilities. However, significant disparities exist in the distribution of these technologies. For instance, in high-income countries, there are 3.2 PET-CT scanners per million inhabitants, while in low-income countries, the number is as low as 0.007 PET-CT scanners per million. Only 9 of 54 African countries have PET scanners, highlighting these disparities (3).

The number of services and equipment in the diagnostic radiology field is uncertain. The assessment is complicated by the fact that **there is an emerging role of private healthcare providers in LMICs who have different reporting structures.** However, according to the World Health Organization, between one-half to two-thirds of the world's population lacks adequate access to radiologic services, with most of this population residing in low- and middle-income countries (LMICs). The distribution of specialized radiology equipment is also heterogeneous. For example, there are 37.767 CT scanners per million people in high-income countries, compared to only 0.602 per million in low-income countries. Similarly, magnetic resonance imaging (MRI) is available at 26.529 units per million in high-income countries, but only 0.188 per million in low-income countries. For mammography, there are 30 units per million in high-income countries, but none in low-income countries (4).

In addition to this highly inequitable access to diagnostic and treatment technology, **there is a lack of highly trained healthcare professionals** (1). A survey conducted by the International Organization for Medical Physics (IOMP) revealed that the lowest number of medical physicists is found in LMICs, with most working in radiotherapy, resulting in a significant shortage of professionals in diagnostic radiology. The understanding of the role of medical physicists in diagnostic radiology and nuclear medicine facilities is still low, necessitating efforts to raise awareness in these regions (5).

The **PRC committe**e remains aware of these issues and actively works to contribute to substantial and positive change. The committee recognizes the pivotal role of medical physicists in disseminating knowledge, sharing expertise, and effectively demonstrating the significance of medical physics in diagnosis and treatment on a global scale. It is also essential to emphasise the role of medical physicists in respect to patient and staff safety not only from a radiological perspective. Furthermore, the PRC underscores the value of collaboration and seeks to align its efforts with committees of other organizations that share similar objectives and initiatives. Through collective action, we aim to effect meaningful change, alleviate disparities, and deliver optimal patient care.

Professional Relation Committee's Report

Simone K Renha, PhD

Chair of IOMP Professional Relation Committee

In this context, I invite everyone to our next webinar, ***"Inspiring and Energizing the Next Generation of Medical Physicists."*** We are honoured to have Prof. Ehsan Samei and Dr. Stephen Avery as lecturers. The webinar will be held on July 29th at 12 pm GMT.

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Medical Physics World Board (MPWB) Committee's Report

Chai Hong Yeong, PhD

Chair of IOMP Medical Physics World Board (MPWB)

CHAI HONG YEONG

IOMP MPWB Committee Chair

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"In January 2024, we launched our revamped website that serves as a hub connecting global medical physicists and sharing essential medical physics information. Between January and June 2024, it garnered 977k views from 190k visitors"

The MPWB committee's responsibilities encompass:

- Publishing the IOMP Newsletter bi-monthly;
- Publishing eMPW semi-annually;
- Regularly updating the IOMP website;
- Managing the IOMP's social media presence; and
- Assisting the IOMP ExCOM in global medical physics communication.

In the first half of 2024, the committee released three issues of the **IOMP Newsletter**:

- IOMP Newsletter, Vol. 6, No. 3, June 2024
- IOMP Newsletter, Vol. 6, No. 2, April 2024
- IOMP Newsletter, Vol. 6, No. 1, February 2024

These newsletters disseminate current IOMP activities, international articles, and guidelines bi-monthly to over 50,000 members. To join, please complete the subscription form on our webpage (https://www.iomp.org).

In January 2024, we launched our revamped website (www.iomp.org), that serves as a hub connecting global medical physicists and sharing essential medical physics information. Between January and June 2024, it garnered 977k views from 190k visitors, with the top 5 pages being the Home page, News & Updates, IMPW 2024, IOMP School Webinars, and IOMP Webinars Certificate.

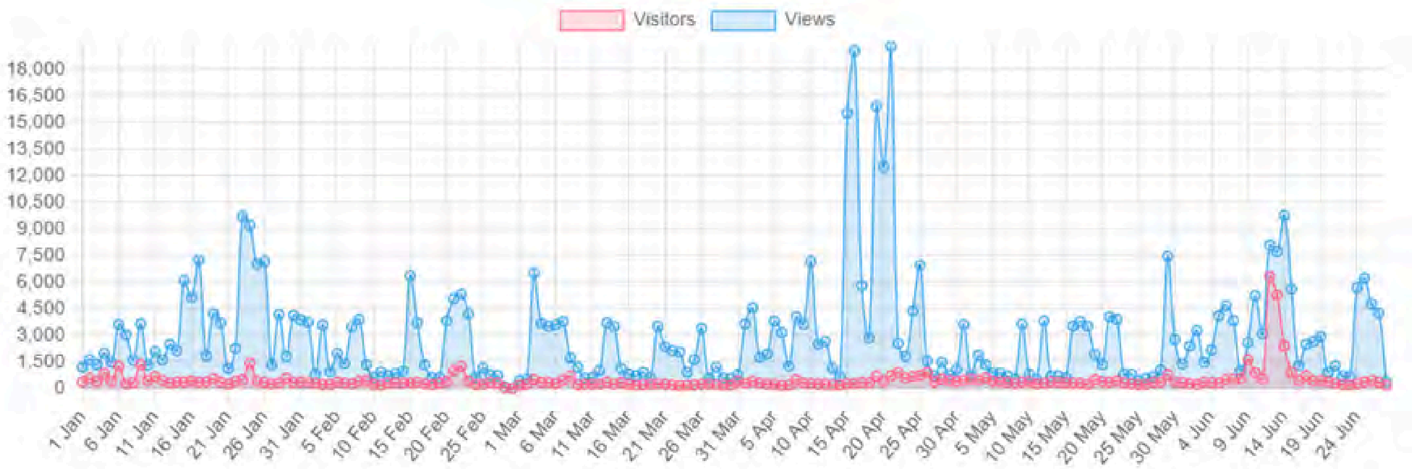
The committee will continue to manage and operate the social media accounts of the IOMP. We invite all of you to follow/subscribe to our social media pages:

- **Instagram** (https://www.instagram.com/iomp.official/)
- **Facebook** (https://www.facebook.com/InternationalOrganizationforMedicalPhysics)
- **Linkedin** (linkedin.com/in/iomp-international-organization-for-medical-physics-a402b824b)
- **Twitter** (https://twitter.com/IOMP_Official)
- **YouTube** (https://www.youtube.com/@IOMPOfficial)

Medical Physics World Board (MPWB) Committee's Report

Chai Hong Yeong, PhD

Chair of IOMP Medical Physics World Board (MPWB)



	Views	Visitors
Chart Total:	111,444	27,535
All Time Total:	977,802	190,092

Figure 1: Daily traffic trend of the IOMP website (www.iomp.org)

IOMP MPWB COMMITTEE MEMBERS (2022-25):

1. Chai Hong Yeong, Malaysia – Chair
2. Rosana Pirchio, Argentina - Secretary
3. Afua Yorke, United States
4. Cheryl Lian, Singapore
5. Habib Ashoor, Bahrain
6. Ismail Zergoug, Algeria
7. Joerg Lehmann, Australia
8. Milton Estuardo Ixquiac Cabrera, Guatemala
9. Niki Fitousi, Belgium
10. Safayet Zaman, Bangladesh

IOMP WEB SUB-COMMITTEE MEMBERS (2022-25):

1. Chai Hong Yeong, Malaysia – Chair
2. Cinthia Kotzian Pereira Benavides, Brazil
3. Eleftherios Tzanis, Greece
4. Leyla Moghaddasi, Australia
5. Li Kuo Tan, Malaysia
6. Mark Pokoo-Aikins, Ghana
7. Nabil Iqeilan, Qatar
8. Santiago Girola, Argentina
9. Yiwen Xu, Canada

www.iomp.org

Publication Committee's Report

Francis Hasford, PhD

Chair of IOMP Publication Committee

FRANCIS HASFORD

IOMP Publication Committee Chair

haspee@yahoo.co.uk

"MPI-Experiences is being established with the focus of serving as a comprehensive platform for documenting and disseminating high-quality experiences related to various aspects of medical physics services."

Among other things, the Publications Committee is mandated to provide or support appropriate publications as a result of research, education and professional programs of IOMP, oversee the publication agreements with publishers of IOMP journal(s), make nominations of editorial board members, identify the need for international scientific, research and professional publications, etc.

Recent activities being undertaken by the Publications Committee include:

1. Establishment of the "MPI-Experiences" Journal

The Publications Committee has been coordinating processes for the establishment of MPI-Experiences, a new journal of the IOMP. MPI-Experiences is being established with the focus of serving as a comprehensive platform for documenting and disseminating high-quality experiences related to various aspects of medical physics services, encompassing practical, professional, educational, computational, and technological dimensions, which serve to demonstrate the most effective methods for implementing technical recommendations, guidelines, and codes of practice. The journal's scope, potential publishers, guidelines for editorial board membership, financial and logistical considerations are under review by the Publications Committee.

2. Publication of Medical Physics International (MPI) Journal

The December 2023 issue of MPI (Vol. 11, No. 2) was published on 22 January 2024. The issue is the biggest volume so far produced, with 618 pages, featuring book of abstract of the International Conference on Medical Physics (ICMP-2023) held in Mumbai, and theses abstracts of the ICTP Medical Physics Programme. Going forward, a special issue called "MPI-Proceedings" is to be established for future publications of books of abstracts from IOMP-organized ICMPs and World Congresses (WCs). This step is to streamline calatolguing of all books of abtracts of subsequent ICMP and WCs in one place. The Publications

Publication Committee's Report

Francis Hasford, PhD

Chair of IOMP Publication Committee

Committee will through this initiative build a solid brand of journals for the IOMP, including MPI, MPI-History Edition, MPI-Experiences, and MPI-Proceedings. The June 2024 issue of MPI (Vol. 12, No. 1) is currently being prepared for release in the second week of July.

3. Publication of MPI-History Edition

The latest issue of the MPI-History Edition has been published on 16th June 2024 and available at http://www.mpijournal.org/MPI-v12HEi10.aspx. This 10th Anniversary MPI-HE issue has a main focus on two special Anniversaries:

- The coming 60th Anniversary from the first International Conference on Medical Physics ICMP 1 in 1965; and
- The 30th Anniversary of the First International Conference on Medical Physics Education in 1994.

The Annex to the MPI-HE issue includes the book with Abstracts from the ICMP 1 in 1965 and the Book with Papers from 1994. The publication presents the status of the Medical Physics profession 60 years ago and the status of education (mainly in Europe) 30 years back. This shows the remarkable progress in medical physics made after these cornerstone events. The issue also includes other papers focused on the history of medical physics progress.

4. Update of the History Sub-Committee

The History Sub-Comnittee intends to conduct video interviews of past IOMP officers over the internet and compile same for inclusion in the history interviews. The history interviews were started during the World Congress (WC) 2009, and a planned continuation of these after 10 years for WC2021 was interrupted due to the COVID-19 pandemic. The History Sub-committee now intends to continue with these, aiming to have a number of colleagues interviewed by WC 2025.

Official Publications of IOMP:

Medical Physics International (Official Journal of the IOMP)
Physics in Medicine and Biology
Physiological Measurement
Medical Physics
Journal of Applied Clinical Medical Physics – an open access journal
Physica Medica – European Journal of Medical Physics
Journal of Medical Physics (JMP) – an open access journal
Radiological Physics and Technology
Physical and Engineering Sciences in Medicine (PESM)

Publication Committee's Report

Francis Hasford, PhD

Chair of IOMP Publication Committee

IOMP PUBLICATIONS COMMITTEE 2022-2025:

- Francis Hasford, Ghana – Chair
- Hassan Kharita, Syria – Vice Chair
- Marina Sala, USA – Secretary
- Lorenzo Brualla, Germany
- Mohamed Metwaly, UK
- Michael Lee, Hong Kong
- Gustavo Daniel Sanchez, Argentina
- Hafiz Mohd Zin, Malaysia
- Bamidele Awojoyogbe, Nigeria
- Magdalena Stoeva, Bulgaria
- John Damilakis (IOMP President) - Ex-Officio
- Eva Bezak (IOMP Vice President) - Ex-Officio
- Slavik Tabakov (MPI History Edition) - Ex-Officio
- Perry Sprawls (MPI History Edition) - Ex-Officio
- Sameer Tipnis (Medical Physics International) - Ex-Officio
- Chai Hong Yeong (e-Medical Physics World) - Ex-Officio
- Iuliana Toma-Dasu (Physica Medica) - Ex-Officio
- Kang-Ping Lin (Health and Technology) - Ex-Officio
- Jamie Trapp (Physical and Engineering Sciences in Medicine) - Ex-Officio
- Jong Min Park (Progress in Medical Physics) - Ex-Officio
- Ambika Pradhan (Journal of Medical Physics) - Ex-Officio
- Ishmael Parsai (e-Medical Physics World) - Ex-Officio
- John M. Boone (Medical Physics) - Ex-Officio
- Katia Parodi (Physics in Medicine and Biology) - Ex-Officio
- Michael David Mills (Journal of Applied Clinical Medical Physics) - Ex-Officio
- Simone Renha (Revista Latinoamericana de Física Médica) - Ex-Officio
- Nobuyuki Kanematsu (Radiological Physics and Technology) - Ex-Officio

Medical Physics International (MPI) Journal Report

Francis Hasford and Sameer Tipnis

co-Editors-in-Chief

FRANCIS HASFORD
haspee@yahoo.co.uk

SAMEER TIPNIS
tipnis@musc.edu

In the second week of January 2024, the **December 2023 issue of MPI (Vol. 11, No. 2)** was published. The edition attracted lots of readership, with MPI website attracting 1,000+ readers daily upon release. The issue had 618 pages, which makes it the biggest volume so far produced. Included in the issue were the ICMP-2023 Book of Abstracts and the thesis abstracts of the ICTP Master of Medical Physics Programme. Owing to huge volume of pages for MPI editions that feature book of abstracts, special issue (MPI-Proceedings) is being planned solely for publication of books of abstracts of future editions of the International Conference of Medical Physics (ICMP) and World Congresses (WCs). In this case, all books of abstracts of subsequent ICMP and WCs will be catalogued in one place. Ultimate vision is to develop MPI as an IOMP brand and gradually grow it by adding more journals as needed (e.g., MPI, MPI-History Edition, MPI-Experiences, MPI-Proceedings, etc.).

As Co-Editors-in-Chief (EiCs), we appreciate the support and contribution of everyone, including medical physics researchers, scholars, and experts who have contributed their valuable research articles to MPI and have been part of our success story this far. We continue to look forward to working with everyone to advance medical physics scientific knowledge through publication of high-quality impactful articles in the MPI. In ensuring quality standard articles are produced, we perform in-depth read and critique the received submissions, and then discuss the merits as well as drawbacks of the manuscripts before sending feedback for authors' revision. This assures a balance of perspectives.

The upcoming edition **(June 2024 issue) of MPI (Vol. 12, No. 1)** is under preparation and expected to be released in the second week of July. This edition will have about 15 full articles in thematic areas of research papers, educational topics, professional issues and collaborating organizations. We encourage readers to submit more "how-to" or practical tip articles which can be used by fellow medical physicists around the globe. Kindly visit www.mpijournal.org/index.aspx for latest MPI publications and enjoy reading our exciting publications.

History Sub-Committee's Report

Slavik Tabakov, PhD

Chair of IOMP History Sub-Committee, IOMP Past President

SLAVIK TABAKOV

IOMP History Sub-Committee Chair

slavik.tabakov@emerald2.co.uk

"This year marks 15 years from the establishment of the IOMP History Sub-Committee (HSC). This establishment was led by A Niroomand-Rad (IOMP President 20023-2006)"

This year marks **15 years** from the establishment of the IOMP History Sub-Committee (HSC). This establishment was led by A Niroomand-Rad (IOMP President 20023-2006), who became the first Chair of HSC in 2008. The HSC is not part of ExCom, as a Sub-Committee it is placed under the IOMP Publication Committee. Its charge is to keep information about IOMP history, its active members and related data.

The current members of the HSC are:

- Slavik Tabakov, (UK)
- Azam Niroomand-Rad, USA
- Geoffrey Ibbott, USA
- KY Cheung, Hong Kong
- Perry Sprawls, USA
- John Damilakis, Greece (Ex-Officio)
- Eva Bezak, Australia (Ex-Officio)
- Francis Hasford, Ghana (Ex-Officio)

History Sub-Committee regularly updates the IOMP History Tables - https://www.iomp.org/history-sub-committee-activities/ and keeps a track on important anniversaries, associated with the history of the international development of medical physics.

In connection with the coming 60th anniversary of the First International Conference on Medical Physics (ICMP 1, 1965, Harrogate, UK) the full Book with Abstracts from this ICMP is arranged as an Annex to the soon coming Journal – **Medical Physics International – History Edition (MPI-HE No.10 - http://www.mpijournal.org/history.aspx)**. The Book with Abstracts shows the progress in the profession since 1965. In connection with another anniversary, the coming MPI-HE will also include in its annex the Book with papers from the First International Conference on Medical Physics Education in 1994.

Currently the HSC is preparing for the renewing of the activity associated with **video interviews** with eminent past contributors to the International development of medical physics.

IOMP Women Sub-Committee's Report

Loredana Marcu, PhD

Chair of IOMP Women Sub-Committee

LOREDANA MARCU

IOMP Women Sub-Committee Chair

loredana@marcunet.com

"the IOMP Women Subcommittee is focused on a number of activities aimed to attract more women to medical physics and to assist women MPs with their continuous professional development."

The objective of the IOMP Women Subcommittee is aligned with the key IOMP mission, namely, to advance medical physics practice worldwide by disseminating scientific and technical information, fostering the educational and professional development of medical physicists, and promoting the highest quality medical services for patients.

In view of the above, the IOMP Women Subcommittee is focused on a number of activities aimed to attract more women to medical physics and to assist women MPs with their continuous professional development.

To fulfil the aforementioned goals, the IOMP Women subcommittee has set a number of action plans:

- To develop, implement and coordinate activities and projects related to the role of females in the scientific and professional advancement of medical physics.
- To promote the role of the women in medical physics and encourage female medical physicist to advance in the profession.
- To support the contribution of female medical physicists at major scientific conferences and congresses.
- To disseminate the work undertaken by the subcommittee through scientific publications and conference presentations.
- To provide regular status/progress updates to the IOMP on all tasks and projects related to the IOMP Women subcommittee.

IOMP Women subcommittee main activities/events during Jan-June 2024:

During the past half a year the IOMP Women Subcommittee was involved in a number of tasks/ activities:

(1) Our subcommittee has received a nomination for a new membership (nominee Dr. Iyobosa B. Uwadiae, Secretary General of Nigerian Association of Medical Physics (NAMP)), that was approved by the executive committee of IOMP.

IOMP Women Sub-Committee's Report

Loredana Marcu, PhD

Chair of IOMP Women Sub-Committee

Thus, as of this year, our committee has **17 active members**. Dr. Uwadiae is a welcome addition to the Women Subcommittee, given the underrepresentation of the African continent in the medical physics profession, particularly female physicists.

(2) This year's **International Women's Day (8th March 2024)**, was marked by a special webinar organized by IOMP Women Subcommittee dedicated to early career female medical physicists with the theme Celebrating International Women's Day with early career medical physicists. The three invited speakers presented their journeys through research in medical physics as well as their involvement in various professional matters and they were:

- Ashleigh Hull (Allied Health and Human Performance Academic Unit, University of South Australia, Adelaide, SA, Australia) presenting on the topic of In vitro development of MUC1-CE targeted alpha therapy for pancreatic ductal adenocarcinoma
- Ashley Cetnar (Department of Radiation Oncology at The Ohio State University) presenting on two aspects of medical physics– scientific and professional through her talk on Exploring Ultra-high Dose Rate Radiation and Growing as an Educator in Medical Physicist
- Leticia Irazola (Medical Physics at Centro de Investigaciones Biomédicas de la Rioja, Spain) presenting her experience as the chair of the Early Career Medical Physicists - Special Interest Group within EFOMP, with the topic Making progress only needs to get started.
- The webinar was very well received and well attended.

(3) **Collaboration with IUPESM WiMPBME group**: a new paper was written reporting the quantitative data resulting from the international survey developed by the group with the title: A gender breakdown of unexpected benefits generated by work from home in STEM fields - a qualitative analysis of the WiMPBME Task Group survey. Currently the paper is under review in the journal of Social Problems.

IOMP WOMEN SUBCOMMITTEE MEMBERS (2022-25):

- Loredana Marcu, Romania – Chair
- Huda Al-Naemi, Qatar
- Zakiya Al-Rahbi, Oman
- Hanan Aldousari, Kuwait
- Hasin Anupama Azhari, Bangladesh
- Laurentcia Arlany, Singapore
- Eva Bezak, Australia
- Kathleen Hintenlang, USA
- Simone Kodlulovich, Brazil
- Anchali Krisanachinda, Thailand
- Savanna Nyarko, Ghana
- Nadia Octave, Canada
- Elina Samara, Switzerland
- Magdalena Stoeva, Bulgaria
- Rajni Verma, India
- Rafidah Zainon, Malaysia
- Iyobosa B. Uwadiae, Nigeria

International Organization for Medical Physics
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INTERNATIONAL MEDICAL PHYSICS WEEK (IMPW)

22 - 26 April 2024

- **M** Meetings with authorities
- **T** Training program
- **W** Write about achievements
- **T** Teleconference
- **F** Facing challenges plan
- **S** Safety of patient
- **S** Sum up

Contents

IMPW 2024 Report

Magdalena Stoeva, PhD

Secretary General of IOMP

For 5 consecutive years, IMPW has been gathering medical physicists from all over the world to celebrate the profession through educational, scientific, and professional activities organized by the IOMP. The main objective is to improve the qualification of the professional community and contribute to global awareness among our fellow disciplines and society.

IMPW 2024 had a unique setup and atmosphere – dedicated to IOMP's Regional Organizations the IMPW 2024 webinars focussed on various aspects of medical physics from regional and organizational matters to the most recent professional, scientific and educational developments in the area. With this IOMP and its 6 regional organizations gave their unique contribution to the global development of the profession.

Carefully selected, the themes and the guest speakers were among the most prominent medical physicists representing each of the IOMP's regional organizations.

Fig. 1. Summary of the IMPW 2024 speakers and topics

The post-IMPW statistics is extremely satisfying and reflects the global importance of the event. With a total of **5344 attendees from >100 countries** throughout the 5 days, IMPW 2024 can only be compared to the largest professional events – the World Congress and the International Conference on Medical Physics.

The IOMP Webinars certification system also reflects the broad interest in the event scoring a total of 4149 CPD/CME certificates.

Each one of the webinars has been recorded and freely available online through the IOMP channels.

IMPW 2024 Report

Magdalena Stoeva, PhD

Secretary General of IOMP

Table 1. Summary of IMPW 2024 webinars and recordings

Date	Topic	Speaker(s)	Recording
22. Apr. 2024	The new EFOMP Protocol for the Quality Control of Dynamic Imaging Systems	Annalisa Trianni Nicholas Marshall	https://youtu.be/_sBhwqWgN-I
23. Apr. 2024	Medical Physics in the Middle East	Hassan Kharita Meshari Alnuaimi Rabih Hammoud	https://youtu.be/ZJ_l9JABJq8
24. Apr. 2024	Introducing Radiotherapy in Africa through Network Collaborations	Chris Trauernicht George Acquah	https://youtu.be/VJz8rDb54YQ
25. Apr. 2024	Development and Implementation of Structured Clinical Training Programs for Medical Physicists in Latin America: A Comprehensive and Practical Review from the Experience of the Integral Oncology Center of Leben Salud in Patagonia, Argentina	Ricardo Ruggeri	https://youtu.be/G4B4pZj7pJ0
26. Apr. 2024	Radiation Protection in Nuclear Medicine	S Somanesan Pankaj Tandon	https://youtu.be/KHj_GN1IH4o

The International Medical Physics Week stays solid at the events calendar of the IOMP, its regional and national member organizations uniting medical physicists throughout the world in their diversity, overcoming distances and time differences to contribute to the global development of our profession.

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

Name: Quality Assurance in Radiation Medicine for Sustainable Healthcare
Date: November 13 – 17, 2023
Venue: ROK Hilton, Kingston Jamaica

Executive Summary:

The "Quality Assurance in Radiation Medicine for Sustainable Healthcare" conference, held from November 13 to 17, 2023, at the ROK Hilton in Kingston, Jamaica, successfully achieved its objectives of providing practical information for delivering radiation medicine in limited resource conditions while maintaining required quality standards.

The conference, endorsed by the Ministry of Health and Wellness Jamaica and supported by an impressive array of contributing organizations and sponsors, attracted a diverse global audience. With 113 participants representing 22 countries, including virtual and in-person attendees, the event successfully facilitated knowledge exchange and collaboration.

The inclusion of renowned partners, such as the International Atomic Energy Agency (IAEA), the International Organization for Medical Physics (IOMP) and the Pan American Health Organization (PAHO), added depth and credibility to the conference content. The 22 Continuing Education Credits (CPD) offered underscore the commitment to professional development within the field.

The "Quality Assurance in Radiation Medicine for Sustainable Healthcare" conference not only met but exceeded its objectives, fostering a global network committed to delivering radiation medicine in resource-constrained environments while upholding the highest quality standards. The success of this event lays a strong foundation for future collaborations and advancements in the field.

Conference Objectives:

To provide attendees with the practical information necessary to deliver radiation medicine in limited resource conditions while maintaining the required quality standards.

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

Attendance and Participants:

Total number of attendees: 114
Presenters: 28
Virtual Participants: 19
In-person Participants: 59
Organizers: 6
Sponsors: 2
Geographical Representation (22): Antigua and Barbuda, Austria, Australia, Bahamas, Barbados, Belize, Canada, Colombia, Costa Rica, Croatia, Dominica, Greece, Grenada, Guatemala, Guyana, Jamaica, Saint Lucia, St. Vincent and the Grenadines , Trinidad and Tobago, Suriname, USA, and Venezuela.

Continuing Education Credits: 22 CPD

Partner (1):

1. The Ministry of Health and Wellness Jamaica (MOHW)

Contributing Organizations (14):

1. International Atomic Energy Agency (IAEA)
2. International Organization for Medical Physics (IOMP)
3. International Medical Physics Certification Board (IMPCB)
4. Pan American Health Organization (PAHO)
5. Asociación Latinoamericana de Física Médica (ALFIM)
6. The American Association of Physicists in Medicine (AAPM)
7. Medical Physics for World Benefit (MPWB)
8. The International Society of Radiographers and Radiological Technologists (ISRRT)
9. The International Society of Radiology (ISR)
10. The Planning Institute of Jamaica (PIOJ)
11. International Centre for Environmental and Nuclear Sciences (ICENS)
12. Hazardous Substances Regulatory Authority (HSRA)
13. The University of the West Indies – Mona (UWI)
14. The University Hospital of the West Indies (UWHI)

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

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Refersher Topics Covered:

1. Radiation Biology Review
2. Patient Positioning and Iso-Centre Placement
3. Analouge to Digital Exposure Factors Adjustments
4. Quality Assurance in Digital Mammography
5. Radiotherapy Breast Planning
6. Gamma Evaluation for Patient Specific QA
7. Remote and Automated QC in Radiology
8. QA HDR Brachytherapy
9. The Art of CT imaging

Main Topics Covered:

1. Quality Assurance Programme in Diagnostic Radiology: The Radiographer Perspective
2. Modern Innovations in Quality Control for Diagnostic Radiology
3. The Role of the Radiologist in a Quality Management System
4. Justification in Medical Imaging and the EU-JUST-CT Project
5. Current Best Practices in Computed Tomography
6. Current Best Practices in Mammography
7. Current Best Practices Radiography: The Radiographer Perspective
8. Setting up a Quality Assurance Programme in Radiotherapy
9. Basic Equipment Needs for a Comprehensive Quality Assurance Programme in Radiotherapy
10. Improving Treatment Quality with Image Guidance
11. End-to-End QA: What It Is and Where It Fits in a Radiotherapy QM Program
12. Optimizing Patient Workloads in Radiotherapy
13. Quality Assurance in Radiation Therapy
14. RapidPlan: Implementing and Validating a Knowledge-Based Planning Tool, Clinical Experience
15. Quality Assurance Practices in Nuclear Medicine
16. The Role of the Radiopharmacist in Nuclear Medicine
17. Dosimetry in Nuclear Medicine.

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

Presenters:

1. Eva Bezak, Australia
2. Virginia Tsapaki, Austria
3. Corey Drakes, Barbados
4. John Schreiner, Canada
5. Juan Carlos Paz Lozada, Colombia
6. Jorge Rojas, Costa Rica
7. Patricia Mora, Costa Rica
8. Boris Brkljacic, Croatia
9. Dimitris Katsifarakis, Greece
10. Alejandro Montezuma, Guatemala
11. Kamala Anderson, Jamaica
12. Barrington Brevitt, Jamaica
13. Tracia-Gay Kennedy, Jamaica
14. Kern Pemberton, Jamaica
15. Darrion Walker, Jamaica
16. Mitko Voutchkov, Jamaica
17. Travine Sharpe, Jamaica
18. Rahje Shields, Jamaica
19. Whitney Colour, Suriname
20. Sherisse Hunte, Trinidad and Tobago
21. Colin Orton, USA
22. Deon Wilks, USA
23. Yakov Pipman, USA
24. Adel Mustafa, USA
25. Pablo Jiménez, USA
26. Ehsan Samei, USA
27. Kayiba Medlen, USA
28. John Humm, USA

Sponsors (2):

1. Varian Medical Systems
2. Prad Radiation Partners

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

Successes and Achievements:

A few of the major highlights were the participation of the English-speaking Caribbean states, with 11 of the region's countries represented at the conference (made possible with the help of the IAEA). It was also commendable that we were able to attract research presentations from the region, with presentations highlighting the work of medical physicists from Jamaica and Trinidad and Tobago.

Challenges Faced:

The small number of professionals who practice radiation medicine in the English-speaking Caribbean makes it difficult to host a conference of this nature with focus on a single professional group. The cross-cutting approach to the conference made it difficult to address all the relevant topics in the limited time available.

Conclusions:

The "Quality Assurance in Radiation Medicine for Sustainable Healthcare" conference not only met but exceeded its objectives, fostering a global network committed to delivering radiation medicine in resource-constrained environments while upholding the highest quality standards. The success of this event lays a strong foundation for future collaborations and advancements in the field.

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

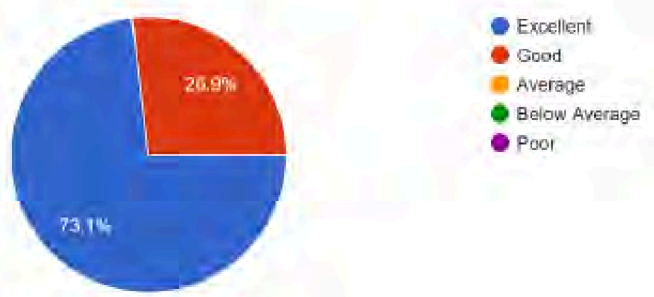
President, Jamaican Association for Physics in Medicine

Participants Feedback & Poll Results:

1.

How would you rate the overall quality of the presentations?

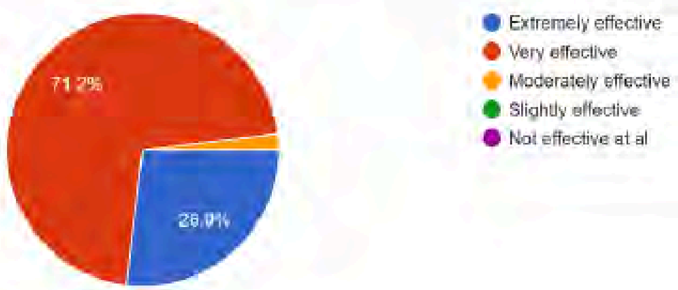
52 responses



2.

How effective were the speakers in communicating the intended concepts?

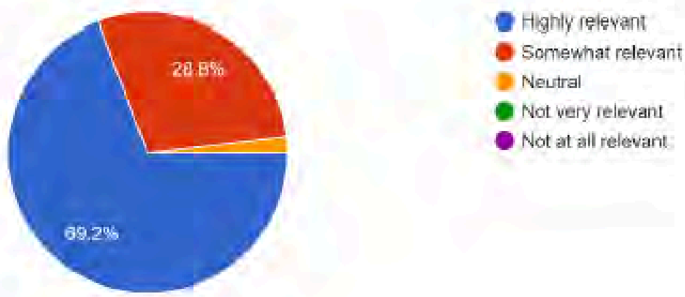
52 responses



3.

Were the topics covered in the conference relevant to your area of interest?

52 responses



Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

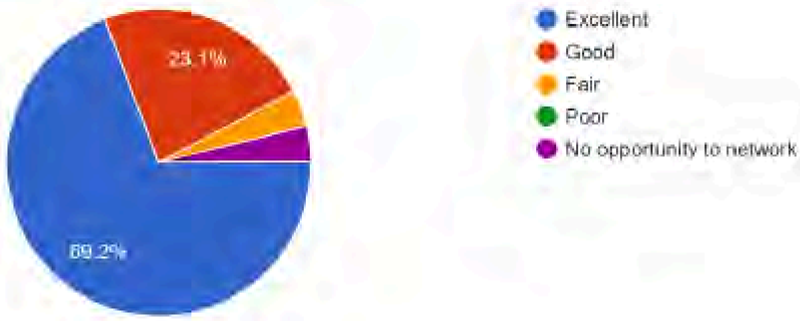
Sanchez Palmer

President, Jamaican Association for Physics in Medicine

4.

How would you rate the networking opportunities provided during the conference?

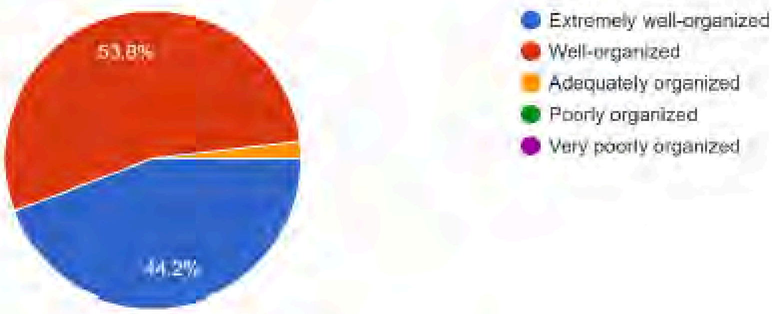
52 responses



5.

How well was the conference organized in terms of scheduling, logistics, and overall management?

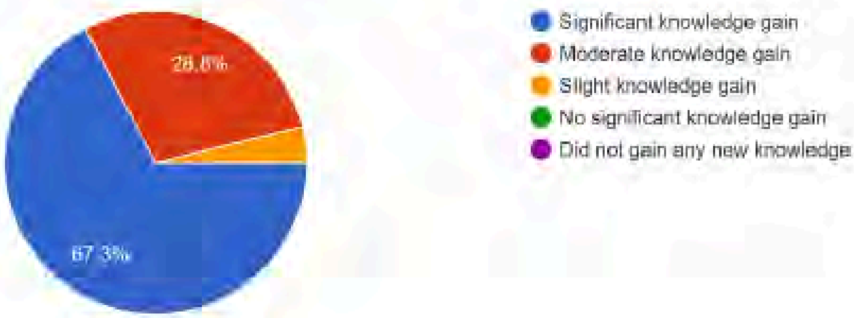
52 responses



6.

To what extent do you feel you gained new knowledge or insights from the conference?

52 responses

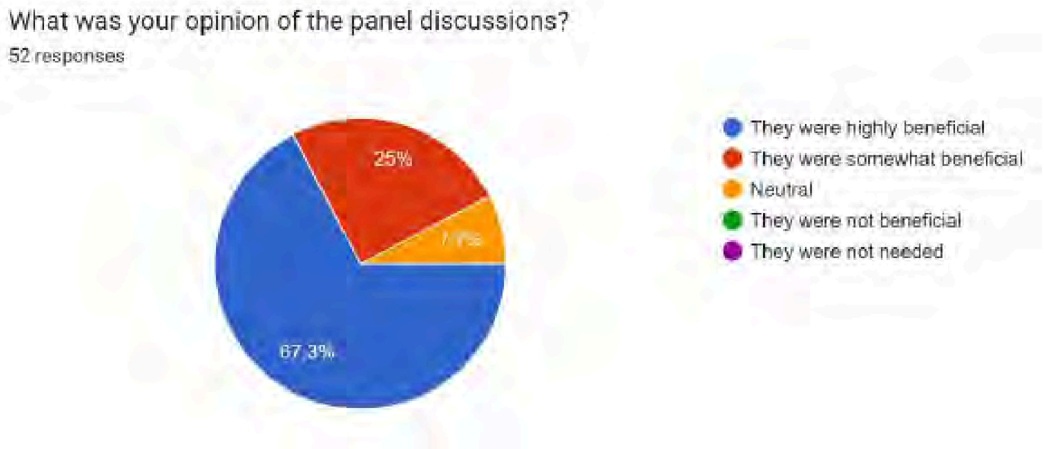


Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

7.



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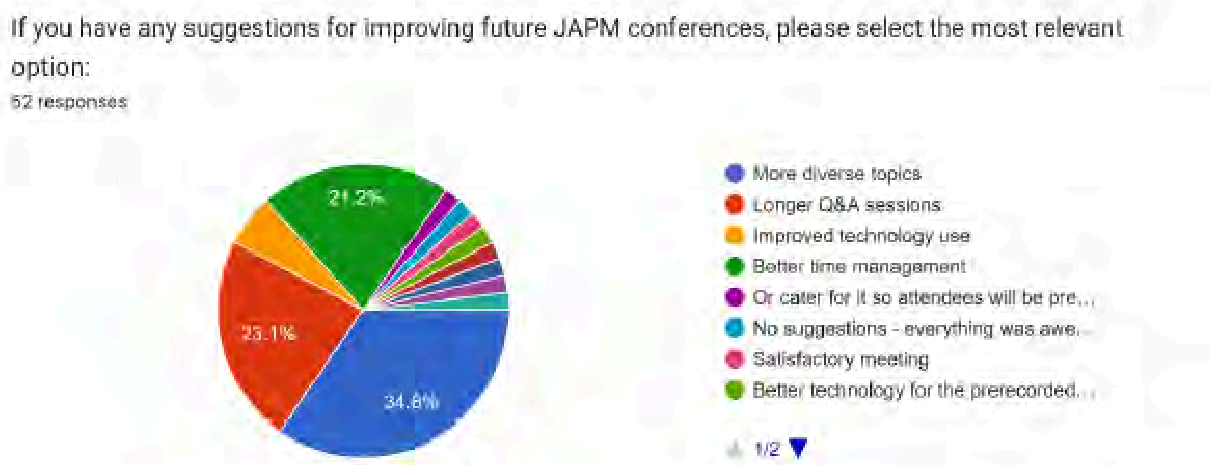

Post Conference Report - Quality Assurance in Radiation Medicine for Sustainable Healthcare

Sanchez Palmer

President, Jamaican Association for Physics in Medicine

Participants Photo:

Jamaican Association for Physics in Medicine
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A Tribute to Professor Luciano Bertocchi – A Living Legend in Medical Physics

By ICTP Master of Advanced Studies in Medical Physics (MMP) Faculty and Alumni

In the spirit of acknowledging excellence and dedication, a heartfelt tribute was extended to Professor Luciano Bertocchi during the celebration of IDMP-2023. As he marked his ninetieth birthday in December 2023, Professor Bertocchi stands as a living legend in the field of medical physics. His contributions, particularly during the International Centre for Theoretical Physics (ICTP) master of Medical Physics program (MMP), have been nothing short of extraordinary. As an essential pillar of support for the program, Professor Bertocchi's wisdom and guidance have shaped countless aspiring medical physicists, inspiring them to emulate his commitment to excellence.

Professor Bertocchi is not merely an academic figure; he embodies the values of passion, resilience, and a relentless pursuit of knowledge. His influence extends far beyond the classroom, resonating with all who have had the privilege of learning from him. In honoring Professor Bertocchi, the global medical physics community not only pays tribute to an exceptional individual but also sets an example for future generations to follow.

An inspired life - Marie Curie

Pirchio Rosana

Secretary, IOMP Medical Physics World Board (MPWB) Committee

Just months I started to ask me about the Marie Curie life, because I only knew about the Novel Prizes that she had won. I said to myself, it is time to research the life of this scientist. So, I read so many books and articles, but it wasn't impossible to read all of them. His life was very interesting, from a personal and scientific point of view.

The Nobel Prize in Physics 1903 was shared for Becquerel by the discovery of spontaneous radioactivity and for Pierre and Marie Curie by the research on the radiation phenomena. The Nobel Prize in Chemistry 1911 was in recognition by the discovery of radium and polonium, by the isolation of radium and its study.

My life changed a lot, I learned that small things are important, that the goal of scientific is to help society, don't forget it.
She lived and left your life for science, leaving a life without luxuries, selfishness nor arrogance.
She had a thrilling life, obsessive about researching, for her job. She loved her family; she lived in a time what the women don't have many rights. However, she lived a very hard time or in other words, she overlived.

Sorry Marie, because science must be interesting but things according to your words, not to people, but now you will be the center of this story. This story will not be perfect, full, but I tried to do my best.

"I am Marie Curie, you are Marie Curie, everybody can do things for others, without waiting for something."

"I have frequently been questioned, especially by women, about how I could reconcile family life with a scientific career. Well, it hasn't been easy."

"You can't hope to build a better world without making people better. To that end each of us must work for our own betterment and at the same time, share a general responsibility with all humanity, our particular duty is to help those to whom we believe we can be most useful."

An inspired life - Marie Curie

Pirchio Rosana

Secretary, IOMP Medical Physics World Board (MPWB) Committee

Her life

Marie Curie was born a 7 November 1867 in Washaw, Polonia, but her scientific life was developed in France. A 4 of July 1934, 67 years, she died of leukemia because of exposure to ionization radiation. What happened in the middle?

She had a hard childhood, living in a country dominated for Austria, Prussia and Russia, she couldnt talk in her language neither talk about the situation. Her father was Wladyslaw Sklodowski, and her mother was Bronislawa Bogusca. both were teacher. His Brothers were Zosia - José – Bronia – Hela.

During 1876 her family started to suffer economic problems because they went against to Russia and then her father lent money and lost it. After that Zosia became ill with typhoid fever and died, her mother, after some years suffering from tuberculosis, in 1878 died. It was very sad because her mother wasn't loving the family to avoid spreading the illness. This not only made her feel lonely, unloved, but she turned away from the catholic faith and made her afraid of illness and death.

She had a difficult adolescence (with happy moments too) where she couldn't study at university for being a woman, the economic situation wasn't good, she must be a governess living with families and the love hit her door. However, she was always so mature and decided, she wanted to study and to do everything for her family and her country. She agreed with Bronia to work and save money and her father too, meanwhile she studied medicine in Paris, at the time she would be in Paris too to study physics and mathematics.

The first day at Sorbonne University was 3 November 1891. She enjoyed a lot be a student, and she studied all the time. But she didn't have much money, so sometimes didn't eat, and didn't have heat, light. She wore the same clothes, and she repaired her shoes because had learned it from her mother. In 1893 she graduated in Physics Sciences, being the best student.

Marie at University La Sorbona Paris, 1891
https://commons.wikimedia.org/wiki/File:Curieosity_marie_curie_2456753.jpg

An inspired life - Marie Curie

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After graduating, he returned to Warsaw, already penniless, and wanting to finish his degree in Mathematics Science. A friend got her a scholarship for merit students to continue their studies abroad. A society asked him to do a job, he did it, he charged it and.... He returned the prize money he had received. This was not customary, but I did it to help other students. With the money back, and not wanting to ask anyone for help, he gets very cold and hungry, again. The Society for the Promotion of National Industry in Paris asked him for another job in magnetism, he had already done one before, and suggested that he could contact a scientist who had a laboratory and was dedicated to that subject.

That's how they met, in 1894, and each other dazzled, after a few months Pierre asked her to marry him. Marie thought about it a lot because she wanted to live in Poland to help her family and fight for her country. The same year she graduated in Mathematic Sciences, being the second-best student.

Pierre Curie, was a brilliant professor and researcher at the School of Industrial Physics and Chemistry in Paris, together with his brother created the famous “electrometer”, which he carefully calibrated, which he patented, among other things.

Her marriage with Pierre

She got married to Pierre Curie, the partner of her life. They both shared a devotion to science, even though Marie had things to let go, they would share their mornings, afternoons, and evenings, they would be inseparable. When they got married, Marie's relatives gave her a small amount of money, and they used that money to buy 2 bicycles and their honeymoon was touring the French countryside. They constantly took trips across France, on bicycles, which was something that fascinated both. At first, Pierre was more of a stay-at-home worker, but he adapted to those outings and vacations.

Marie encouraged Pierre to finish his doctorate, which had been holding him back for a long time, and in 1895 he graduated with an excellent work in piezoelectricity. Then she had the new challenge of doing her own PhD in Physics, too, but it didn't have a subject. Which happens a lot, doesn't it?

Marie and Pierre Curie, 1895 - https://commons.wikimedia.org/wiki/File:Pierre_et_Marie_Curie_devant_leur_maison_de_Sceaux_en_1895.jpg

An inspired life - Marie Curie

Pirchio Rosana

Secretary, IOMP Medical Physics World Board (MPWB) Committee

PhD in Physics

She was very interested in the novel work of that time, such as that of Becquerel and Roentgen, on the emission of energy by uranium and the discovery of X-rays, respectively. So she decided to research the origin of emissions from natural elements. The great themes of the time were mass – energy, the atom... So they began to acquire large quantities of mineral pitchblende, uranium is the primary element, because Becquerel had seen natural radiation from that material.

Marie realized that radiation emissions did not change with the physical properties of matter, it would be something inherent to the atomic nucleus, to the atom. That's when the term radioactivity came up to talk about the decay of the nucleus and then the unit was called Curie.
From samples of pitchblende she made precise charge measurements with Pierre's calibrated electrometer. She saw that there must be another material than uranium because his measurements were higher than expected. There was indeed a radioactive decay of uranium. That new element had to be extracted, weighed, its atomic number calculated, and so on. Years of working to find the best separation technique for this new element. This is how they discover radium and polonium.

The care of her daughter was an issue that Marie had a hard time solving. In other words, she had to continue working in the lab with Pierre, apparently that was the agreement, but at the same time he had to take care of her and her house. This stressed her out, it must have happened to us too. That's when they decided to hire a woman.

Eugene Curie, Pierre's father, was a doctor like his grandfather. In September 1897 Irene was born and a few months later Pierre's mother died, so the father moved in with them and helped them a lot in raising the girls.

Marie and Pierre with Irene.
https://commons.wikimedia.org/wiki/File:Marie_Pierre_Irene_Curie.jpg

Pierre at one point gave up his work on magnetism and devoted himself fully to radioactivity, which ended up fascinating both.

In 1901 she obtained the title of Doctor of Physics with her work on radioactivity, consisting of the fact that there are natural elements that emit radiation, and that is due to atomic properties. In 1902 they succeeded in isolating radium and calculating its atomic number.

An inspired life - Marie Curie

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Her research

It is known that to this day there is contamination in the laboratory where they worked for so many years with the famous Radium. Everything that was in there will be subject to radioactive decay which is the half-life of the Radium of almost 2000 years. They themselves say that during the nights they saw green and blue lights, amazed, today we know that they were beta gases that when they reacted with the air formed phosphorescence. Even after they had managed to discover the Radium, they would take it in their talks, turn off the lights and show the colors.

This is a big topic, the couple knew perfectly well about the damage of radiation to animals, but they thought that human beings only got burns. In fact, Pierre was exposed to a source of barium for 10 hours and analyzed the damage it did to his arm. He documented it day by day. They were so enraptured by their discovery and by the radioactivity that they considered the damage they received to be a sign of their strenuous work. So much so that they had samples of radium chloride in their room, they were fascinated by the lights they emitted, and they went to the laboratory at night to observe the lights. Pierre carried a fountain in his pocket and impressed his students by showing off the green bluish lights. We can also remember that Marie, Pierre, and Irene inhaled radium, as if it were something harmless.

The discovery

It took many years for Marie and Pierre to separate the famous radium from the waste uranium. They were so poor that they were working in a building with extremely deplorable conditions (and here I wonder why this happens so often in research, why it seems that some people should be denigrated).

As previously recounted, the couple bought from Austria tons of garbage, pitchblende, what was left of separating the uranium, in total they used 8 tons to extract one gram of radium. He received financial support from a group that would later benefit from his discovery. How did you separate that element? They created a methodology, adding acids and heating, stirring for hours, which Marie's PhD was based on. Then the dilemma was if they were going to patent it, they could get a lot of money for their research..... But they decided to tell it and spread it for free, for the good of humanity. As a comment, at that time the wife did not have any right to audit a patent, it belonged to

Curie couple working at the laboratory.
https://commons.wikimedia.org/wiki/File:Marie_and_Pierre_Curie_Converse.jpg

An inspired life - Marie Curie

Pirchio Rosana

Secretary, IOMP Medical Physics World Board (MPWB) Committee

the husband and patents with economic benefits were given for a period of time. As we saw, women at this time had very few rights. Let's remember that they already had several patents under their belt.

Radio should not enrich anyone, it is an element and belongs to everyone, that's what they said. So they spread the separation methodology and their experience all over the world. This element, quite expensive by the way, was widely and excessively used at that time, as if radiation protection did not exist. Also beneficially used in medicine.

Death of Pierre – April 19, 1906

Pierre Curie was really very ill, bone pains, loss of stability. But just like her, they went out of their way to get to work. It is said that on the day of his death, he was still in very poor health but still decided to continue with his tasks. He was at home, his employee asked him for a raise, and he said no, he had had an exchange of words with Marie, because he insisted that she was to work. So he went out to the laboratory, then to a meeting, and in the middle of the rain, he crossed the street, he slipped, the horses of a cart do not step on him, but a wheel destroyed his head. A tragic death.

She and Pierre had talked about the death, that if she wasn't there, he would still be working but he would have lost his soul. She took these words as her own and continued her studies, trying to apply radium in medical applications. When Pierre died, the University offered her a pension that she refused, so they offered her the position of Pierre and to continue with the research work. She was the first woman professor at the Sorbonne University, and that first day of class was filled with media, all eager to listen to her. Entering the physics amphitheater on November 5, 1906, it was a great event, greeted by long applause. Marie Curie began by explaining the theory of radioactivity, the work of Becquerel and Pierre. She showed a piece of radium to show the blue lights, as they used to do, and when she finished the class, she retired insensible, cool to the huge audience.

“There's nothing more wonderful than being a scientist, nowhere would I rather be than in my lab, staining my clothes and getting paid to play.”

“Nothing in life is to be feared, it has to be just understood.”

“It is important to make a dream out of life and the reality of a dream.”

An inspired life - Marie Curie

Pirchio Rosana

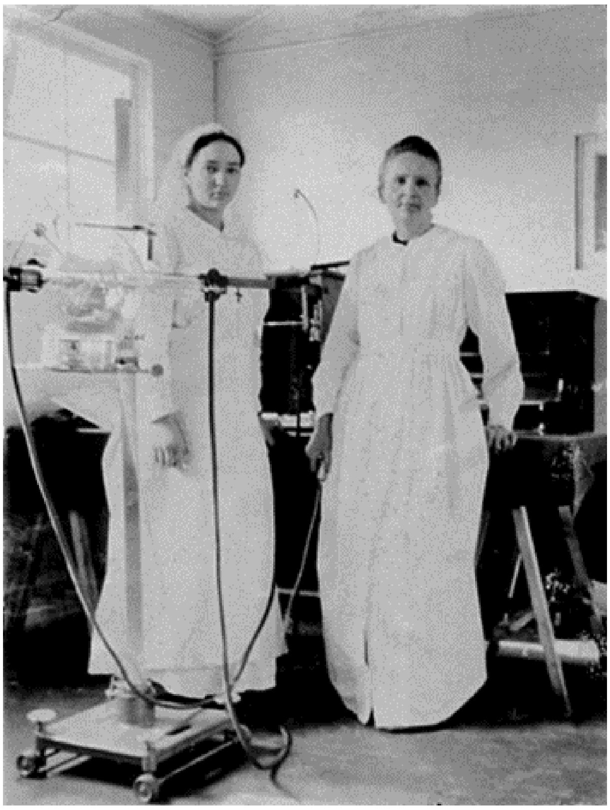
Secretary, IOMP Medical Physics World Board (MPWB) Committee

Working during the Russia-France War

Around 1918, she was sick, again..This is already known that she had many stages of relapse, fatigue – pain - fever, she was operated on more than 4 times for cataracts, other surgeries, and her immune system was very weak. The radiation was destroying her health.

Marie set in motion the creation of the Radium Institute, but when the construction of its facilities was completed, the project was interrupted by the outbreak of the FirstWorld War. She collaborated with the wounded with all his money, his savings, his gold. She was in charge of the mobile X-ray units - so - called little Curies vans - which had portable X-rays, Marie. Her daughter and others took more than a million X-rays of the wounded soldiers. A great job and a great way to risk their lives.

When the war ended she found herself again in a very bad economic situation and needed radio to continue his research.



During World War I, Marie Curie organized about 200 mobile radiation stations, which were used on more than three million wounded French soldiers. https://commons.wikimedia.org/wiki/File:Marie_Curie_w_I_wojnie_%C5%9Bwiatowej.png

She had to ask for the donation because the money received from the Nobel Prizes was used to improve the external part of the laboratory and to buy X-ray equipment to equip hospitals during the First World War.

In 1920 she talks to a great journalist and tells her that he needs a gram of radium to finish his research, he tells her that he is going to get it and in 1921 they already have it. Marie had never spoken to journalists or exposed herself before, she considered the exception worthwhile. So, she was invited with her daughters, they are received as celebrities, even the president of the United States honors and rewards her.

An inspired life - Marie Curie

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Her final days in Warsaw

Marie, obsessed with creating a Radio Institute in Poland, asked for the collaboration of her sister and brother-in-law, both of whom were doctors who lived there. With donations they managed to erect the building, but it lacked the radius. Then he asks again for a donation from the United States. She returned to Poland, now free, in 1932 and the Radio Institute was inaugurated. His dream had come true.

As his daughter Eve, the writer, recounts, he handled the unprotected radio, its emanations, for 35 years, using Roentgen's devices in the war. If you ask your students to use tweezers to handle radioactive tubes, always use leads to protect themselves.

Sadly, the Curie couple, as well as many students, ended up with wounds on their hands, loud ringing, osteoarthritis in the spine and all over the body, cataracts in the eyes. In her last days she was weaker but always working, with her son-in-law and daughter, her rose bushes, her Institute. She had a fever, as other times. Physicians suspected it was bronchitis and due to the insistence of her daughters they hospitalized her. Everyone takes care of her, she keeps talking about work, about her book. It doesn't get better, so they take it somewhere else and realize it's not just bronchitis. On July 4, 1935, Marie died of aplastic anemia in Sancellemoz, France. In 1995 Marie was buried with Pierre in the French Panthéon – Académie de Paris, the place of the world's great scientists. Her crate was covered with sheets of lead, and all her working materials are now isolated due to contamination.

Irene won prizes and died young (58 years old) of leukemia after working for so many years without protection, carrying the radium in wooden boxes. Eve passed away at the age of 103, she wrote several books about her mother.

Marie, a woman of few words, low profile, shy, passionate......

"One never realizes what one has done, one can only see what remains to be done".

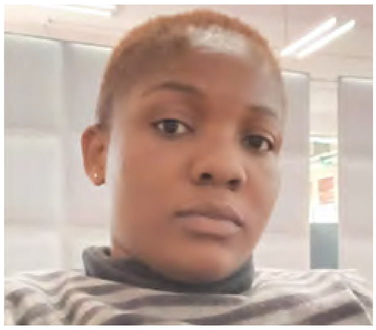
"Be more curious about ideas than people".

"Don't be afraid of perfection, it won't be achieved"

Becoming a Medical Physicist

Nyaradzo Juliana Jaji Murwira

Medical Physicist, Zimbabwe



My name is Nyaradzo Juliana Jaji Murwira, a Medical Physicist from Zimbabwe. My journey in this field began at a young age, around 10 years old, when my grandmother shared her experience of battling breast cancer. I vividly remember her describing radiotherapy as "to be burnt," a phrase that sparked my curiosity and drove me to understand the treatment process she underwent.

In 1983, despite discouragement from her community, my grandmother courageously sought treatment at Parirenyatwa Group of Hospitals in Harare, where she underwent surgery and radiotherapy using a linear accelerator. Her resilience and the mysterious concept of radiotherapy ignited my ambition to become a doctor to comprehend and potentially improve such treatments.

Unexpectedly, I pursued Physics at the University of Zimbabwe from 2008 to 2011. In my final year, a professor redirected my focus towards Medical Physics, explaining how it aligned perfectly with my aspirations. However, no such program existed in Zimbabwe at the time. Encouraged to apply to the International Center for Theoretical Physics (ICTP) in Italy, I embarked on a postgraduate diploma in physics in 2011, hoping to transition into Medical Physics.

During my time at ICTP, I met key figures who shaped my path, including Professor Luciano Bertocchi, who assured me of ICTP's future plans for a Medical Physics program. Though initially heartbroken by a rejection in 2015, I persisted, eventually joining Zimbabwe's inaugural Medical Physics class in 2015, fulfilling my dream.

My journey was not without challenges. In 2017, illness interrupted my studies, but I resumed in 2018, graduating with a Master's in Medical Physics just as my grandmother passed away peacefully at 96, cancer-free.

After a period of unemployment, I seized an opportunity at ICTP, graduating again in December 2023 with a Master of Advanced Studies in Medical Physics.

To women facing similar challenges, I encourage you: ***where there is a will, there is always a way. Pursue your aspirations with determination, and never give up.***

Dosimetry for Nuclear Medicine Therapy Agents

Michael G Stabin

RADAR, Inc

Abstract

This paper reviews some radiopharmaceuticals in use as anti-cancer agents. Criteria for choosing an appropriate radiopharmaceutical are summarized. The fundamentals of radiation dose calculations are briefly reviewed. Then a number of categories of nuclear medicine radiopharmaceutical are discussed, focusing on the radiation dosimetry aspects. Dosimetry and cancer, 131I metaiodobenzylguanidine therapy for neuroblastoma and phaeochromocytoma , 90Y labeled microspheres for treatment of liver cancer, 177Lu DOTATE for treatment of neuroendocrine tumors and 177Lu and 225Ac prostate-specific membrane antigen (PSMA) for treatment of prostate cancer. The importance of performing patient-individualized dosimetry for nuclear medicine patients is discussed.

Keywords: Nuclear medicine therapy, radiation dosimetry

Introduction

Internal dose calculations for therapeutic applications uses of radiopharmaceuticals are an essential component of the evaluation of the safety of these compounds. Methods for calculation of internal dose estimates for organs and tumors are very well established; well established software codes have been extensively verified, and are accepted by the worldwide scientific community. These codes use standardized calculational techniques, and provide dose calculations based standardized anthropomorphic models for 'reference' adults, children, and pregnant women. Patient-individualized dosimetry, based on patients' Computed Tomography (CT) and nuclear medicine images (Positron Emission Tomography (PET) or Single Photon Emission Computed Tomography (SPECT)) have also been established and are in use.

<u>1. Choice of therapy agents</u>

Nuclear medicine therapy is being used increasingly in the treatment of cancer:

a. Thyroid cancer
b. Leukemia and lymphoma with radioimmunotherapy (RIT)
c. Primary and secondary (breast and prostate cancer) bone malignancies
d. Neuroendocrine tumors (NET)

The use of internal emitters, specifically targeted to diseased tissues, is resulting in significant benefits in the treatment of many of these neoplasms. Both electron and alpha emitters are being used in a variety of new approaches to the fight against cancer. Positive responses have been recorded in many patient populations, resulting in the commercial development of new approved agents and techniques. The highest rates of success are with traditional I-131 NaI therapy against hyperthroidism and thyroid cancer. Significant gains are being seen in the treatment of bone and marrow cancers. Some novel targeting strategies and radionuclides are being proposed for other

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cancers. The use of high LET emitters, including alpha and Auger electron emitters, is also on the increase in newly proposed regimens.

The effectiveness of an agent will depend on two key quantities:

- The range of the principal emission(s) and
- The physical half-life of the radionuclide.

Nuclide	Half-life	Emissions	Range
^{125}I	60.0 d	Auger, gamma	10 nm
^{211}At	7.2 h	Alpha	65 µm
^{212}Bi	1.0 h	Alpha, gamma	70 µm
^{169}Er	9.5 d	Beta	1.0 mm
^{177}Lu	6.7 d	Beta, gamma	1.5 mm
^{131}I	8.04 d	Beta, gamma	2.0 mm
^{153}Sm	1.95 d	Beta, gamma	3.0 mm
^{186}Re	3.77 d	Beta, gamma	5.0 mm
^{89}Sr	50.5 d	Beta	8.0 mm
^{32}P	14.3 d	Beta	8.7 mm
^{188}Re	16.95 h	Beta, gamma	11.0 mm
^{90}Y	2.67 d	Beta	12.0 mm

2. Dosimetric methods

The primary quantity of interest in internal dose calculation is "absorbed dose," i.e. the amount of energy from ionizing radiation absorbed per unit mass of any material. A generic equation for the absorbed dose in an object T irradiated by a source S uniformly contaminated with radioactivity may be shown as:

$$D_{(T \leftarrow S)} = \frac{k\ \tilde{A}_S \sum_i y_i\ E_i\ \phi_i(T \leftarrow S)}{m_T}$$

where $\overline{D}_{(T \leftarrow S)}$ = absorbed dose to a target region of interest (Gy or rad),
yi = number of radiations with energy Ei emitted per nuclear transition,
Ei = energy per radiation for the ith radiation (MeV),
$\phi_i(T \leftarrow S)$ = fraction of energy emitted in a source region (S) that is absorbed in a target region (T),
mT = mass of the target region (kg or g), and
k = proportionality constant (Gy-kg/MBq-sec-MeV or rad-g/mCi-hr-MeV).

Dosimetry for Nuclear Medicine Therapy Agents

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The proportionality constant k includes the various factors that are needed to obtain the absorbed dose in the desired units from the units employed for the other variables, and it is essential that this factor is properly calculated and applied. The quantity Ãs is often called the cumulated activity (Bq-s or mCi-hr) and gives the total number of disintegrations that have occurred over time in a source region.

ÃS is calculated as:

$$\tilde{A}_S = \int_0^\infty A_S(t)\,dt = A_0 \int_0^\infty f_S(t)\,dt$$

where Ao is the activity administered to the patient at time t = 0, and fs(t) is the fractional distribution function for a source region (the fraction of administered activity present within the source region at time t). We may model the function fs(t) as a sum of the exponential functions:

$$f_S(t) = f_1\, e^{-(\lambda_1+\lambda_p)t} + f_2\, e^{-(\lambda_2+\lambda_p)t} + \cdots + f_N\, e^{-(\lambda_N+\lambda_p)t}$$

where terms f1...fN represent the fractional uptake of the administered activity within the 1st to Nth compartments of the source region, $\lambda_1 \ldots \lambda_N$ represents the biological elimination constants for these same compartments, and λ_P represents the physical decay constant for the radionuclide of interest. 'Biological elimination constants' are analogous to 'radiological decay constants', i.e. the instantaneous rate of removal of activity from a region, by biological removal or radioactive decay. Other functional expressions may be used to represent the fractional distribution function, but exponentials are most commonly encountered.

A generalized expression for calculating the internal dose, has been described in publications by different authors. The Radiation Dose Assessment Resource (RADAR) Committee of the Society of Nuclear Medicine and Molecular Imaging (SNMMI) developed the following equation [1]:

$$DF = \frac{k \sum_i y_i\, E_i\, \phi_i\, w_{R_i}}{m_T}$$

where N is the number of nuclear transitions that occur in source region S (identical conceptualy) to ÃS), and DF is defined as the "dose factor." In almost all internal dose calculations, it is assumed that the geometry of the irradiation remains constant over the period of integration of As(t) (organ masses do not change, organ orientations do not change). The factor DF contains the various components shown in the formulas above for dose except Ãs; it combines decay data with absorbed fractions (AFs, values of $\phi_i(T \leftarrow S)$) (Fig 1), which are derived using the Monte-Carlo simulation of radiation transport in models of the body and its internal structures (organs, tumors, etc.):

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$$DF = \frac{k \sum_i y_i \, E_i \, \phi_i \, w_{R_i}}{m_T}$$

As written, the above equations give only the dose from one source region to one target region, but they can be generalized easily to multiple source regions. Note also that the radiation weighting factors (wR) is now included so that equivalent dose (H) may be calculated (1):

$$H_T = D_T \times w_R = \frac{k \sum_S \tilde{A}_S \sum_i y_i \, E_i \, \phi_i(T \leftarrow S) \, w_{R_i}}{m_T}$$

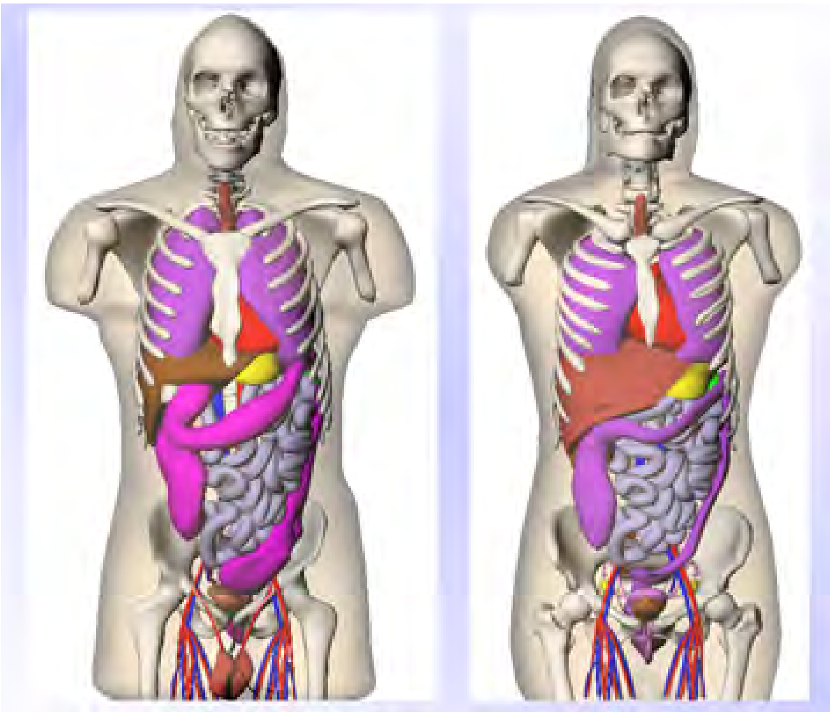

Fig 1. RADAR reference adult male and female phantoms (1)

3. Radioiodine therapy agents

The highest rates of success are with traditional I-131 NaI therapy against hyperthroidism and thyroid cancer. Small amount for diagnosis (99mTcO4- a possible substitute, but not the same uptake pathway). Fetal thyroid dose – very important for any radioiodine. Pregnancy tests mandatory for any therapy administration. Questionable, but perhaps a good idea even for diagnostic I-131 scans. In hyperthyroidism, dosimetry can significantly improve medical practices. In thyroid cancer, the thyroid is usually almost completely removed surgically, then treatment of the remnants and metastases is not dependent on dosimetry.

Dosimetry for Nuclear Medicine Therapy Agents

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Very good dosimetry is possible with a modest investment of effort:

- 4 activity estimates in 48 hr, direct integration or 2-exponential fit
- Estimate of mass (changing mass, Traino and DiMartino, various publications, e.g. (2)

$$m(t) = \left[2\left(\frac{kA_m}{c} \exp(-c(t-T)) - \frac{kA_m}{c} + \frac{1}{2} m_t^{\frac{2}{3}} \right) \right]^{\frac{3}{2}}$$

- Uniform, average dose to tissue is sufficient.

Traino et al. (2): not performing a patient-specific evaluation of thyroid uptake and the change in mass over time resulted in a 9-30% difference in the estimate of thyroid dose in hyperthyroid treatment with I-131-NaI. Peters et al. (3): clear correlation of the success of hyperthyroid therapy with the calculated radiation dose, and they "strongly recommend individual calculation of the iodine activity to be administered for treatment of Graves' hyperthyroidism."

Kobe et al. (4), in a study of 571 subjects with Graves disease, attempted to achieve a target dose of 250 Gy, and found that relief from hyperthyroidism was achieved in 96% of patients who received more than 200 Gy, even for those with thyroid volumes > 40 mL.

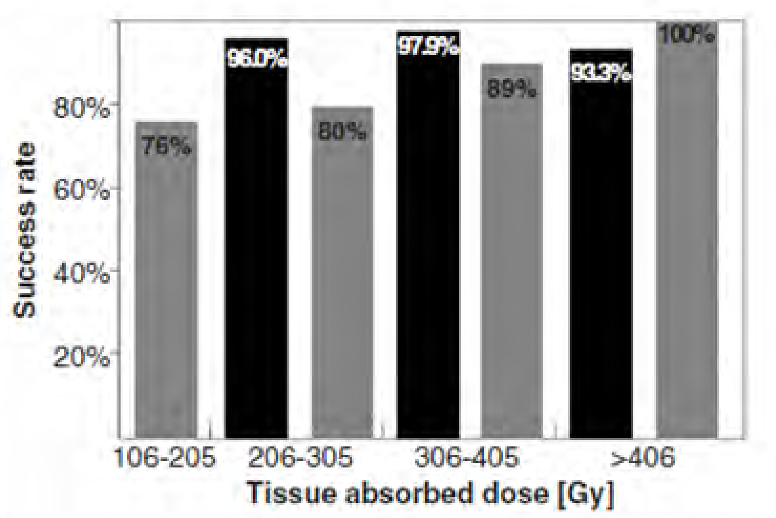

Figure 2. Success rates of Graves' disease therapy at 12 months post-therapy characterized by Kobe et al.[40] using therapy guided by patient-specific dose calculations (black bars), with comparison to those of others (gray bars). Reprinted with permission of Schattauer GmbH.

Fig 2. First treatment efficacy in Graves' Disease (4)

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Jonsson and Mattsson (5), looked retrospectively at their patient population, for which they did not perform patient-individualized dosimetry, and noted that I-131 was generally overprescribed without individualized dosimetry.

Microsphere therapy for liver cancer

Y-90 SirSpheres and Theraspheres are used for patients with primary and metastatic liver cancer. Technique involves injecting radioactive microspheres into the hepatic artery accessed via transfemoral route or through a hepatic arterial infusion port/pump. Holmium-166 microspheres have recently become available for commercial use in Europe for SIRT in unresectable hepatic tumours (Tong et al. [6]). As Ho-166 microspheres emit both gamma (81 keV) and beta radiation, this new treatment modality has unique imaging as well as dosing possibilities as compared to treatments using Y-90 microspheres. Additionally, Ho-166 microspheres can be used in lower quantities (and activity) as a "scout scan" and theoretically should have superior performance for a radiation simulation scan as compared to using Tc-99m macro aggregated albumin (MAA).

The two commercial products are (7):

- SIR-Spheres™ -resin microspheres with a specific activity of 40-70 Bq/sphere (Sirtex Medical Inc, Lake Forest, IL)
- TheraspheresTM – glass microspheres with a specific activity of 2400-2700 Bq/sphere (MDS Nordion)

Both products are between 35-40 um in diameter. Microspheres injected intrahepatic arterially are distributed preferentially in the tumor compartment and are trapped within the microvasculature of the tumors. Microspheres are biocompatible but not biodegradable, and therefore there is no biologic elimination.

Although in reality, the Y-90 microsphere distribution is never uniform, and in fact, is invariably patchy with a wide range of variation, dose estimations are based on the assumption of a uniform distribution. Obviously this assumption of uniform distribution of the microspheres is acceptable only as a first order of approximation. Despite this recognized limitation, the dose methodology provides a consistent and reproducible dose estimates. 3D dosimetry approaches have been made.

AAPM Task Group Report 144 (7, 8) gave a summary of almost all aspects of performing Y-90 microsphere therapy. Properties of the two products are shown in their Table 1 :

TABLE I. Properties of commercially available ^{90}Y microspheres.

Description item	SIR-Spheres®	TheraSphere®
Sphere material	Resin	Glass
Sphere diameter (μm)	20–60	20–30
Activity in single vial (GBq)	3	six sizes: 3, 5, 7, 10, 15, and 20
Number of spheres per vial	40–80 × 10^6	six sizes: 1.2–8 × 10^6
Density (g/cm^3)	1.6	3.29[a]
^{90}Y activation mode	Carrier-free	Reactor
Assumed activity per sphere (Bq)	50	2500
Shelf life	24 h after calibration	12 days after calibration
^{90}Y average decay energy	0.9267 MeV per disintegration	
^{90}Y half-life	2.6684 days	

Three phase CT image sets are performed, to determine normal tissue and tumor masses:

FIG. 1. Representative three phase image set. (A) Noncontrast initial image, (B) arterial phase, and (C) venous phase. Window/level is 380/10 for the three images.

Fig 4. 3 phase image set for Y-90 microsphere therapy (7)

Dosimetry is typically carried out at the whole organ level, although voxel level dosimetry has also been performed.

Tong et al. (9) notes the three outcomes that may be achieved:

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- Curative – If the tumor is relatively confined to a limited area of the liver, SIRT may achieve a cure.
- Neo-adjuvant – Downstage large and unresectable tumors and prepare for surgery or liver transplant.
- Adjuvant/Palliative – advanced liver HCC therapy plays a part in adjuvant therapy or palliation

A multicenter trial called DOSISPHERE-01 noted significant increases in median overall survival (26.7 months vs 10.7 months, p=0.012) with vs without personalized dosimetry.

Multidisciplinary approaches are recommended to provide personalized dosimetry to patients.
- Tricompartmental modeling
  - Hepatic tumor
  - Nontumoral hepatic tissue
  - Lung parenchyma
- Voxel-based modeling

A serious concern in microsphere brachytherapy for hepatic cancers is the possibility of arteriovenous shunting from the arterial deliver point directly to the lungs or other body sites. Once the delivery point has been identified, 70–150 MBq of Tc-99m macroaggregated albumin (MAA) are infused into the liver as a surrogate for the 90Y microspheres. Whole-body planar imaging is done with a moving, large field-of-view gamma system with low energy, high resolution, parallel-hole collimators capable of obtaining conjugate anterior and posterior images of the patient. A whole-body scan from the top of the neck to the bottom of the hips is sufficient (8).

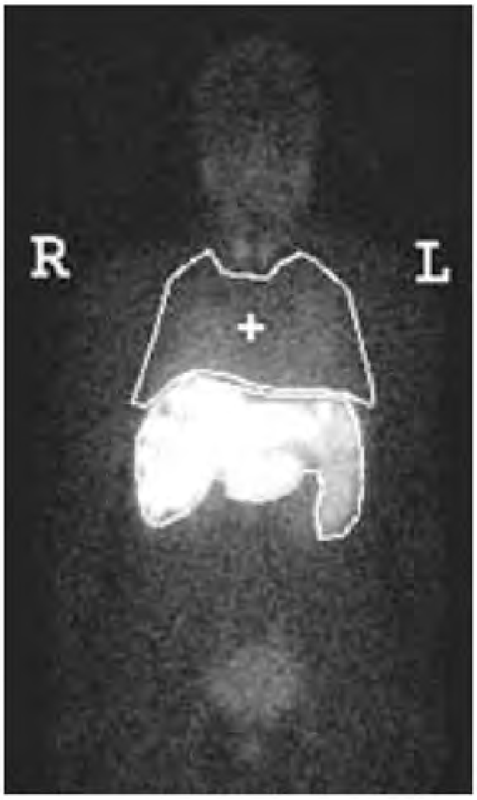

Fig 5. Planar gamma camera image to assess lung shunting (7)

<u>Lung shunting</u>

Whole-body gamma camera imaging of Tc-99m MAA provides data about the shunting of labeled particles to the lungs. The lung shunt ratio is the quotient of the total lung counts (CLung) to the sum of lung and liver counts (CLiver).

$$L = \frac{C_{Lung}}{C_{Lung} + C_{Liver}}$$

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Patients who have considerable shunting of the activity to the lungs, typically greater than 20% shunt value or 16.2 mCi (600 MBq) delivered lung activity, should be disqualified from the use of microsphere brachytherapy due to the possibility of radiation pneumonitis. This activity is determined by assuming a maximum dose of 30 Gy to 1 kg lung mass. However, activity reduction methods have been suggested to maintain the lung dose below 30 Gy (10).

Table 1. Factors that determine the activity to prescribe for SIR-Spheres. The prescribed activity = base activity × lung-shunt modifier × fraction-of-liver modifier.

Extent of disease	
Fraction of liver involvement	Base activity in GBq
>50%	3
25–50%	2.5
<25%	2
Lung shunting	
Fraction of counts in the lung	Dosage modifier
<10%	1.0
10–15%	0.8
15–20%	0.6
>20%	0.0 (DO NOT PROCEED)
Target	
Part of liver	Dosage modifier
Whole liver	1.0
Right lobe only	0.7
Left lobe only	0.3

Fig 6. Criteria for inclusion/exclusion of patients, considering lung shunting (7)

Organ-level dosimetry is quite easy, and does not require the use of sophisticated dosimetry software programs. Calculations can be easily done in a simple spreadsheet:

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$$k\langle E\rangle \frac{T_{1/2}}{\ln(2)} = \left(\frac{0.9267\ \text{MeV}}{\text{dis}}\right)\left(\frac{1.6022\text{x}10^{-13}\text{J}}{\text{MeV}}\right) \times \left(\frac{\text{Gykg}}{\text{J}}\right)\left(\frac{10^{9}\ \text{dis}}{\text{sGBq}}\right)\left(\frac{86400\ \text{s}}{\text{day}}\right) \times \left(\frac{2.6684\ \text{day}}{\ln(2)}\right) = 49.38 \pm 0.05 \frac{\text{Gykg}}{\text{GBq}}$$

giving

$$D[\text{Gy}] = 49.38 \frac{A_0[\text{GBq}]}{m[\text{kg}]}.$$

The prescribed activity for TheraSphere is calculated by solving the equation above for activity, determining the mass of perfused volume to be treated from a CT image set and choosing a dose to be delivered. A typical dose between 100 and 120 Gy is selected for TheraSphereVR treatments involving patients with HCC. The target dose for a particular solid tumor is not known but it is currently believed that this dose range balances the response rate with the risk of hepatic fibrosis (11, 12).

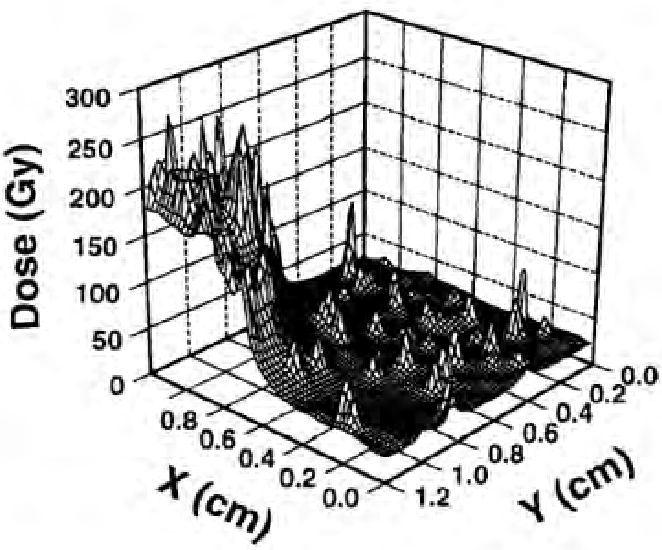

FIG. 2. Dose distribution for ^{90}Y distributed throughout a 0.5 cm radius spherical tumor and surrounding tissues (origin is at center of tumor). The concentration of microspheres in tissue is 1500 cm^{-3} and in tumor is 22 000 cm^{-3}. The nominal activity per microsphere is 370 Bq.

Fig 7. Simulated Y-90 microsphere distribution in normal liver and tumor (11)

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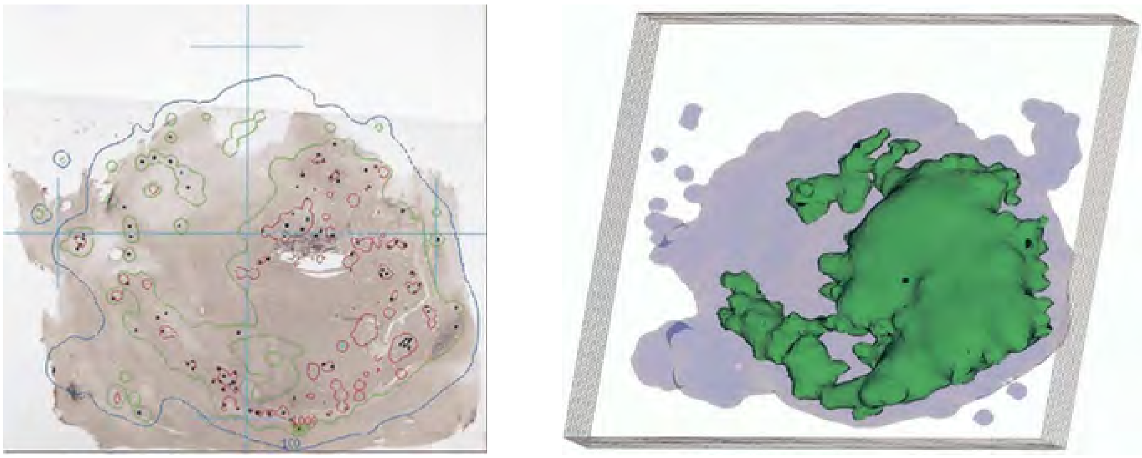

Fig 8. 3D distribution of Y-90 microspheres in liver (12)

4. I-131-mIBG therapy for neuroblastoma and phaeochromocytoma

Flux et al. (13) note the large range of doses administered to patients in therapy with I-131 mIBG (meta-iodobenzylguanidine):

TABLE I.—*Range of absorbed doses delivered to whole-body and tumour for I-131 mIBG treatment of neuroblastoma.*

Number of patients (number of intervals)	Administered activities (MBq)	Absorbed WB dose (mGy/MBq)	Total absorbed WB dose (Gy)	Absorbed tumour dose (mGy/MBq)	Total absorbed tumour dose (Gy)	Comments
6 (1-5)	1536-5550	0.30-0.35	0.56-2.57	N/A	N/A	Absorbed doses derived from combination of pretherapy & post-therapy data [25]
6 (1-3)	4884-8410	0.13-0.45	0.13-0.23	N/A	N/A	External probe measurements [16]
16 (1)	5726-8383	0.15-0.39	1.56-2.87	1.41-5.06	15-56	Treatments based on 444 MBq/kg [18]
26 (1-5)	1759-32871	0.04-0.42	0.46-3.51	N/A	N/A	Treatments based on 444 MBq/kg. External counts. Correlation between WBD and neutrophilia [28]
8 (2)	3590-13300	0.18-0.43	0.93-2.90	N/A	N/A	Initial treatment based on 444 MBq/kg. Second treatment to total 4 Gy cumulative WBD [32]
42 (1)	3330-30969		0.057-0.65		0.31-300	Treatments based on 555 MBq/kg [17]
4 (1)	7400	0.16	N/A	N/A	N/A	Treatments based on 7400 MBq [23]
25 (1)	2400-12100	0.14-0.63	0.7-2.6	N/A	N/A	Absorbed dose escalation study [22]

TABLE II.—*Range of absorbed doses delivered to whole-body and tumour for I-131 mIBG treatment of adult neuroendocrine tumours.*

Indication (number of intervals	Administered activities (MBq)	Mean absorbed WB dose (mGy/MBq)	Total absorbed WB dose (Gy)	Absorbed tumour dose (mGy/MBq)	Total absorbed tumour dose (Gy)	Comments
5 CA (1-3) 3 PC (1-6) 1 MTC (1)	5550-11110	0.07-0.09	0.52 ± 0.13 0.56 ± 0.19 0.64	N/A	N/A	Doses based on combination of pretherapy & post-therapy data [25]
5 PC (1-3)	7357-1096	0.12-0.13	0.98-1.44	1.09-5.77	10-60	Treatments based on 444 MBq/kg [18]
1 PG (1)	10716	0.13	1.40	4.29	46	Treatments based on 444 MBq/kg [18]
9 PC	7400	0.07-0.16	N/A	0.4-16.9	N/A	Treatments based on 7400 MBq [23]
6 PC (1-3)	8600-13400	0.05-0.20	0.60-2.0	N/A	N/A	Improved response over administered activity of 5550 MBq [53]

CA: carcinoid; PC: phaeochromocytoma; MTC: medullary thyroid cancer; PG: paraganglioma.

Fig 9. Variability in doses received in I-131 mIBG therapy (13)

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5. Radiolabeled peptides

Bodei et al. (14) showed a wide difference in kidney doses (and biologically effective doses) with radiolabeled peptides, which are now in common use.

Table 3 Dosimetry data in 12 patients

Patient #	Injected activity (IA, GBq)	Kidney dose/IA (Gy/GBq)	Cumulative kidney dose (Gy)	Cumulative kidney BED (Gy)	Bone marrow dose/IA (Gy/GBq)	Cumulative bone marrow dose (Gy)	Liver dose/IA (Gy/GBq)	Cumulative liver dose (Gy)	Spleen dose/IA (Gy/GBq)	Cumulative spleen dose (Gy)
5	22.2	1.65	37	41	0.06	1.3	0.20	4.4	1.95	43
10	22.1	0.87	19	21	0.05	1.1	0.26	5.7	2.91	64
13	26.6	0.62	17	17	0.04	1.1	0.08	2.1	0.64	17
14	29.2	0.52	15	16	0.03	0.9	0.89	25.9	0.42	12
18	26.5	0.74	20	21	0.03	0.8	0.45	11.8	0.65	17
20	25.9	0.92	24	26	0.05	1.3	0.15	3.9	1.96	51
24	25.2	0.61	15	17	0.02	0.5	0.41	10.3	0.59	15
26	25.2	1.05	26	31	0.03	0.8	n.a.	n.a.	n.a.	n.a.
28	25.2	0.54	18	15	0.02	0.5	0.23	5.7	1.57	40
29	25.2	0.59	15	16	0.02	0.5	n.a.	n.a.	n.a.	n.a.
30	25.2	0.33	8	9	0.02	0.5	0.16	4.0	0.47	12
33	28.9	1.10	32	38	0.03	0.9	1.01	29.2	0.42	12

Patients #5, 10, 13, 14, 18 and 20 from group 1; #24, 26, 28, 29, 30 and 33 from group 2

n.a. not assessed

Fig 10. Variability in doses with radiopeptides (14)

6. Bone agents

Ra-223 dichloride (Xofigo, Bayer HealthCare Pharmaceuticals Inc.) is an FDA-approved alpha particle-emitting radioactive therapeutic agent indicated for the treatment of patients with castration-resistant prostate cancer, symptomatic bone metastases and no known visceral metastatic disease. The agent targets bone metastases and has been shown to be safe and effective in the palliation of painful bone metastases, resulting in improved survival with manageable toxicity (15). Ra-223 is an alpha emitter with a half-life of 11.4 days and it decays by a series of alpha and beta emissions, with some attendant photon emissions, ultimately to stable Pb-207.

For imaging, Ra-223 itself has X-rays at 81 and 84 keV and gamma peaks at 269 and 154 keV and the Rn-219 daughter (short half-life) has a significant peak at 271 keV. There is manageable (max grade 3) toxicity, more likely with neutrophils. Seven serious adverse events. One supra-ventricular arrhythmia and a nausea/vomiting episode were assumed to be treatment related, but were treatable. Episodes of transient diarrhea were reported at all dose levels. Radium is excreted mainly via the gastrointestinal (GI) tract (16). While radium in the liver is retained with a biological half-time of 50 d before it is re-transferred to the blood, most of the radium in other tissues is quickly retransferred to the blood with biological half-times of 0.1 d and 1 d, respectively.

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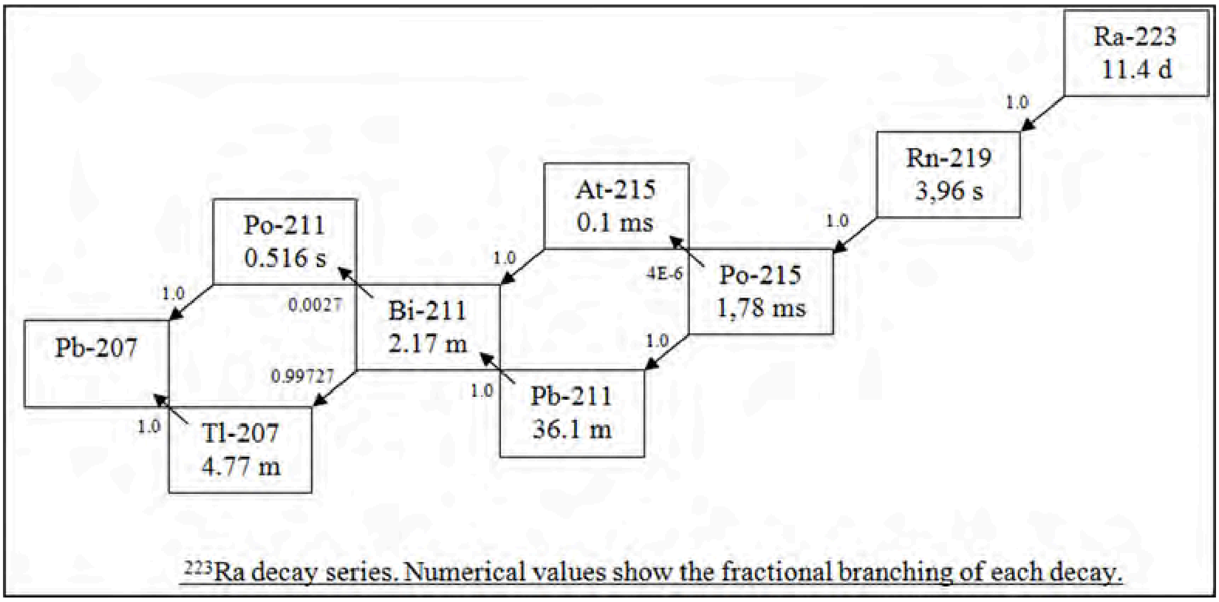

^{223}Ra decay series. Numerical values show the fractional branching of each decay.

Fig 11. The Ra-223 decay series.

7. Lu-177 and Ac-225 PSMA

The prostate-specific membrane antigen (PSMA) has been labeled with both Lu-177 and Ac-225 for treatment of prostate cancer (17). Both have shown good effectiveness. The Ac-225 labeled agent has shown lower rates of recidivism.

Conclusions

Many radiopharmaceuticals are currently in use in cancer therapy. It is a very exciting time to be working in this field. Unfortunately, most centers use these compounds without performing patient-individualized dosimetry, and this must change (18). Physicians generally administer similar levels of activity to all patients, with reliance primarily on experience to determine the activity level desired to deliver a sufficient radiation dose to malignant tissues while avoiding adverse effects are in other tissues. This works fairly well in the use of radioiodines for thyroid cancer, as the ‘therapeutic window’ (difference in dose levels between what is experienced by the tumor and that experienced by the most important normal tissue) is large. However, patient-individualized dosimetry should be performed for patients with Graves’ disease (see above), and after decades of successful treatments with large numbers of patients, the use of a fixed activity approach has led to the fact that few investigators have characterized the radiation doses received by their subjects, so that an understanding of normal and diseased tissue response to radiation dose could be well established. In other forms of therapy, however, (e.g. the use of radiolabeled peptides for RIT), the tumor-to-normal tissue absorbed dose ratio may be low, and without the use of a patient-specific treatment planning strategy based on radiation absorbed dose, patients are mostly given low amounts of the therapeutic agent, to cautiously avoid deleterious effects in normal tissues (most notably the kidneys or bone marrow).

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As was noted above, patients have significant variability in their tumor and normal tissue uptake concentrations as well as in the clearance rates at which activity leaves these tissues. Thus only a small fraction of the patient population receives optimal care, and the vast majority of patients receive a lower than optimum administration of activity. This usually results in no deleterious effects in normal tissues, but suboptimal therapy generally being delivered to the malignant tissues, with poorer response rates and higher rates of relapse.

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About the Author:

Michael Stabin is an instructor in Health Physics courses for NV5/Dade Moeller and dose evaluator for the Radiological Support Services / Mission Support Alliance program in Richland, WA. Before that he was an Associate Professor at the Department of Radiology and Radiological Sciences in Vanderbilt University, Nashville, Tennessee. He was also a Visiting Professor at the Universidade Federal de Pernambuco in Recife, Brasil for two years, and was a scientist at the Radiation Internal Dose Information Center of Oak Ridge Institute for Science and Education for 15 years. He has a Bachelor of Science and a Master of Engineering degree in Environmental Engineering (Health Physics emphasis) from the University of Florida and received his PhD in Nuclear Engineering (Health Physics emphasis) from the University of Tennessee. He is a Certified Health Physicist (1988, recertified in 1992, 1996, 2000, 2004, 2008). He is a member of the Health Physics Society, the Society of Nuclear Medicine. He has over 250 publications, most in the area of internal dosimetry for nuclear medicine applications. He has served as a member and Chair of the American Board of Health Physics Certification Examination Panel (Part I and II), and Associate Editor of the Health Physics Journal from 1992 until now. He also serves on task groups of the Society of Nuclear Medicine (the RAdiation Dose Assessment Resource, RADAR), American Association of Physicists in Medicine (AAPM) and the International Commission on Radiological Protection (ICRP). He has developed several models, methods, and tools that have become widely used in the nuclear medicine community, including the MIRDOSE and OLINDA/EXM personal computer software codes for internal dose calculations.

Precision Radiotherapy and AI Innovations: India's Battle Against Cancer Amidst Global Challenges

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The World Health Organizaztion (WHO) Director-General stated that cancer deaths around the world are projected to reach 8.9 million by 2030, with approximately 70% of these patients being from developing countries (1). Despite making remarkable strides in several sectors, India is still classified as a Lower Middle-Income Country (LMIC) according to the World Bank classification, mainly due to its inconsistent socio-economic and health indicators. As a developing country with a large lower middle-income group, India shows unwavering dedication to scientific rigor and technological innovation. Radiotherapy stands as a beacon of hope, offering solace and salvation to countless cancer patients across the nation. According to the Global Cancer Observatory (GCO) statistics from 2022, the cumulative risk of developing cancer before the age of 75 is 10.6%. The top three leading cancers are breast cancer, lip and oral cavity cancer, and cervical cancer (2).

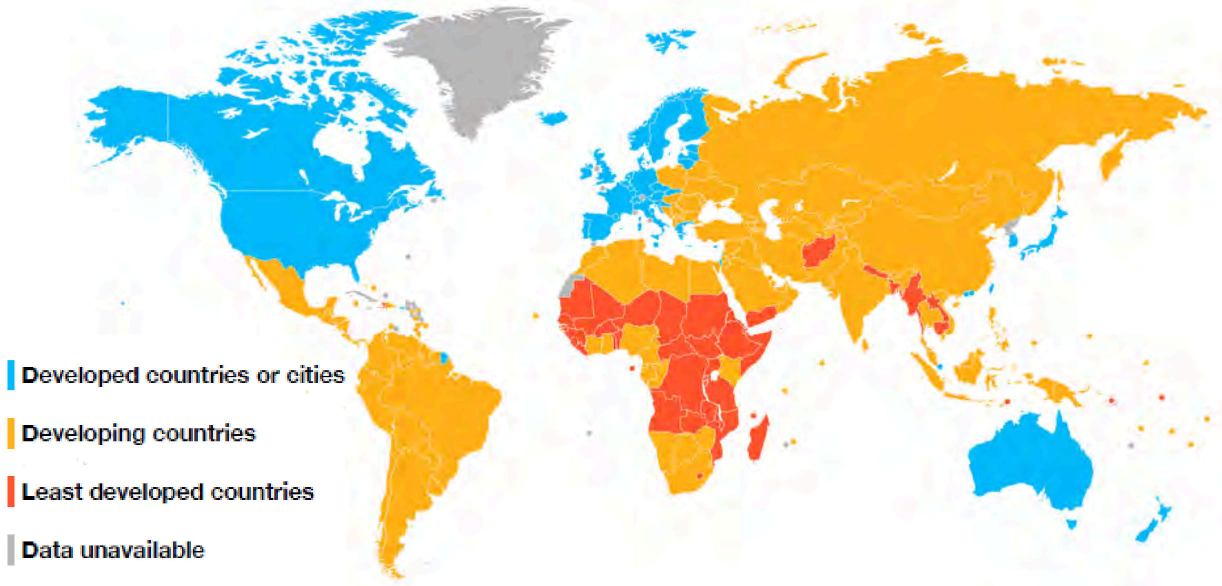

Fig. 1: Latest classifications sorted by the IMF (3)

India's Strides on the Global Stage:

In the realm of cancer treatment, India stands as a beacon of innovation, advancing the frontier of radiotherapy with remarkable progress and pioneering initiatives. Over the past few years, India has witnessed a substantial surge in the adoption of image-guided radiation therapy (IGRT), with utilization rates soaring by over 50%. This surge reflects India's commitment to integrating real-time imaging modalities into the radiotherapy process, enhancing treatment precision and efficacy. With radiotherapy's precision beams and AI's insightful guidance, the complexities of the disease are unraveled. In the light of innovation, hope ignites, paving the way for a future free from cancer's plight.

Precision Radiotherapy and AI Innovations: India's Battle Against Cancer Amidst Global Challenges

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In parallel, the integration of AI-driven treatment planning software has revolutionized high-precision radiotherapy practices across the nation. The AI-assisted treatment planning systems have reduced the medical physicist planning time by 40%, while simultaneously improving the quality of the plan by 25%. Over 70% of radiotherapy facilities in India now utilize AI-powered software for treatment optimization. These advancements underscore AI's critical role in improving cancer care outcomes and highlight India's dedication to leveraging cutting-edge technology to enhance cancer treatment and elevate the standard of patient care. In India's scientific embrace, cancer's grip defies. In the light of innovation, hope ignites, paving the way for a future free from cancer's plight.

Widespread definite types of Cancer:

In India, a mosaic of innovative techniques and modalities adorns the landscape of radiotherapy, each meticulously tailored to combat the unique challenges posed by diverse tumor types. Breast cancer asserts its dominance among women, shadowed closely by cervical cancer. Men face the menacing grip of oral cancer, fueled by the relentless consumption of tobacco. The insidious rise of lung cancer mirrors the urban sprawl and environmental degradation. Stomach cancer, a silent predator, often evades detection until it's too late. Colorectal cancer surges amidst shifting dietary patterns and sedentary lifestyles. Ovarian cancer whispers its presence, striking at the very essence of womanhood. Esophageal cancer, endemic in certain regions, reflects cultural habits and dietary nuances. Prostate cancer quietly targets the aging male populace, while liver cancer's insidious advance is intertwined with the shadows of hepatitis and alcoholism. In this intricate dance of life and mortality, early detection and comprehensive awareness initiatives serve as the beacon of hope in India's relentless pursuit of conquering these formidable adversaries.

Radiation Revolution in Oncological Technologies:

In the realm of oncological care, radiotherapy stands as a formidable weapon against the relentless advance of cancer. Harnessing the power of ionizing radiation, this therapeutic approach meticulously targets malignant cells while safeguarding the delicate balance of healthy tissues. Externally delivered beams of radiation, epitomized by External Beam Radiation Therapy (EBRT), emanate from state-of-the-art linear accelerators, traversing precise trajectories to converge upon tumor masses with surgical precision. Conversely, brachytherapy ventures into the intimate terrain of the body, deploying radioactive sources with exquisite precision to deliver localized doses of radiation directly to tumor sites, sparing surrounding tissues from undue harm.

Precision Radiotherapy and AI Innovations: India's Battle Against Cancer Amidst Global Challenges

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Recent strides in technology have ushered in a new era of precision and efficacy in radiotherapy. Proton therapy, a marvel of modern science, harnesses the distinctive properties of protons to target tumors with unprecedented accuracy, minimizing collateral damage to healthy tissues. Similarly, the fusion of real-time magnetic resonance imaging with radiation therapy in MRI-guided radiation therapy offers unparalleled insights into tumor dynamics, enabling oncologists to adapt treatment strategies on the fly for optimal outcomes. Adaptive radiation therapy, propelled by cutting-edge imaging modalities and computational algorithms, provides a dynamic framework for tailoring treatment plans to the evolving landscape of tumor biology. Particle therapy modalities, such as carbon ion therapy and heavy ion therapy, leverage the unique physical characteristics of charged particles to achieve superior tumor control while mitigating adverse effects on surrounding organs. In the crucible of India's healthcare ecosystem, these advancements converge to empower oncologists in their tireless crusade against cancer.

Aiding Measures in Cancer Treatment

As they say, where there is charity and wisdom, there is neither fear nor ignorance. The central and state governments of India provide unwavering financial support through various schemes to support the cancer treatment of poverty-stricken and underprivileged people of the country. The Government of India has adopted a two-pronged approach under the umbrella of Ayushman Bharat. PM-JAY, the world's largest health insurance/assurance scheme, offers health coverage to nearly 12 crore poor families, which amounts to a staggering 55 crore Indians, encompassing 40% of the population, in convergence with various state government insurance and assurance schemes. The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) also plays a crucial role in prevention and care, providing screening and treatment in both rural and urban areas.

State schemes flourish, with Tamil Nadu's pride insurance offering comprehensive aid far and wide. In Andhra Pradesh and Telangana, Aarogyasri brings hope anew. The Rashtriya Arogya Nidhi provides significant support, while the Employee State Insurance Scheme (ESIS) ensures healthcare for the working class. Both public and private insurance policies cover cancer treatments, diagnosis, and post-treatment aid. NGOs and charities, such as the Indian Cancer Society and the Cancer Patients Aid Association (CPAA), offer financial assistance for patients. In India's vast and varied land, where health and hope go hand in hand, myriad schemes stand bold and bright to battle cancer's daunting plight. Together, they weave a net to catch those who fall and to ease their burden .

Precision Radiotherapy and AI Innovations: India's Battle Against Cancer Amidst Global Challenges

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As India continues to invest in research, infrastructure, and innovation, it is poised to further solidify its position as a global leader in cancer care. With a steadfast commitment to excellence, India's journey towards combating cancer through advanced radiotherapy techniques is not just a testament to progress but a beacon of hope for patients nationwide and beyond.

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Senthamilselvan Chelliah obtained his Doctorate of Philosophy in Medical Physics from Bharathiar University, India, in 2019 under the guidance of Dr. C.S. Sureka. His main areas of research include Medical Imaging, Dosimetry, Radiation Safety, and Protection. He has delivered more than 30 invited/guest lectures relevant to his area of research and has presented 25 scientific presentations at conferences. He has received numerous honors and awards, including participation in ICTP events in Italy in 2018, 2019, and 2022, the Global Teacher Award in 2019, the Swami Vivekananda Youth Achievement Award in 2018, the Researcher and Educational Services Award in 2018, the National Best Teacher Award in 2017, and a Junior Research Fellowship from the DST-SERB research project in New Delhi in 2013. He is responsible for crafting examination question papers and assessing the academic advancement of undergraduate and postgraduate students in specialized fields of medical imaging technology and medical physics across various prestigious academic institutions. He offers insights and advice in various healthcare sectors to illuminate and nurture new ideas and, as a young researcher, shapes the future of research as a harbinger.

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The Use of Shields on Patients

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In many countries, the use of lead shielding on children remains a common practice, but this habit and culture need to change. It is necessary to train technicians and doctors, and to communicate effectively with family members, because in some cases, it is more beneficial not to use lead shielding to protect the gonads than to use them. Promoting a culture of understanding direct digital technology and the appropriate use or non-use of such protectors is crucial. Disseminating this knowledge, as exemplified by the Spanish Society of Medical Physics through their informative posters, is essential.

As we all know, X-rays used in medicine carry a minimal risk of radiation damage. To minimize potential harm to sensitive organs, "contact protectors" have been used for many years, perhaps since the 1950s. These shields absorb radiation and are placed on the patient to attenuate the radiation, thereby protecting the organs underneath.

However, recent technological advances and scientific studies have led to new recommendations, showing that it is only advisable in a few cases to use this type of protection. According to the NCRP document No. 13 [1], there are several reasons why it might be better not to use gonadal shields in certain cases:

- The risks of hereditary genetic effects are now considered to be much lower than previously thought.
- Technological improvements in X-rays from the 1950s to the present day have resulted in up to a 95% reduction in the dose absorbed by pelvic organs.
- Gonadal shields, when placed on the abdomen, can interfere with Automatic Exposure Control (AEC), potentially increasing doses to other pelvic and/or abdominal organs that may be more radiosensitive.
- Gonadal shields can obscure parts of the pelvic anatomy, hiding important findings on X-rays.
- Despite the best practices by radiology technologists, gonadal shields may not fully protect the gonads in some patients. The exact location of the gonads can vary, and the shields may be misapplied due to anatomical variations and shield size.
- A significant portion of the gonadal dose that reaches the ovaries is produced by scattered X-rays, which are not attenuated by gonadal shields.

In conclusion, the shift away from routine use of gonadal shielding in pediatric radiology reflects a nuanced understanding of radiation risks and technological advancements. Training and communication with healthcare professionals and families are vital to implementing these changes effectively.

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Based on the statements in the NCRP document cited above, we might ask: Should we stop using gonadal protectors? Would the non-use apply only to pelvic or abdominal X-rays? What about pediatric patients? And what about pregnant patients? The decision and proper use of these protectors have undoubtedly become a matter of discussion. To such an extent that, at the end of 2023, numerous European entities met to discuss these aspects. As a result, a consensus was reached, embodied in a document entitled "European Consensus on Patient Contact Shielding" [2]. This document provides an easy-to-read table using "colored shields" to define the current state of each technique and a guideline for the use of shields.

What can we do in Argentina? One option would be to bring together experts in radiation protection, radiology doctors and technicians, medical physicists, and other professionals in the field to work on a similar consensus. Another option would be to take the European document and adapt it to our reality if it is significantly different. In any case, it would be necessary to discuss certain aspects outlined above, even if only to confirm them.

Let's break down the main ideas. We know that gonadal protectors are often not correctly positioned, which can force us to repeat the study. The shield is placed where the radiologist assumes it will cover the gonads. This protection is traditionally used, especially in pediatric patients, and it is not unusual for parents to demand these protectors for their children.
It's understandable. This practice began in the 1950s due to the fear of the harmful effects of ionizing radiation and has always raised many doubts due to the difficulty in properly placing gonadal shields, which could hide diagnostic information.

Today, technological advances allow practices that impart much lower doses to the patient, especially with systems where the exposure is automatically regulated based on the dose received by the detectors that generate the image. The use of shields in these systems would cause fewer photons to reach the detectors, leading to an increase in incident radiation in response, which means a higher dose to the patient.

For example, in 2013, the Spanish Society of Pediatric Radiology (SERPE) and the Spanish Society of Radiological Protection (SEPR) prepared a technical note based on the scientific evidence of the time, recommending the abandonment of gonadal protectors in girls [3]. Apparently, this recommendation was not strongly enforced, and the use of protectors continued for a long time. The reasons were likely due to a lack of dissemination, information, or training of technicians, or possible pressure from parents or guardians to use these protectors on children.

In April 2019, the American Association of Medical Physicists (AAPM), with the support of the American Society of Radiology (ACR), the Image Gently Alliance, the Canadian Organization of Medical Physicists (COMP), the Physical Health Society (HPS), and other scientific societies (as stated by SERPE in its minutes PP-32 A of 2-4-2019), recommended discontinuing gonadal and fetal protection of patients during X-ray examinations as standard practice. They stated that

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gonadal and fetal shielding provide little or no health benefit to patients and may adversely affect the efficacy of the examination. This statement by SERPE is based on the following considerations:

- The radiation doses received during diagnostic imaging are not associated with measurable damage to the gonads or fetus.
- The shield placed over the patient does not prevent scattered radiation, which is the main source of irradiation to internal organs.
- The shield may hide important diagnostic information, which may necessitate repeating the test.
- On automatic dose exposure equipment, the protector can interfere with automatic exposure control (AEC) and increase the dose administered to the patient.
- Exceptionally, gonadal protection could be considered, knowing its limitations and risks, in cases of marked anxiety and fear of radiation, where the use of the protector may contribute to the performance of the examination.

A similar situation occurs with thyroid protectors. Most of the ones found in hospitals in Argentina were designed for use by workers (doctors, technicians, etc.) and only in very particular cases could they be used on the patient. However, in mammography, for example, where the patient requests it the most, it is not advisable to use it for two reasons: firstly, because the dose received by the thyroid gland in a mammogram is insignificant. Secondly, a small shift of the thyroid protector could interfere with the image obtained, forcing the repetition of the study, which would double the mammary glandular dose. In other words, the risk of its use is greater than the benefit.

Another case would be the unnecessary use of shields on patients when there is no direct impact on them. It is very important to point out that for tissues not directly exposed, most of the radiation received comes from within the organism itself and the use of external protection does not prevent this irradiation. Its use can actually hinder the practice and force the repetition of the study. This is the case with the use of lead aprons on the abdomen of a pregnant patient when it is not directly irradiated to the fetus. This and other practical examples are illustrated in the excellent poster published by the Spanish Society of Medical Physics [4].

Based on the above, this article should be considered a trigger to start reflecting on all these statements about the use of gonadal protectors and other protective elements applied to patients. The use of modern systems with automatic exposure forces us to optimize daily practice with the necessary care, to analyze each particular case that may arise, and to ultimately address this paradigm shift in the use of these radiation protection elements. For this reason, it is advisable to analyze each of the agreed aspects exposed above, deepening the analysis based on the reference articles.

The Use of Shields on Patients

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- He holds a Master's degree in Medical Physics and a Bachelor's degree in Management of Educational Institutions and serves as a Senior Professor in Physical Sciences. As a Medical Physicist in Argentina, he works at the National Cancer Institute (INC) where he leads audits, coordinates auditors in Quality Management, and heads the Dosimetry Laboratory. He also contributes to the National Breast Cancer Program in radiological protection and quality control. He is the Director of the Medical Equipment Quality Control Laboratory at INSPIRE (FEMEBA Simulation Center).
- He is an auditor for Accreditation of Diagnostic Imaging Centers with the Argentine Society of Radiology (SAR) and the Argentine Federation of Associations of Radiology, Diagnostic Imaging, and Radiant Therapy (FAARDIT). As an expert professor for the International Atomic Energy Agency (IAEA), he specializes in Radiological Protection and Quality Control in various imaging modalities and collaborates on their Radiological Protection of the Patient project.
- At Favaloro University, he teaches Diagnostic Imaging and Quality Control, while at the National University of La Plata (UNLP), he is involved in the Medical Physics program and the Laboratory of Dosimetry and Radiological Protection. He also teaches Nuclear Medicine at the University of Buenos Aires and Quality and Radiological Protection at the Argentine Society of Radiology.
- He is a founding partner and Director of Quality Quest Argentina, focusing on implementing ISO 9001 and ISO 13485. Additionally, he consults on Radiation Protection, Quality Management, and Quality Control in diagnostic imaging for various hospitals and is a Lead Auditor for Management Systems Certification MSC - Brazil.
- He has authored over 50 papers on Radiological Protection and Quality Control and delivered more than 30 lectures at medical physics and radiological protection conferences.

Calendar of Events (July - December 2024)

Ibrahim Duhainii

Calendar Editor

2024 IRPA + HPS 16th International Congress

When: Jul 7 – 11, 2024
Where: Orlando, FL 32819, USA
Website: https://burkclients.com/IRPA/2024/site/

ESMRMB 2024

When: Oct 2 – 5, 2024
Where: Barcelona, Spain
Website: https://www.esmrmb2024.org/

2024 World Congress of Brachytherapy

When: Jul 10 – 13, 2024
Where: Maryland, USA
Website: https://www.americanbrachytherapy.org/meetings-events/2024-world-congress-of-brachytherapy/

Patient Communication for Medical Physicists Workshop

When: Oct 7 – 8, 2024
Where: Virtual
Website: https://medschool.ucsd.edu/som/radiation-medicine/research/Pages/PDPCI.aspx

AAPM 66th Annual Meeting & Exhibition

When: Jul 21 – 25, 2024
Where: Los Angeles, California, USA
Website: https://aapm2024.org/

24th AOCMP and 22nd SEACOMP

When: Oct 10 – 13, 2024
Where: Penang, Malaysia
Website: https://www.aocmp2024.com/

AHRA 2024 Annual Meeting

When: Aug 4 – 7, 2024
Where: Orlando, Florida, USA
Website: https://www.ahra.org/education-events/upcoming-events/2024-annual-meeting

PTCOG North America Annual Meeting

When: Nov 14 – 16, 2024
Where: New York, NY, USA
Website: https://www.ptcog-na.org/ptcog-na-10th-annual-meeting

5th European Congress of Medical Physics

When: Sep 11 – 14, 2024
Where: Munich, Germany
Website: https://ecmp2024.org/

RSNA 2024

When: Dec 1 – 5, 2024
Where: Chicago, IL, USA
Website: https://www.rsna.org/annual-meeting

ASTRO's Annual Meeting

When: Sep 29 – Oct 2, 2024
Where: Washington, DC, USA
Website: https://www.astro.org/meetings-and-education/micro-sites/2024/annual-meeting

4th Flash Radiotherapy and Particle Therapy Conference (FRPT 2024)

When: Dec 4 – 6, 2024
Where: Rome, Italy
Website: https://frpt-conference.org/

SROA 41st Annual Meeting

When: Sep 29 – Oct 2, 2024
Where: Grand Hyatt Washington, Washington, DC, USA
Website: https://www.sroa.org/meetings/2024-annual-meeting/

IDMP 2024 theme:

“Inspiring the Next Generation of Medical Physicists”

More info on https://www.iomp.org/idmp-2024/

International Organization for Medical Physics

IOMP