Global Medical Physics: Challenges and Opportunities

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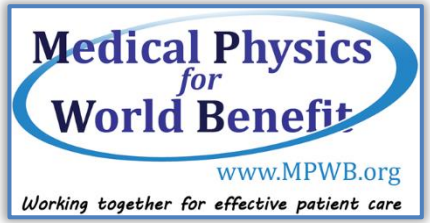
10 July 2022



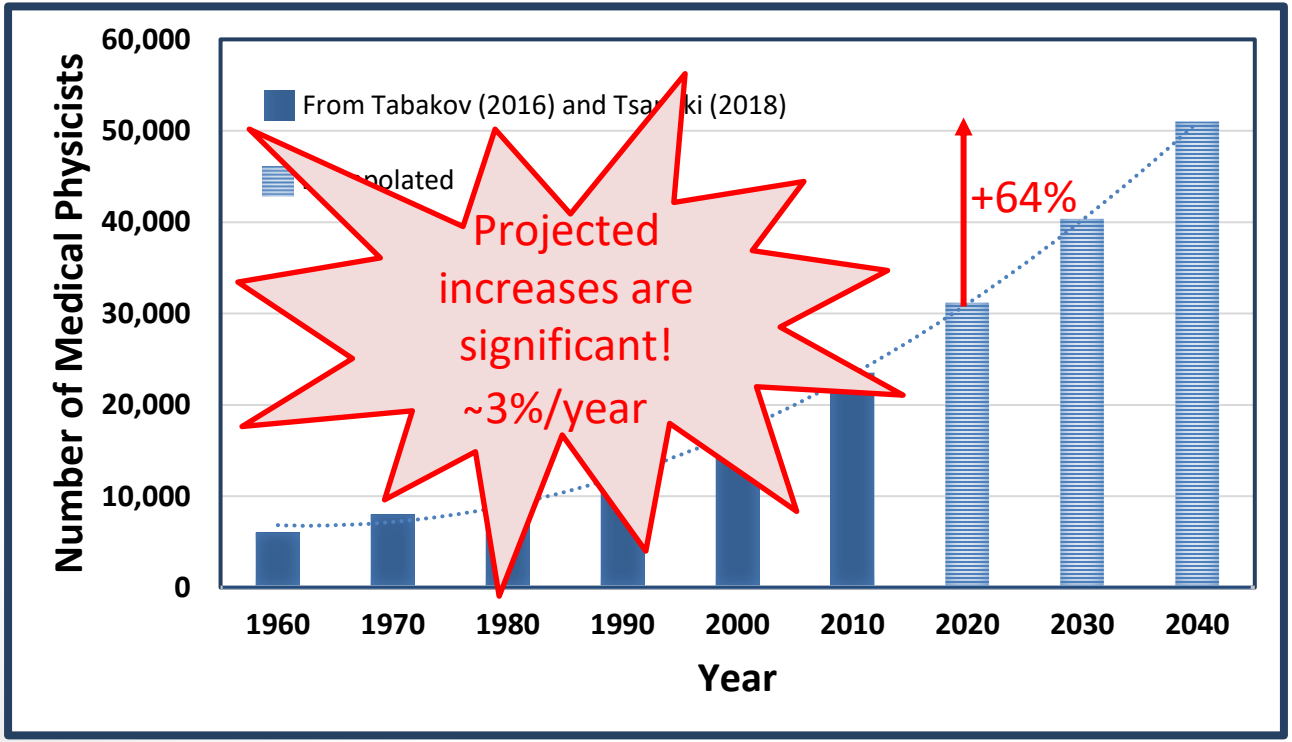
Disclosures

- None related to this presentation

Objectives

- To highlight trends in medical physics around the globe
- To review variations in medical physics around the globe related to training, technologies, organization, diseases, and resources
- To consider some options for addressing these variations

Growth in No. of Medical Physicists

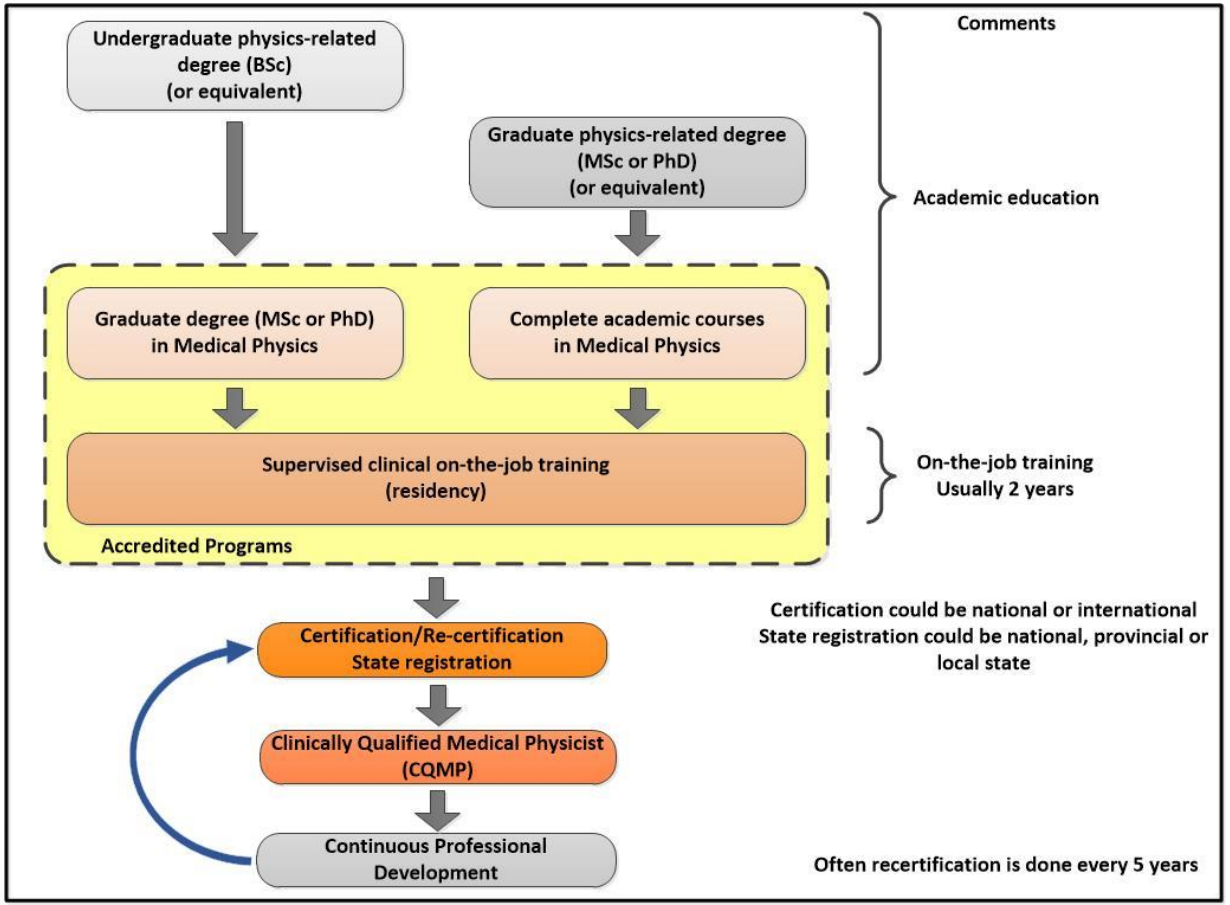


Tsapakia et al, Med Phys 55:33-39; 2018
Tabakov, Med Phys Int 4: 78-80; 2016

Medical Physicists: Composition

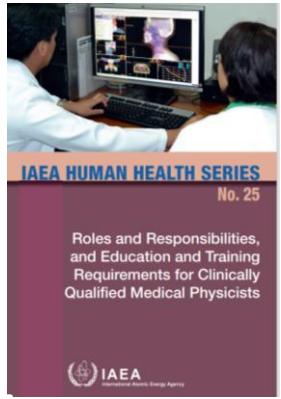
	Global (Tsapaki et al, 2018)	AAPM (2017)
Total	~29,000	~8,000 ~30%
Radiation Oncology Physics	67%	76%
Imaging & Health Physics	33%	24%
Male/Female	70/30	69/31

Education and Training Pathways



Adapted from IAEA HHS No. 25

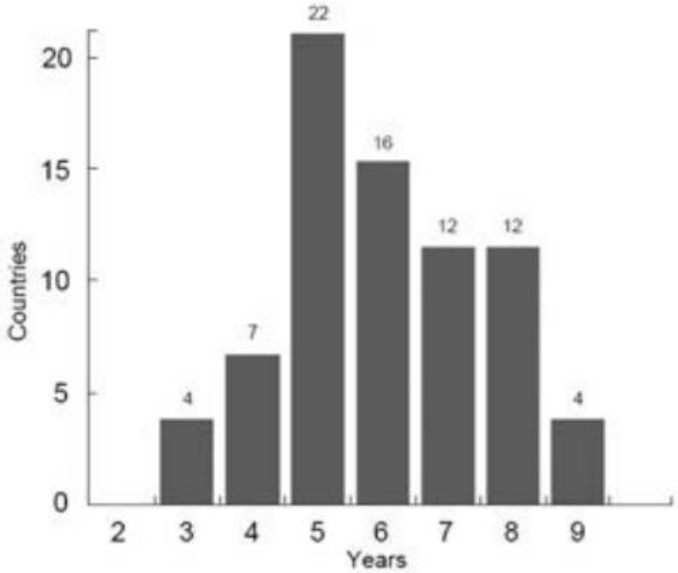
Time to Become CQMP



Surveys: EFOMP 2006

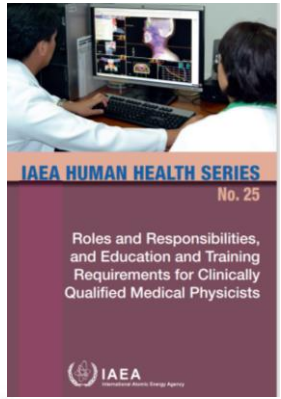
IAEA 2011

77 Countries



3-9 years

Time to Become CQMP



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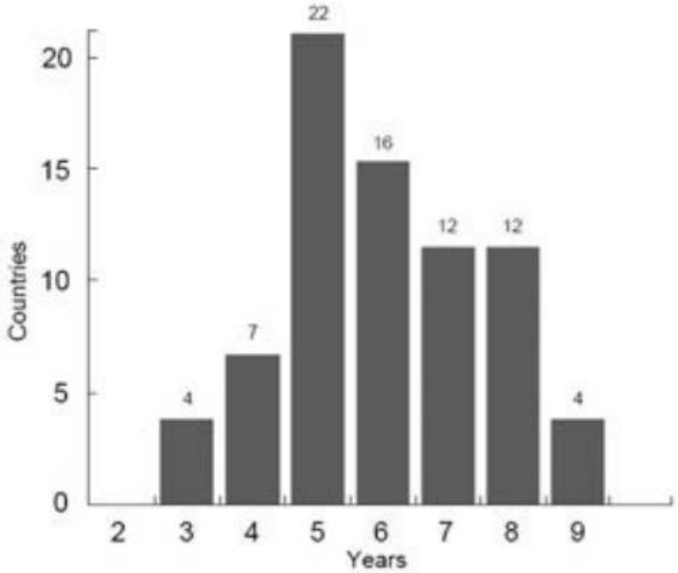
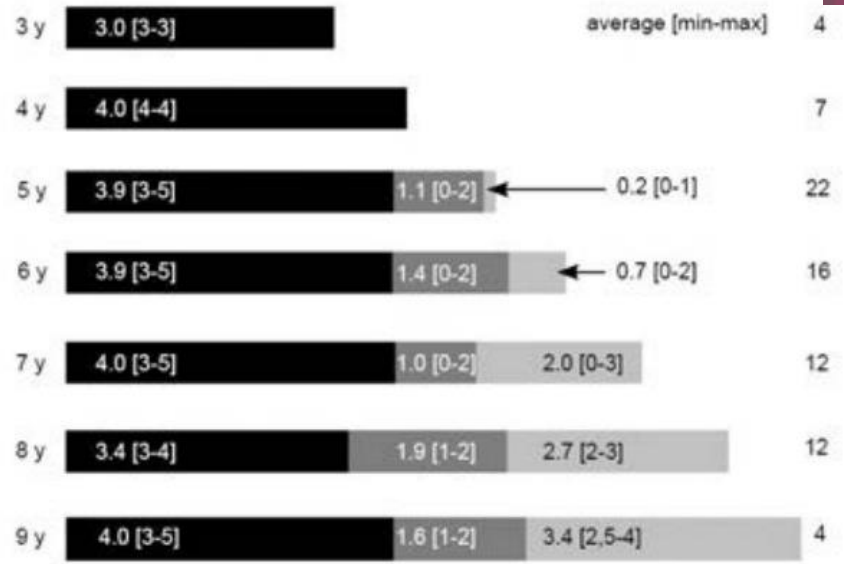


3-9 years



Undergrad ~4 yrs | Grad ~2 yrs | Clinical ~2 yrs

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Number Variations by Country

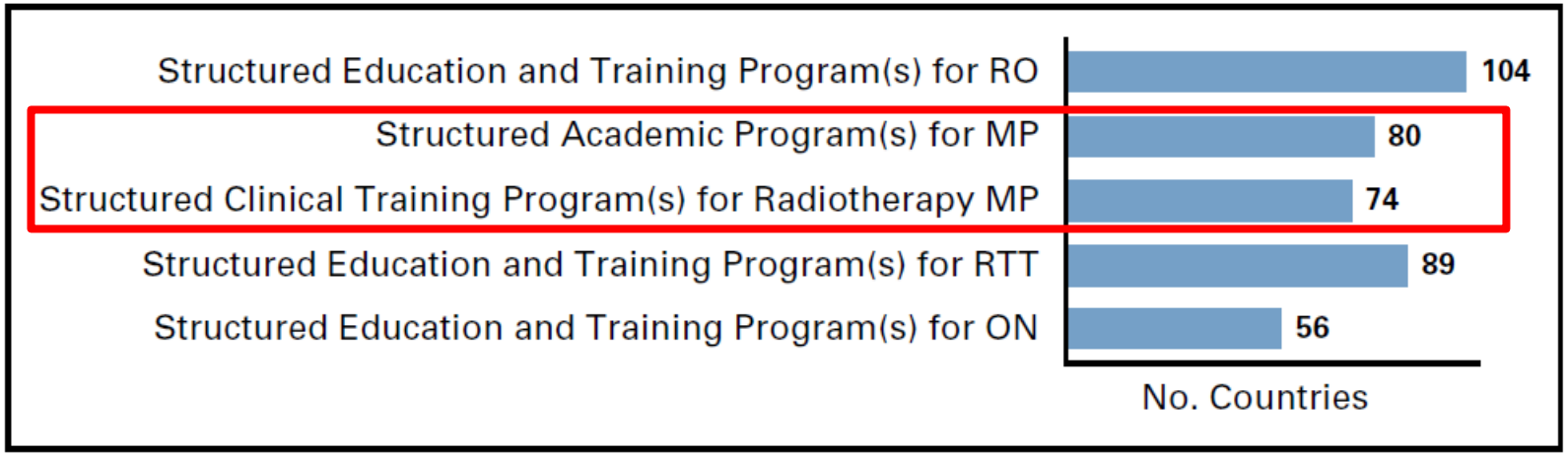
- Health Economics in Radiation Oncology Project of the European Society for Radiotherapy and Oncology (ESTRO-HERO)
  - Variations by country (44 countries in Europe)

Item	Variation Factor
MV machines/1 Million people	6
ROs/1 Million people	15
MPs/1 Million people	20

Note: Significant variation in professional roles

Abdel-Wahab_JCO_GO_7_827_2021
Lievens_Radioth_Oncol_103_109_2012
Grau_Radioth_Oncol_112_155_2014

Training Availability Globally



Out of 214 countries

Abdel-Wahab_JCO_GO_7_827_2021

Technologies:
Different Considerations Around the Globe

https://www.bbc.com/news/world-africa-35997075.amp

IAEA PACT Programme brochure

https://www.philips.com/consumerfiles/newscenter/main/standard/resources/healthcare/2012/joint-elekta-philips/Philips-Ingenia-MRI-Scanner.jpg

MR-Linac
"Super" radiotherapy

Uganda's only radiotherapy machine used for treating cancer is broken beyond repair, the country's main cancer unit says.

BBC News, 8 April 2016

(Population 42 Million)

Update…2022-05-12. IAEA DIRAC: 7 centers, 8 MV machines

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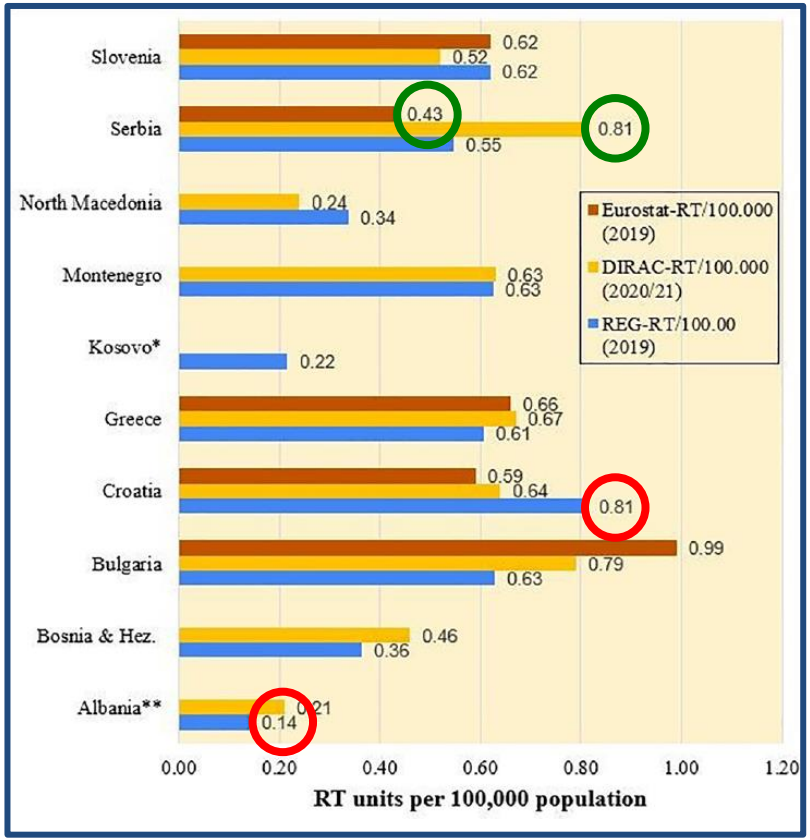
RT Equipment (EBRT & Brachy) in South East Europe

- Density of RT units/100K popul.
- 3 data sources
- Different numbers highlight …
  - Variation from country to country (factor of ~6)
  - Challenges in gathering accurate data (factor of ~2)



European Union

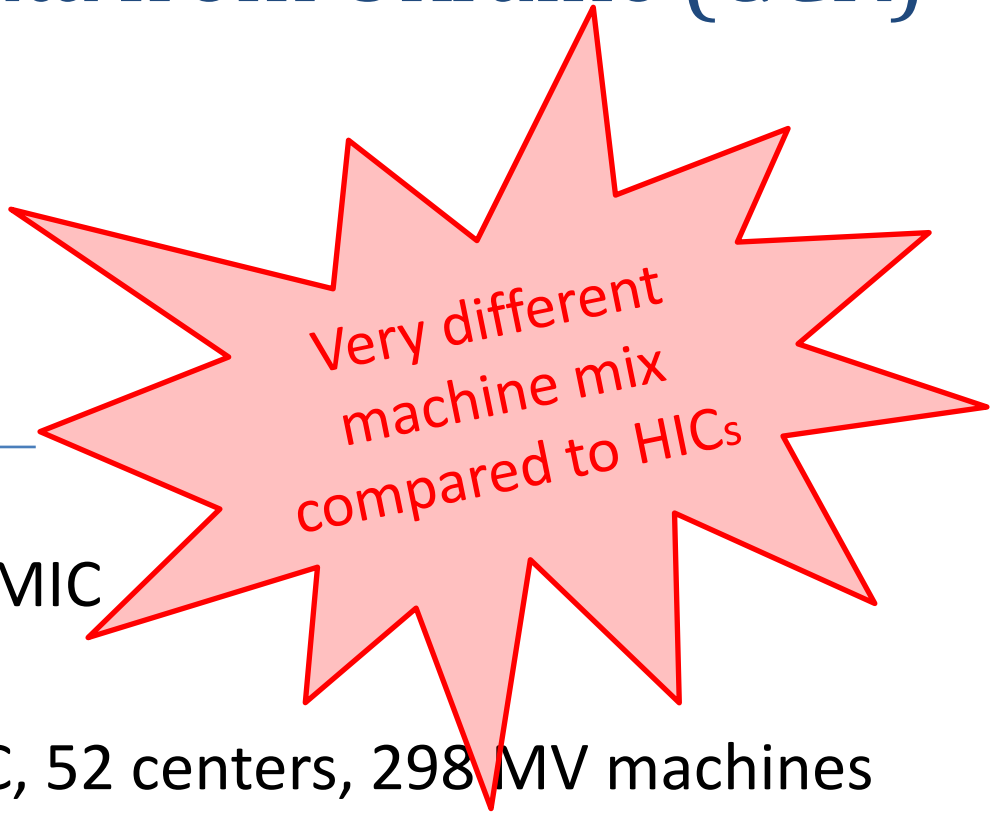
IAEA

This survey

Dosanjh et al. Clin & Translat Radiat Oncol 34: 57-66; 2022

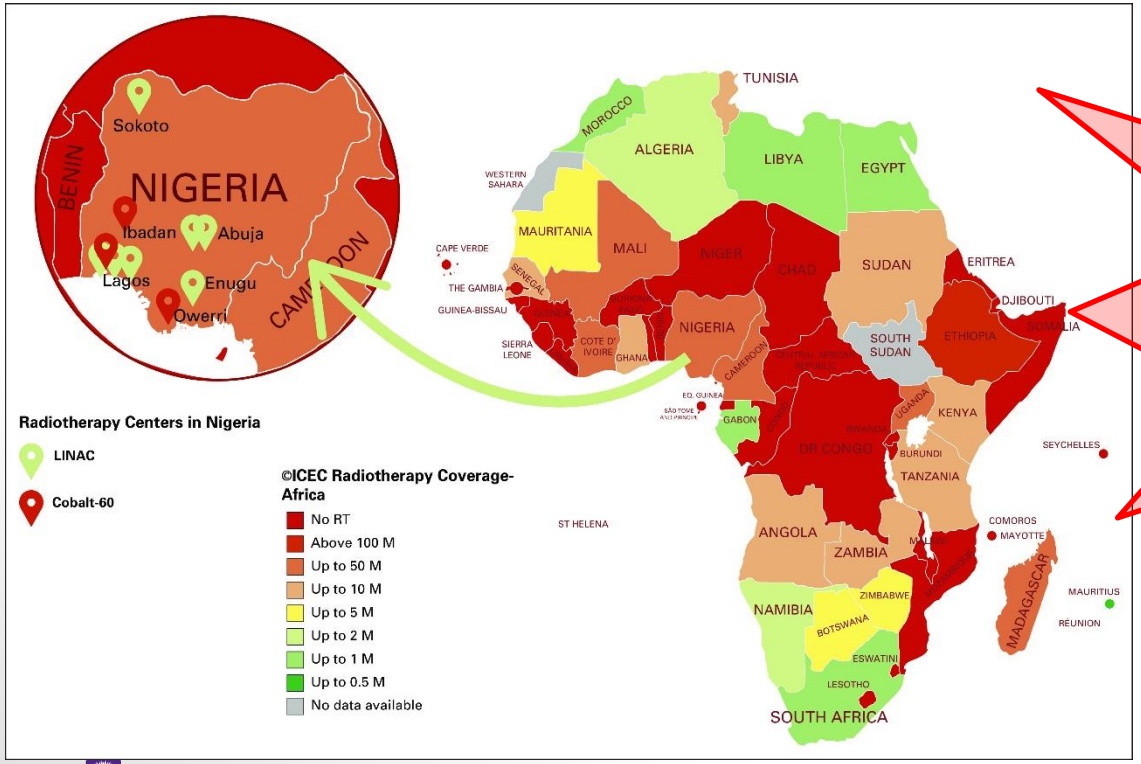
Example: Recent data from Ukraine (GCR)

- 27 April 2022
- 52 RT centers
  - 86 cobalt-60 machines
  - 20 linacs
- Population: 44 Million
- World Bank definition: UMIC
- Compare
  - Canada: 38 Million, HIC, 52 centers, 298 MV machines



Overcoming Challenges in Providing Radiation Therapy to Patients With Cancer in Nigeria and Experience in the National Hospital Abuja, Nigeria

Simeon Chinedu Aruah[1]; Obinna Chizoba Asogwa, MSc[1]; Fatima I. Ubah, MD, MBBS[1]; Nandul Nimark Maurice, MBBS[1]; Rasaaq Oyesegun, MD, MBBS[1]; Taofeeq A. Ige, PhD[1]; C. Norman Coleman, MD[2]; Manjit Dosanjh, PhD[3]; and David Pistenmaa, MD, PhD[2]



27 countries with no radiotherapy

Aruah et al, JCO Glob Oncol. 2020; 6: JGO.19.00177.

Medical Physics Education: Global Issues

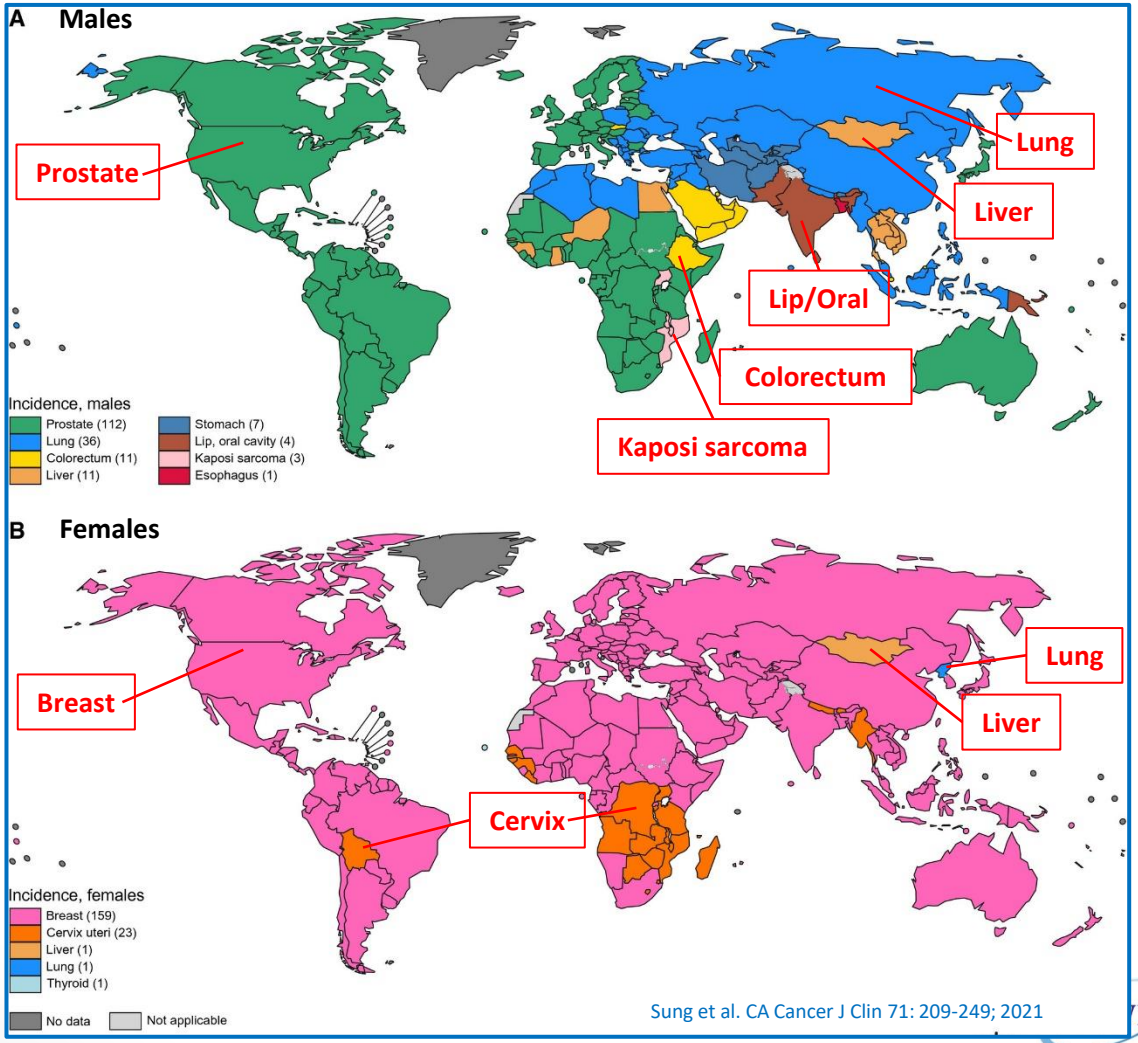
- **Variation in …**
  - Basic educational backgrounds
    - Undergraduate and graduate education
      - Diploma, B.Sc., M.Sc., Ph.D.
  - Residency … or on-the-job training
  - Available technologies
  - Available training programs
  - Available resources
  - Instructors with practical experience
    - And good teaching skills
  - Interdisciplinary relationships
  - Professional certification procedures
- Development of infrastructure … takes time

Medical Physics Education: Global Issues

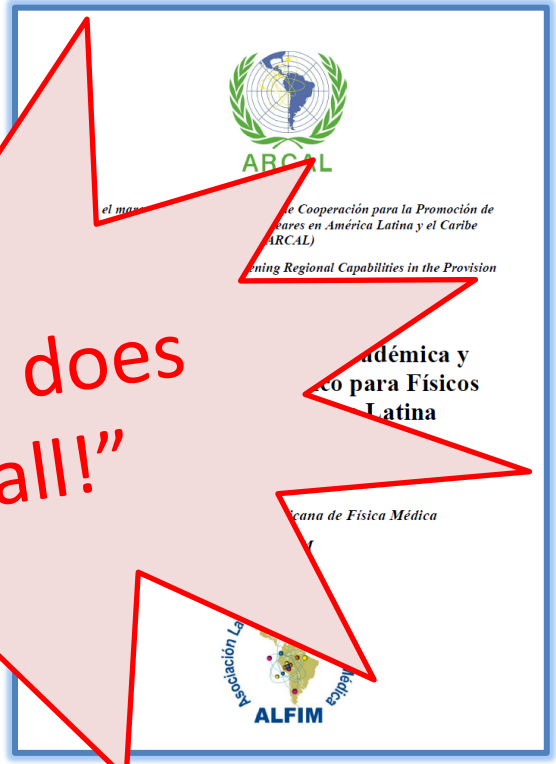
- Concerns about education abroad
  - Different diseases
  - Different infrastructure
  - Potential for “brain drain”

Different Disease Incidence

- Highest incidence per country
  - Globocan data



Sung et al. CA Cancer J Clin 71: 209-249; 2021



"One size does not fit all!"

Academic Training and Clinical Training Guidelines for Medical Physicists in Latin America

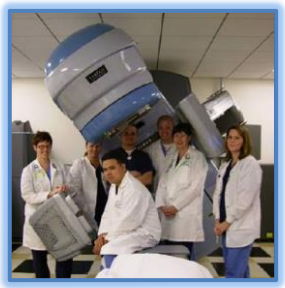
Different Infrastructure

Cost drivers

- Facilities
- Equipment
- Salaries

http://www.grhosp.on.ca/Radiationtherapy

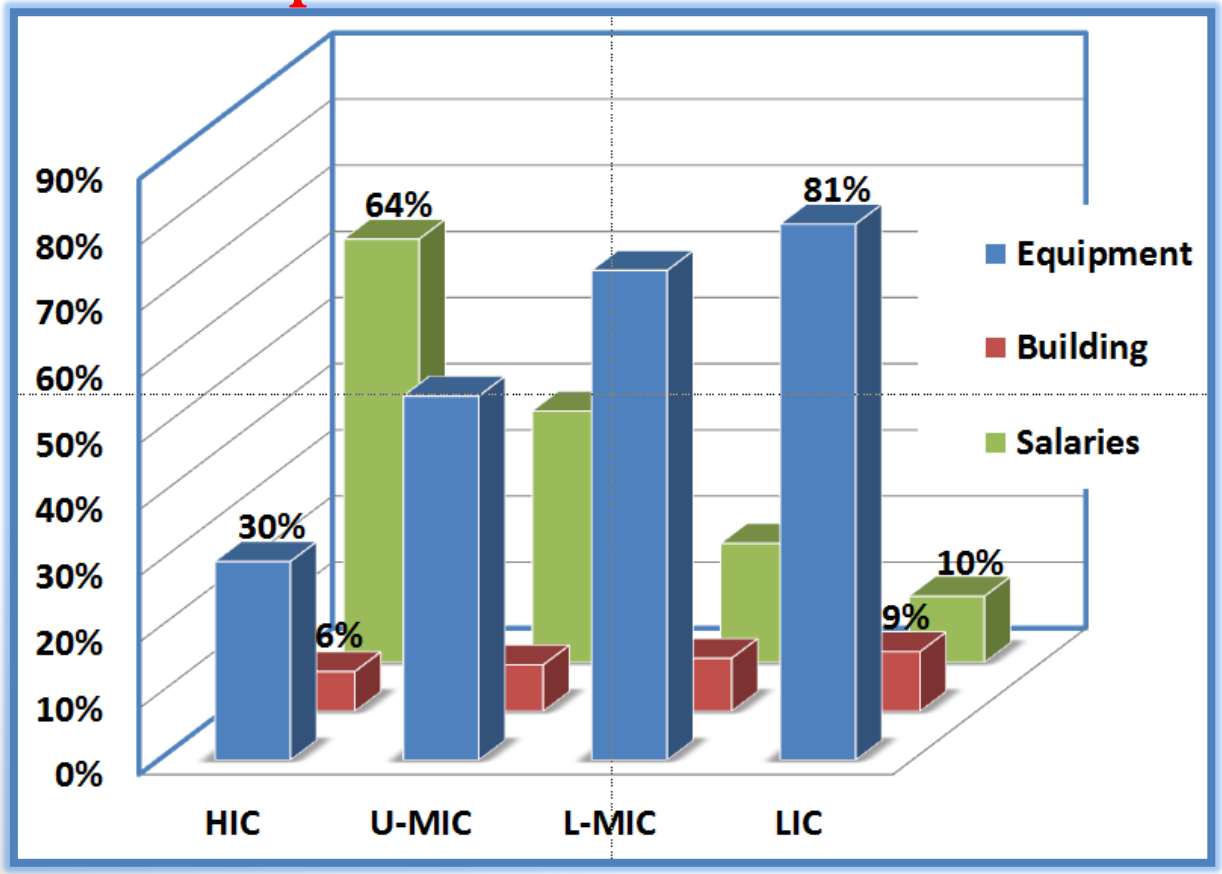
T Kron

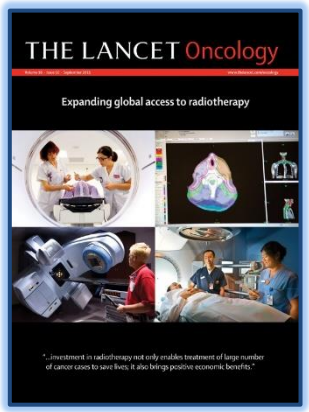


http://healthsciences.ucsd.edu/som/radiation-medicine/education/Pages/national-university.aspx

Different Infrastructure

Relative Component Costs





Atun *et al,* Lancet Oncol, 16: 1153-1186; 2015

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HEALTH SERVICES RESEARCH

Global Radiotherapy: Current Status and Future Directions—White Paper

May Abdel-Wahab, MD, PhD[1]; Soehartati S. Gondhowiardjo, MD, PhD[2]; Arthur Accioly Rosa, MD[3]; Yolande Lievens, MD, PhD[4]; Noura El-Haj, MSc[1]; Jose Alfredo Polo Rubio, PhD[1]; Gregorius Ben Prajogi, MD[1]; Herdis Helgadottir, MA[1]; Eduardo Zubizarreta, MD[1]; Ahmed Meghzifene, PhD[1]; Varisha Ashraf, BSc[1]; Stephen Hahn, MD[5]; Tim Williams, MD[6]; and Mary Gospodarowicz, MD[7]

THE IMPORTANCE OF RESEARCH IN GLOBAL RADIOTHERAPY

Research is a key pillar for the long-term improvement of cancer control, along with clinical and education or training activities, ensuring progress and scientifically based management in radiotherapy. However, the nature and implementation of research activities may vary according to the resources available locally and the interaction with the

BRIEF OPINION

The Case for Elective International Residency Rotations

Derek W. Brown, PhD, John Einck, MD, Todd Pawlicki, PhD, and Arno J. Mundt, MD

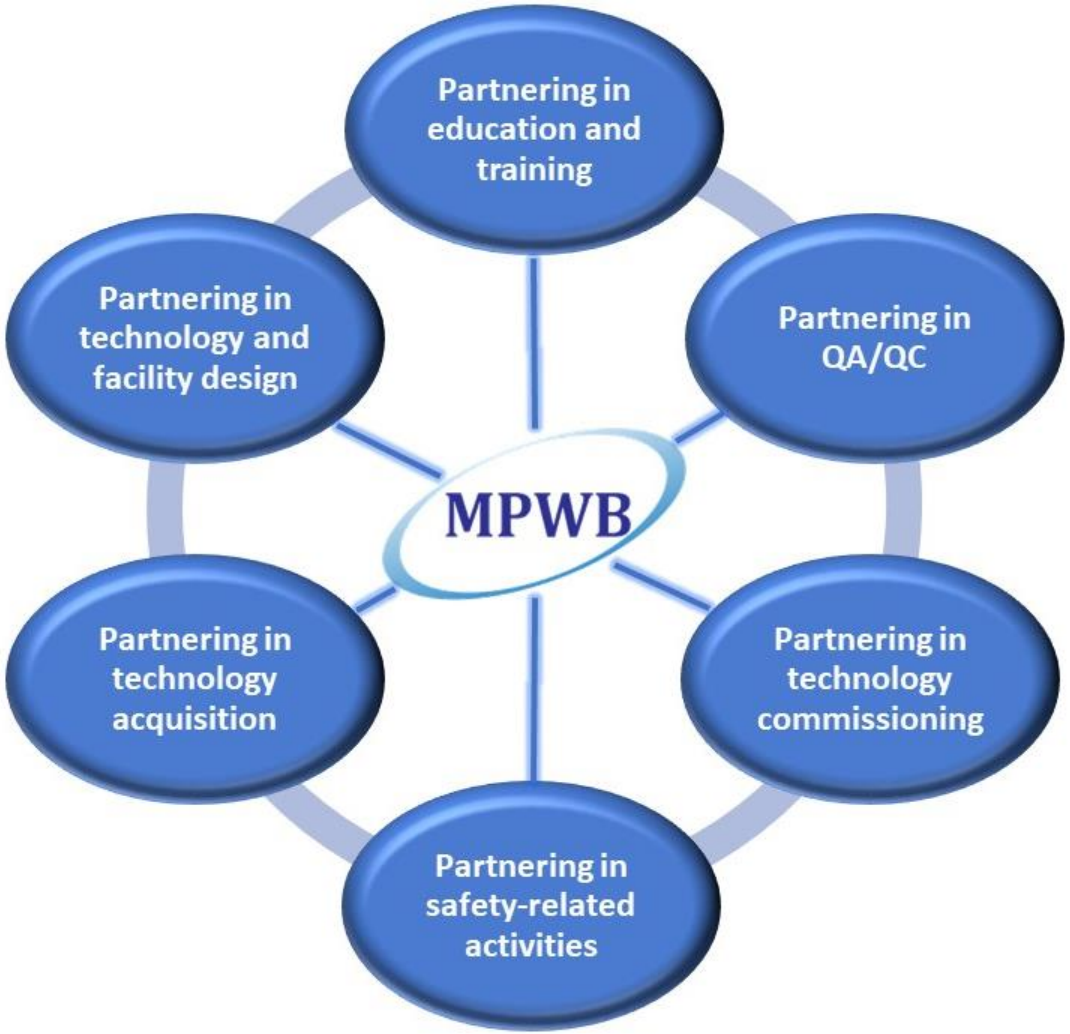
Department of Radiation Medicine and Applied Sciences, University of California, San Diego, La Jolla, California

Received Aug 25, 2015. Accepted for publication Aug 29, 2015.

- Benefits
  - Improves problem-solving skills
  - Fosters an interest in caring for underserved populations
  - Develops broader future interest in choosing a career that involves global health
- Incorporated an elective one-month international rotation into their CAMPEP-accredited medical physics residency program
  - Vietnam – joint RO & MP

Partnering in Medical Physics!

- Training
- Education
- Mentoring!
  - Virtually!



Medical Physics for World Benefit

www.MPWB.org

Virtual Mentoring Global Survey

- ePoster: PO-GePV-E-14
- 510 responses

GUIDANCE IN DEVELOPING MENTORING PRACTICE FOR MEDICAL PHYSICISTS

1. Organizers: Develop mentoring handbook to outline details of total process
2. Obtain applications from potential mentors and mentees
    a. Include details on technical expertise, technologies in use, job role, expectations, …
3. Match mentor and mentee
    • Personal connections, •Local healthcare facility • University
4. Mentor and mentee jointly document a formal mentorship agreement
    a. Define expectations
    b. Define expected frequency, length, and format of meetings
    c. Define review process
        i. Timing and frequency of reviews
        ii. Assess successes and shortcomings
        iii. Criteria for continuation or termination
5. Organizers: Review total mentorship program on an annual basis and make amendments as needed

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Conclusions

- As medical physicists …
  - We need to be educated about
    - Global situation
    - Local partner circumstances
  - We need to understand
    - Needs and wants as defined by local partners
  - We need to communicate, coordinate, and collaborate with local partners and other entities
    - With humility and sensitivity
    - With an open mind
    - With perceptiveness and wisdom