

# Overview of the Global Medical Physics

---



**Medical Physics Conveners:**

**Dr. Stephen Avery**

**Dr. Hany Ammar**

**Prof. Rajaa Sebihi**

**PENN RADIATION ONCOLOGY**



**Penn Medicine**

**July 14, 2021**

# Medical Physics

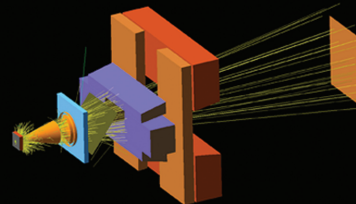
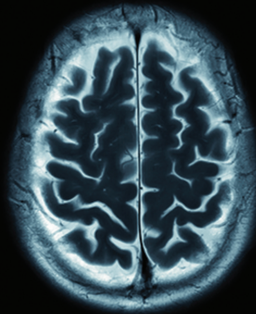
## What is **MEDICAL PHYSICS?**

An Introduction to  
the Field of Medical Physics



**MEDICAL PHYSICS IS** an applied branch of physics concerned with the diagnosis and treatment of human disease with applications in the following areas:

- Radiation and particle based cancer treatments
- Medical imaging modalities to identify and track diseases
- Computer simulations of disease treatment/progression and optimization of therapy
- Utilization of data analytics to improve upon current treatment outcomes



**THERAPEUTIC  
MEDICAL PHYSICS**

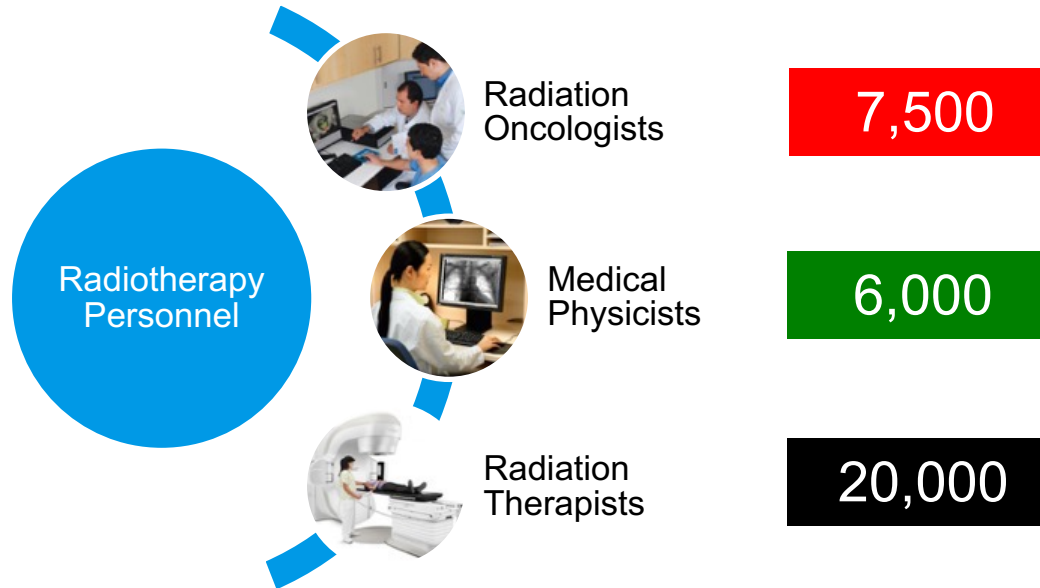
**DIAGNOSTIC/IMAGING  
MEDICAL PHYSICS**

**MODELING AND  
OPTIMIZATION**

**DATA ANALYTICS AND  
DECISION SUPPORT**

# Need for Global Oncology Education

By 2025, LMICs will need an additional...



**EDUCATION is Crucial: Radiotherapy Human Resources lacking**

Source: Lancet Commission Report/UICC

# Status of Medical Physics in Africa

## Introduction

Information on facilities and clinical programmes in Africa:

- 54 countries in Africa
- 1.2 billion population
- 50% of countries with RT facilities
- 20 countries with NM facilities
- ~ 1,000 MPs in region
- 10 countries with MP academic programmes
- 6 countries with MP clinical programmes



## Medical Physics (MP) Workforce

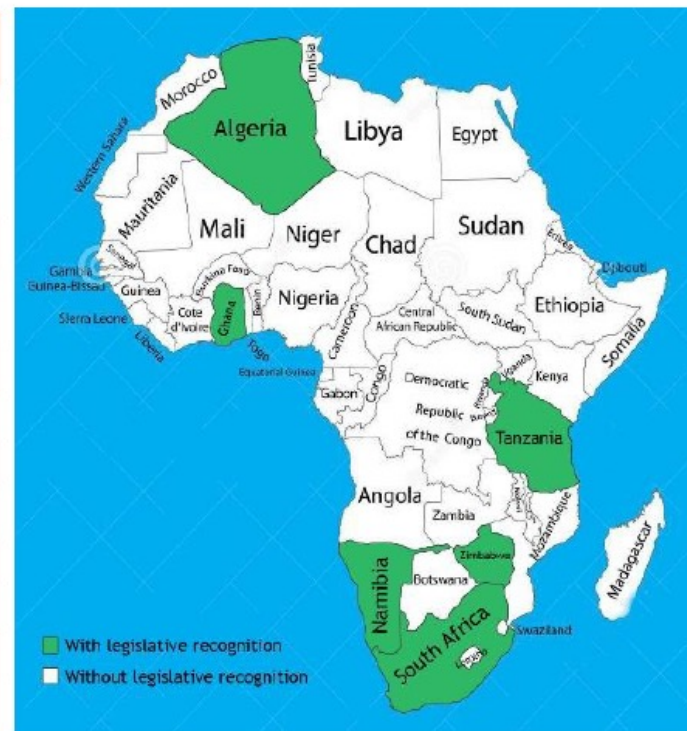
The summary of the Africa's Medical Physics workforce is given as follows:

Country	No. of MPs	Country	No. of MPs
Algeria	129	Nigeria	100
Angola	4	Senegal	3
Benin	3	Sierra Leone	1
Botswana	4	South Africa	136
Burkina Faso	2	Sudan	28
Cameroon	2	Tanzania	4
Congo DR	1	Tunisia	37
Cote d'Ivoire	2	Uganda	10
Egypt	374	Zambia	6
Eritrea	2	Zimbabwe	9
Ethiopia	4	<b>Total</b>	<b>1,041</b>
Gabon	4		

# Legislative Recognition of MPs as Health Professionals

Recognition status all over the continent is given as follows:

Countries With recognition	Countries without recognition			
Algeria	Angola	Cote d'Ivoire	Lesotho	Rwanda
Ghana	Benin	Djibouti	Liberia	Sao Tome & Principe
Namibia	Botswana	Egypt	Libya	Senegal
South Africa	Burkina Faso	Equatorial Guinea	Madagascar	Seychelles
Tanzania	Burundi	Eritrea	Malawi	Sierra Leone
Zimbabwe	Cabo Verde	Eswatini	Mali	Somalia
	Cameroon	Ethiopia	Mauritania	South Sudan
	Central Africa Republic	Gabon	Mauritius	Sudan
	Chad	Gambia	Morocco	Togo
	Comoros	Guinea	Mozambique	Tunisia
	Congo DR	Guinea Bissau	Niger	Uganda
	Congo Republic	Kenya	Nigeria	Zambia



## RADIOTHERAPY IN AFRICA



- South Africa and Egypt account for 60% of radiotherapy equipment resources in Africa.
- North and Southern Africa together account for 90% of total RT machines in the region.
- Analyzed data from 2012 - 2016 (excl. EGY and SAF)

Year	Population	Centres	Cases	LINAC units	Co-60 units
2012	574 mi	67	89000	64	36
2016	589 mi	79	91000	106	33

- There still exist lack of access despite increase in centres and major shift to LINAC

Slide Courtesy of Dr. Francis Hansford (GAEC/GSMP)

# Medical Physics

Federation of African Medical Physics Organizations



## RADIOTHERAPY Cobalt Vs Linac

- South Africa and Egypt
- North and Southern
- Analyzed data from

resources in Africa.  
achines in the region.

Year	Popula
2012	574 m
2016	589 m

Year	No. of Cobalt	No. of Linac
1987	60	15
1997	80	60
2007	100	120
2017	65	270

60 units

- There still exist lack of access despite increase in centres and major shift to LINAC

Slide Courtesy of Dr. Francis Hansford (GAEC/GSMP)

## MEDICAL IMAGING IN AFRICA



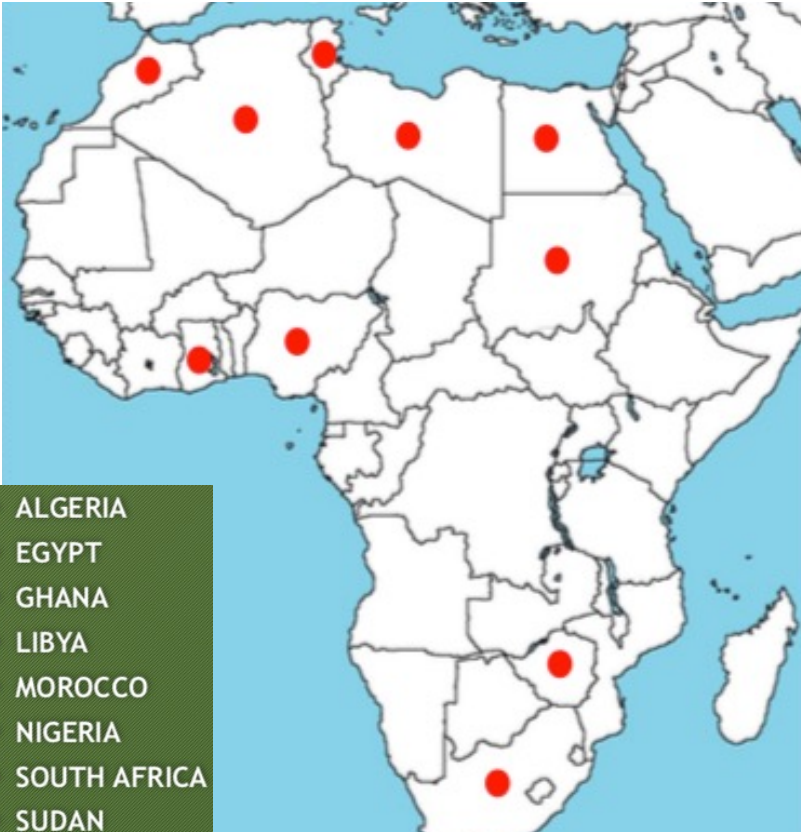
- Most countries have only basic radiology equipment.
- 20 countries have access to nuclear medicine.
- Fewer MPs are dedicated to imaging (DR and NM) than to RT.
- High end imaging (e.g. PET/CT) is available in < 5 countries.
- Tele-radiology is limited by telecommunications infrastructure.

Slide Courtesy of Dr. Francis Hansford (GAEC/GSMP)



# Medical Physics

## Academic Programs



- ALGERIA
- EGYPT
- GHANA
- LIBYA
- MOROCCO
- NIGERIA
- SOUTH AFRICA
- SUDAN
- TUNISIA
- ZIMBABWE

## Residency Programs



- EGYPT
- GHANA
- MOROCCO
- NIGERIA
- SOUTH AFRICA
- ZIMBABWE

### PROPOSED:

- Sudan, Tunisia

# Medical Physics

Federation of African Medical Physics Organizations

## MP WORKFORCE

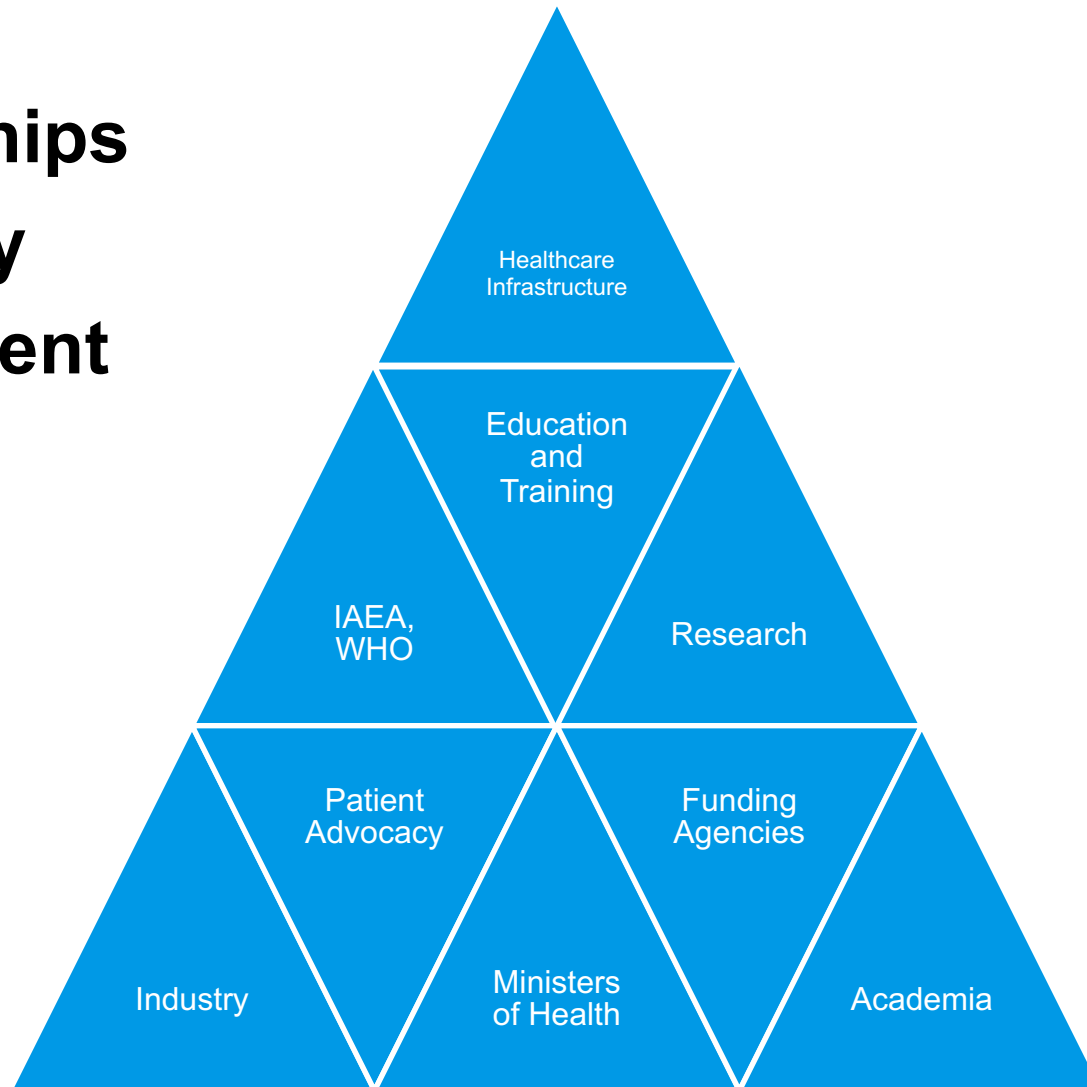


- Many MPs work in more than one of the 3 disciplines (DR, NM and RT sub-specialization gradually being implemented).
- Preponderance of MPs in Academic and Research, some in Radiation Protection, Regulatory body, Health Ministry / DoH, Atomic Energy Commissions, Trade Sector (Vendors), etc.
- 30% MPs are females.
- ~ 75% of MPs are Government employees

Slide Courtesy of Dr. Francis Hansford (GAEC/GSMP)

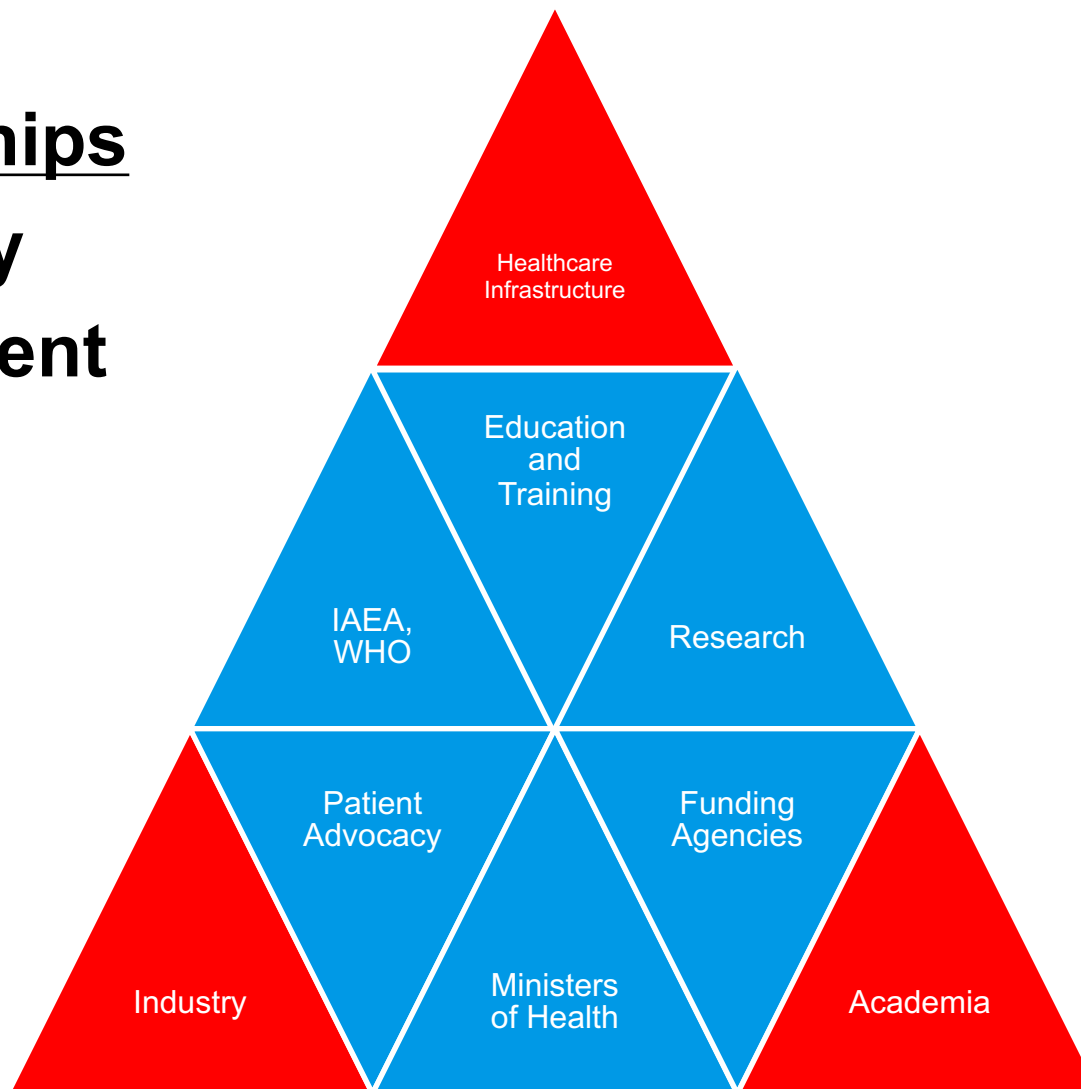
# Medical Physics Capacity Building

- ◆ **Partnerships**
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**



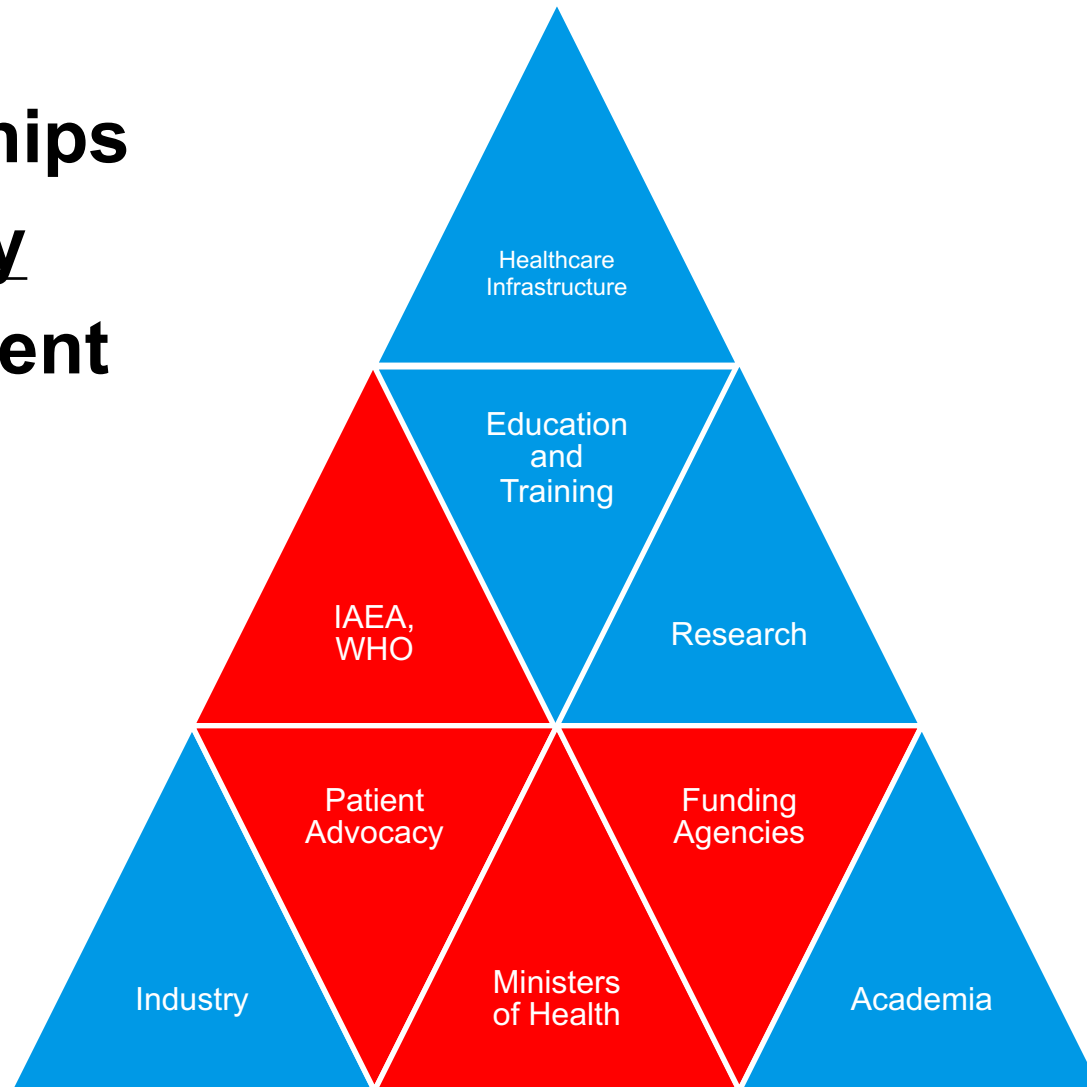
# Medical Physics Capacity Building

- ◆ Partnerships
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**



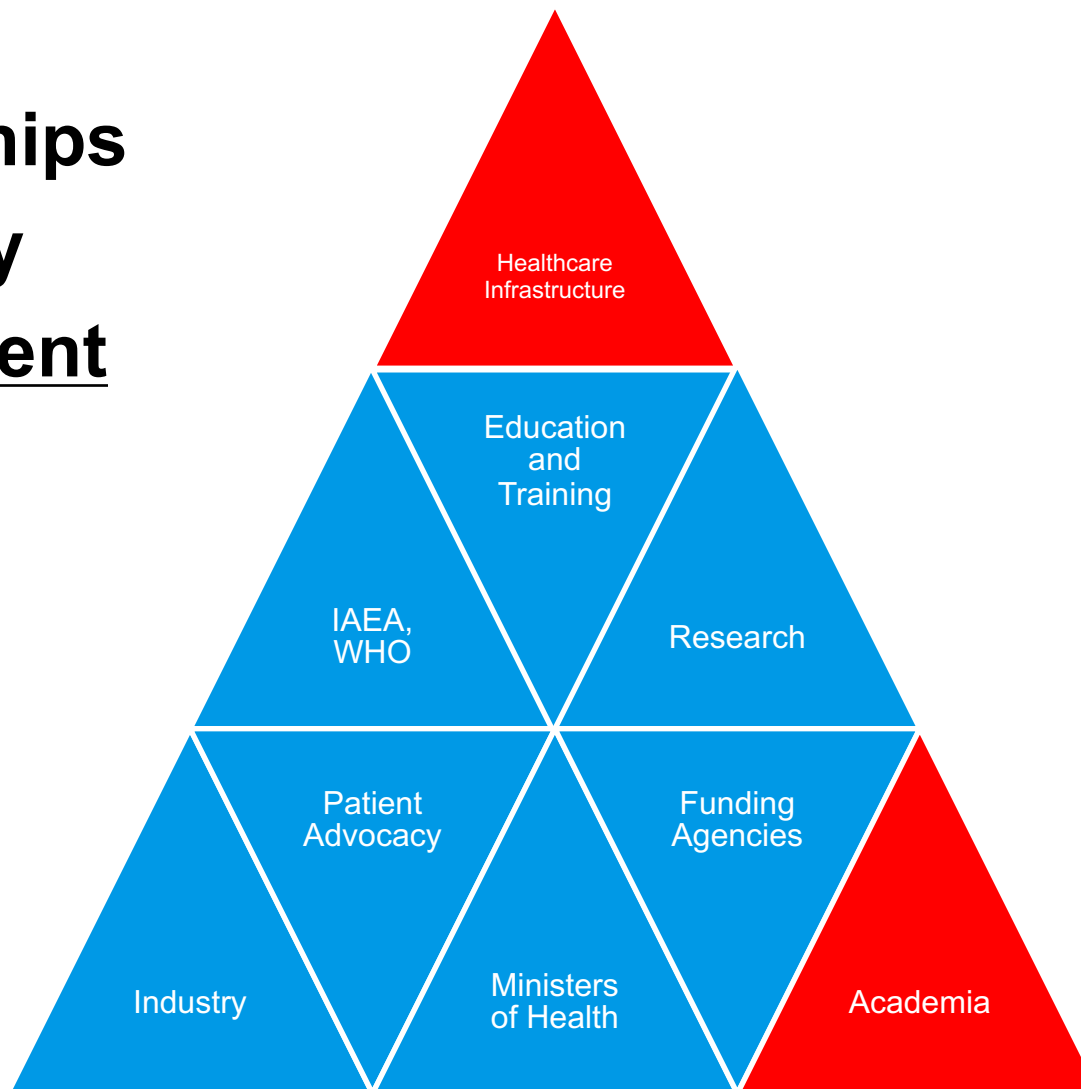
# Medical Physics Capacity Building

- ◆ **Partnerships**
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**



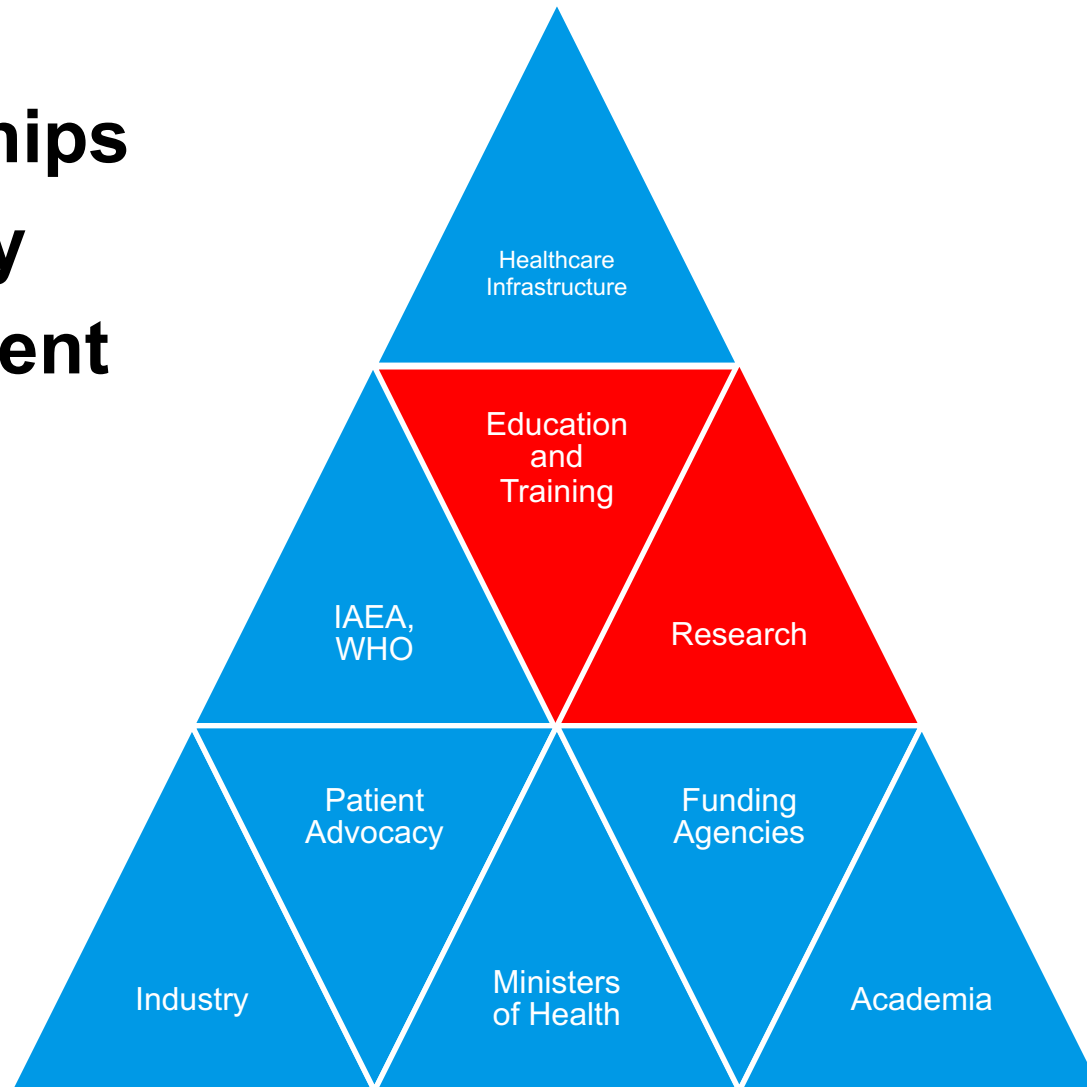
# Medical Physics Capacity Building

- ◆ **Partnerships**
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**



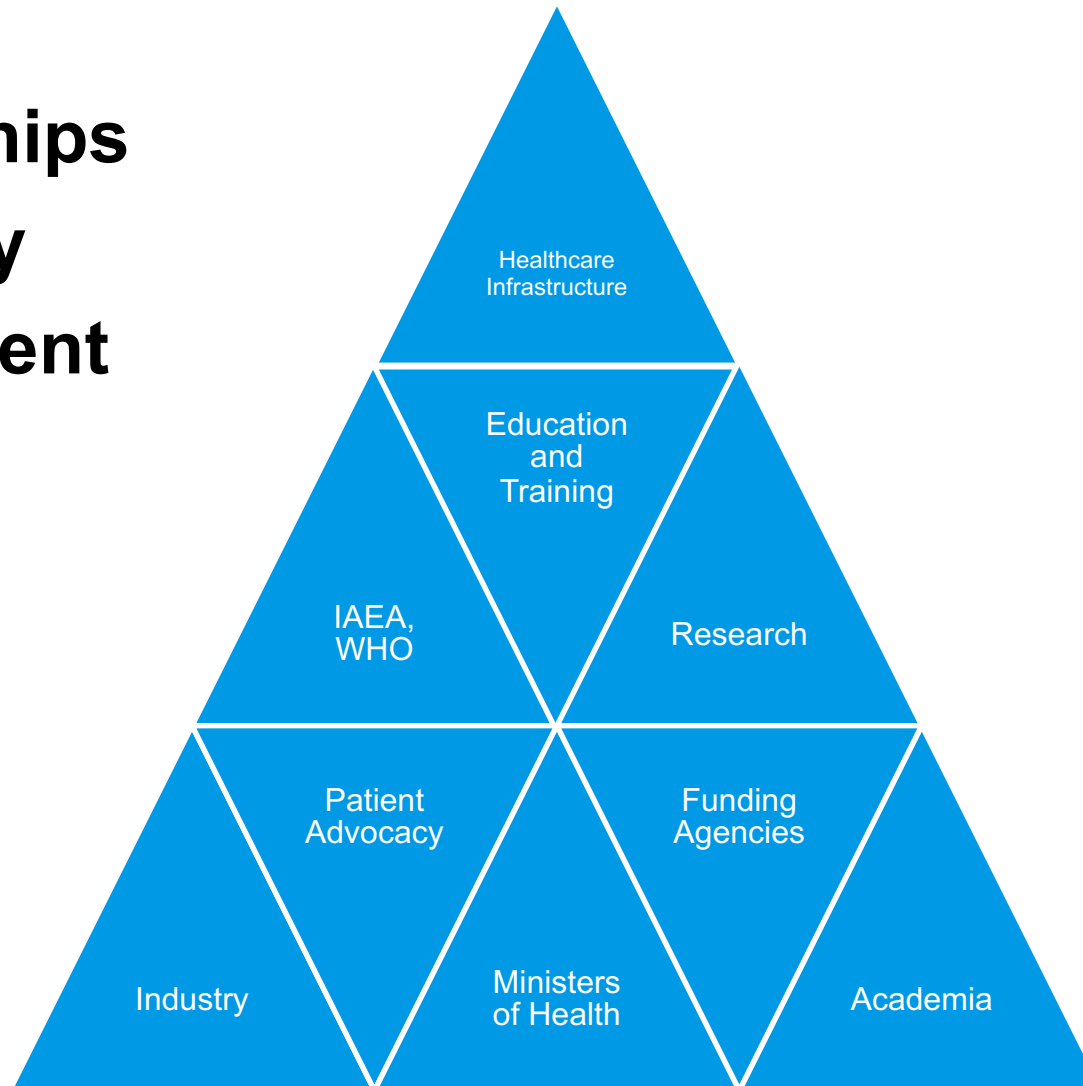
# Medical Physics Capacity Building

- ◆ **Partnerships**
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**



# Medical Physics Capacity Building

- ◆ **Partnerships**
- ◆ **Advocacy**
- ◆ **Recruitment**
- ◆ **Training**







# FAMPO

## FEDERATION OF AFRICAN MEDICAL PHYSICS ORGANIZATIONS

*Regional Federation of IOMP in Africa*



## MEDICAL PHYSICIST AS HEALTH PROFESSIONAL



# November 7

INTERNATIONAL DAY OF

# MEDICAL PHYSICS



### 1st Regional Conference of the Federation of African Medical Physics Organizations

*Medical Physics in Africa: From Imaging to Treatment*

27 - 29 November 2020  
Hotel les Jardins De L'agdal, Marrakech, Morocco.



### FIRST CONFERENCE ANNOUNCEMENT

#### Background:

The Federation of African Medical Physics Organizations (FAMPO) is the regional federation of the International Organization for Medical Physics (IOMP) in Africa. The Federation promotes the application of physics in medicine within the African region. In a region of 1.3 billion population, it has been FAMPO's cherished dream to drastically increase the number of Medical Physics workforce, in consonance with the ambitions of the IOMP. In line with this, FAMPO has collaborated with other agencies like the International Atomic Energy Agency (IAEA) and the IOMP towards strengthening education and training of Medical Physicists, improving Medical Physics practices and achieving the needed recognition for the profession within the region.

#### Objectives:

The major goal of the conference is to bring together Medical Physicists in clinical practice, academia, research and industry, and provide a platform for exchange and sharing of scientific information and experiences in all aspects of the profession.

#### Topics:

The conference will cover recent developments in the field of Medical Physics applications. FAMPO welcomes both academic and practice based contributions and topics in diagnostic radiology, nuclear medicine and radiotherapy:

- Dosimetry
- Quality control and quality assurance
- Audits
- Image quality and dose optimization
- Image registration and processing
- Diagnostic reference levels
- Education and training
- Artificial intelligence
- Radiation protection
- Etc.

#### Audience:

This conference will serve as an opportunity for Medical Physicists and scientists in medical institutions, research centres, universities and standards laboratories to meet for discussions covering the entire Medical Physics spectrum. FAMPO welcomes and encourages the participation of women and early career professionals.

#### Programme Structure:

The conference will consist of sessions including the opening ceremony, plenary sessions, series of topical sessions with oral and poster presentations, a session for poster highlights, exhibition and the FAMPO General Assembly.

**Conference abstracts will be published in the African Journal of Medical Physics (AJMP)**

#### Sale of Exhibition Booths & Logistics Arrangements:

##### Altitude Événementiel

- Contact Person: Ms Bouchra AMARI  
 • Email: altitude@altitudeevoyages.ma  
 • Tel: +212 537778405 / 07  
 • Mob: +212 661203585  
 • Whatsapp: +212 610590381  
 • Address: 43, Rue Oum Rabiâ appt. N°1 Agdal Rabat - 10106 Maroc

#### Important Dates:

- |                   |                                      |
|-------------------|--------------------------------------|
| 01 March 2020     | - 1st Conference Announcement        |
| 08 March 2020     | - Opening of Registration            |
| 08 March 2020     | - Call for Abstract Submission       |
| 01 June 2020      | - 2nd Conference Announcement        |
| 08 July 2020      | - Abstract Submission Deadline       |
| 27 September 2020 | - Notification of Accepted Abstracts |

#### Sponsor:



#### Conference website:

[www.conference.fampo-africa.org](http://www.conference.fampo-africa.org)

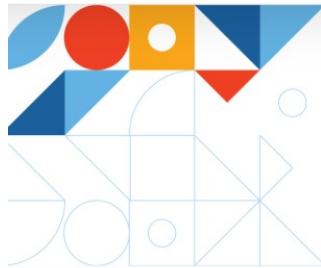
#### Contacts:

Email: [info@conference.fampo-africa.org](mailto:info@conference.fampo-africa.org)  
 Phone: +212661400321 / +239244945805



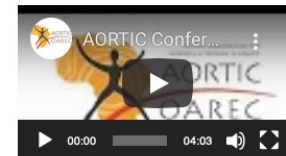
## OUR MISSION

TRANSFORM CANCER CONTROL IN AFRICA THROUGH COLLABORATION  
IN EDUCATION, RESEARCH AND DELIVERY OF EQUITABLE AND TIMELY  
INTERVENTIONS TO MINIMISE THE IMPACT OF CANCER.



## AORTIC 2021 | 5 – 10 NOVEMBER

The 13th AORTIC International Conference on Cancer in Africa will take place virtually from 5 to 10 November 2021, bringing together multidisciplinary specialists from the global cancer community to reduce the impact of cancer in Africa.



# AAPM International Council



## AAPM International Council

### **Vision:**

To have a sustainable, measurable, and meaningful impact on global health as it relates to the practice of medical physics, the international medical physics communities, and medical disciplines associated with medical physics (e.g., radiology, nuclear medicine, and radiation oncology).

### **Goal:**

To identify and develop strategies for advancing the practice of medical physics globally and to address global disparities in healthcare and develop mitigation strategies in collaboration with other stakeholders that include international medical physics organizations, international radiology and radiation oncology societies, and NGOs that deal with the cancer burden as well as other diseases requiring medical physics involvement.



# Global Health Catalysts

## GLOBAL HEALTH CATALYST SUMMIT

Premier yearly global health summits designed to catalyze high impact international collaborations and initiatives to eliminate global health disparities

*"Win-win Collaborations for Global Health and economic development"*

*Due to the Coronavirus, events for this year have been postponed. New information will be available soon.*

## GLOBAL HEALTH CATALYST SUMMIT EUROPE

Join us every first week of September, at the University of Heidelberg, Medical Faculty Mannheim, Germany

*"Catalyzing win-win collaborations for global health"*

## Global Health Catalyst summit Tanzania

Join us at Kunduchi Beach Resort and Conference Center  
April 1-4, 2019

*From Palliative to Curative Care*



# Global Health Catalysts

## Upcoming Meetings Planned





# Global Health Catalysts

## Upcoming Meetings Planned

**GLOBAL HEALTH CATALYST SUMMIT  
UPENN**



Perelman  
School of Medicine  
UNIVERSITY OF PENNSYLVANIA

**GLOBAL HEALTH CATALYST SUMMIT  
AFRICA**

LANCET COMMISSION ON CANCER CONTROL IN SUB-SAHARAN AFRICA  
Will be presented during the GHC meeting in Africa



# Global Health Catalysts

**The Global Health Catalyst (GHC) summit is a premier yearly event dedicated to catalyzing high impact international collaborations to eliminate global health disparities, with main focus on cancer and other non-communicable diseases**

## Objectives

1. At least 5 new collaborations involving researchers from both USA and African institutions each year.
2. Significant increase in participation of URM and the diaspora in global oncology.
3. Turn brain drain to brain circulation for global health gain.
4. Peer-reviewed publications co-authored by both USA and African collaborators.
5. Joint patents resulting from collaborations.
6. Significant access to knowledge-sharing, continuous education and funding opportunities to strengthen and grow collaborations, via the ICT-powered GHC platform beyond yearly face-to-face meeting.
7. Development of a long term funding strategy with Africans in the Diaspora and industry to provide seed-funding each year for new collaborations and secure long term funding via other mechanisms including from NIH, Wellcome Trust, African Academy of Sciences, etc.

## Global Database (ORION) on Radiation Oncology, Nuclear Medicine and Diagnostic Imaging Activities

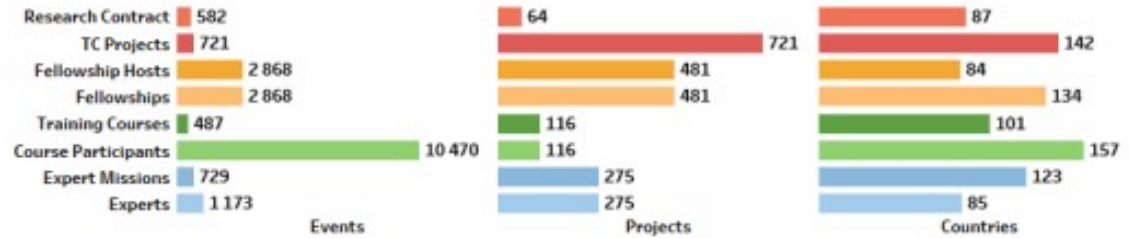


There is an increasing interest in global health across the institutions around the world.

With increasing regional /global initiatives in Radiation Oncology, Nuclear Medicine and Diagnostic Imaging, it is challenging for organizations/ individuals to know who is engaged in their area or region of interest.

There is currently no single database that collates all radiation-related initiatives globally and in any particular region or institution around the world.

168 799 582 2 868 487 10 470 729 1 173  
 Countries Projects Research Contracts Fellows Training Courses Course Participants Expert Missions Experts



### Activities per country





# African School of Physics - Recruitment

**THE SIXTH BIENNIAL AFRICAN SCHOOL OF FUNDAMENTAL PHYSICS AND APPLICATIONS**  
July 5-25, 2020

**THE SECOND BIENNIAL AFRICAN CONFERENCE ON FUNDAMENTAL PHYSICS AND APPLICATIONS**  
July 20-24, 2020

Co-organised by Mohammed V & Cadi Ayyad Universities, Morocco  
at Faculty of Science Semlalia, Marrakesh

**ASP**  
To increase capacity development in fundamental physics and related applications in Africa. The ASP has evolved to be much more than a school. It is a program of actions with directed ethos toward physics as an engine for development in Africa

**SCIENTIFIC PROGRAM**

► **TOPICS**

- Astrophysics & Cosmology
- Nuclear & Particle Physics
- Accelerator, Radiation & Medical Physics
- Renewable Energies & Energy Efficiency
- Materials Physics
- High Performance Computing
- Physics Education
- Physics Communication
- Quantum Information

► **ACTIVITIES**

- Workshop for High School Teachers
- Outreach for Secondary Schools
- Physics Lectures and Tutorials for Students
- Forum to Discuss Capacity Development & Retention
- African Conference on Fundamental Physics & Applications

[www.africanschoolofphysics.org/asp2020/](http://www.africanschoolofphysics.org/asp2020/)

**INTERNATIONAL ORGANIZING COMMITTEE (IOC)**

B. Acharya (ICTP and King's College London),  
K. Assamagan (BNL),  
A. Dabrowski (CERN),  
C. Darve (ESS),  
J. Ellis (King's College London),  
F. Ferroni (GSSI-INFN),  
S. Muanza (CNRS-IN2P3)

**INTERNATIONAL ADVISORY COMMITTEE (IAC)**

F. Azaiez (iThemba LABS), H. Bachacou (CEA-IRFU),  
M. Campanelli (UCL), S. Connell (Johannesburg),  
T. Ekelof (Uppsala), L. Elouadrhiri (TJNAF),  
E. G. Ferreira (USC), H. Gordon (BNL), J. Govaerts (UCL),  
J. Gray (ASP), B. Heinemann (DESY), H. Holtkamp (SLAC),  
J. Huston (MSU), O. Ka (UCAD), S. Kendall (BNL),  
Y. K. Kim (Chicago), D. Kobor (UASZ),  
S. C. Lee (Academia Sinica), B. Masara (SAIP),  
R. Mazini (Academia Sinica), H. Montgomery (TJNAF),  
S. Mtingwa (IUPAP), B. Mueller (BNL),  
R. Nematudi (iThemba LABS), M. Nxumalo (NRF),  
M. Patjane (DST), F. Quevedo (ICTP), L. Rivkin (PSI & EPFL),  
J. Senona (DST), L. Serafini (INFN & Milan),  
H. Severini (Oklahoma), P. Skands (Monash),  
R. D. Tabrizi (Simon Frasier), E. Tesmelis (CERN),  
P. Verdier (CNRS-IN2P3), T. Vickey (Sheffield),  
Z. Vilakazi (Witwatersrand), H. B. White Jr. (Fermilab),  
J. Yu (UTA)

**ASP CONFERENCE COMMITTEE (ACP)**

K. Cecire (UND), D. Charlton (UB), N. Chetty (UP),  
T. Dobbins (RU), U. Goerlach (US),  
S. Hassani (CEA, Paris), E. Kasai (UNAM),  
L. Leeuw (UNISA), R. Nchodu (iThemba LABS),  
M. Silari (CERN), E. Yitamben (ASP),  
IAC, IOC and LOC

**LOCAL ORGANIZING COMMITTEE (LOC)**

► **LOC COORDINATORS**

M. Chabab (Cadi Ayyad)  
F. Fassi (Mohammed V)  
Y. Tayaleti (Mohammed V)

► **LOC MEMBERS**

A. Adahchour (Cadi Ayyad)  
A. Arhrib (Abdelmalek Saadi)  
A. Belhaj (My Slimane)  
D. Benchekroun (Hassan II)  
Z. Benkhaldoun (Cadi Ayyad)  
M. Bouhamidi (Cadi Ayyad)  
R. Cherkaoui (Mohammed V)  
M. Daoud (Ibn Tofail)  
M. El Baz (Mohammed V)  
H. El Mounni (Ibn Zohr)  
M. Goughri (Ibn Tofail)  
D. Goujdami (Cadi Ayyad)  
Y. Hassouni (Mohammed V)  
A. Jabiri (Cadi Ayyad)  
B. Kartah (Mohammed V)  
Y. Khoulaki (Hassan II)  
T. Khalla (Cadi Ayyad)  
A. Lahbas (Mohammed V)  
M. Mansour (My Slimane)  
A. Moussa (Mohammed 1)  
T. Ouali (Mohammed 1)  
M. Ouchrif (Mohammed 1)  
L. Rahili (Ibn Zohr)  
R. Sebichi (Mohammed V)  
M. Sedra (My Ismael)  
E. Tahri (Mohammed 1)  
F. Zainoun (Mohammed V)



## CeLp-RT: Education Resource



### Consultation



### Treatment Preparation



### Simulation

### Contouring



### Planning/ Plan Evaluation

### Patient Setup

#### General tips

##### Clinical Breast Examination (Video)

The video demonstrates important steps in clinical breast examination

👁️ 22 🟡 RO

📄 Access Resource

#### Essential Skills

##### Difficult Conversations in Cancer (e-Learning)

The e-learning course aims to provide radiotherapy professionals with the skills to support patients and families through difficult conversations.

Number of modules: 5

Expected completion time: 2 hours

👁️ 22 🟡 RO 🟠 RTT 🟢 MP

📄 Access Resource

#### Forms

##### Clinical encounter note templates (PDF)

These clinical encounter note templates are provided in fillable PDF format, available in A4, Letter or F4 paper sizes.

👁️ 22 🟡 RO

📄 Access Resource

#### Staging and Imaging Interpretation

##### A guide to FDG PET/CT in Clinical Oncology (e-Learning)

The e-learning course introduces PET/CT and its interpretation for cancer professionals.

Number of modules: 22

Expected completion time: 4 hours

👁️ 22 🟡 RO

📄 Access Resource

##### TNM Cancer Staging (App)

TNM Cancer Staging App is a simple to use mobile app developed to stage down staging of cancer.

👁️ 22 🟡 RO

📄 Access Resource

##### BI-RADS (Guidelines)

BI-RADS is a classification system proposed by the American College of Radiology (ACR) for mammography, later expanded to include ultrasound and MRI.

👁️ 22 🟡 RO

📄 Access Resource

#### Filter by equipment availability keywords (alphabetical order)

- 👁️ 3D Conformal
- 👁️ 4D-CT
- 👁️ Conventional / 2D
- 👁️ IGRT / In-room imaging
- 👁️ IMRT
- 👁️ Motion management
- 👁️ PET/CT
- 👁️ Plan evaluation tool
- 👁️ Record and verify system

👁️ Show

🔍 Hide

# AAPM International Council

GDIEC

GLC

GNAC

GRSIC

GCETC

GMPETC



# GMPETC Structure

Committee chairs – GMPETC oversight with the goal of addressing committee charge to build capacity in Medical Physics

Stephen Avery

David Gierga

Adel Mustafa

Sub-committees – GMPETC will be divided into focus areas. Each sub-committee will have a charge and give updates at the GMPETC meetings.

Course  
Development

Develop syllabi for course(s) that supplement existing graduate programs

Board Certification  
Examiners

Work with IOMP, IMPCB and other local certification boards as examiners

Program  
Accreditation  
Reviewers

Work with IOMP, IMPCB and other local accrediting bodies to serve as reviewers for program accreditation

Global Summer  
Program

Work with AAPM to develop and maintain Global Summer Exchange Program

# Multiple Enriching Organizations

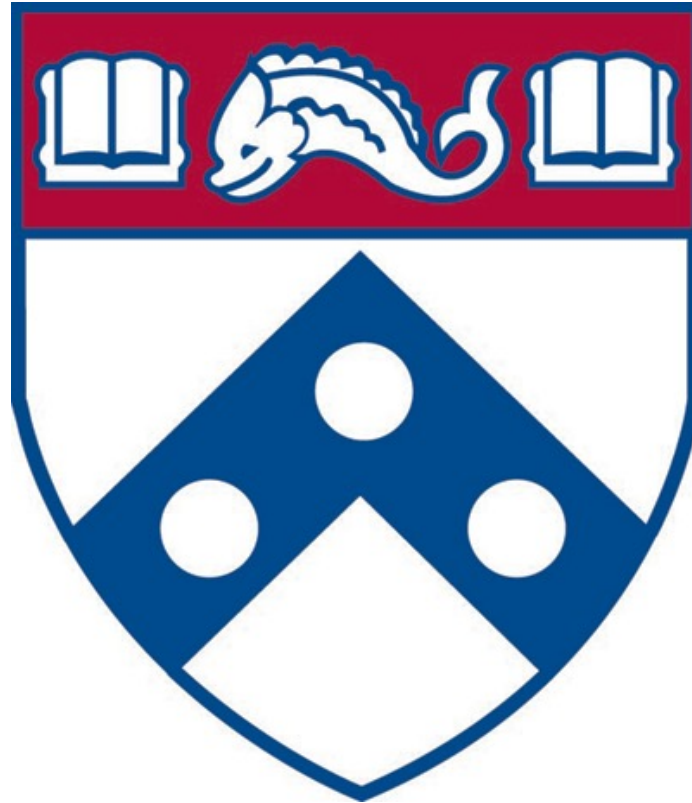


- ◆ >35 RT enriching org's<sup>1</sup>
  - Professional societies
  - Volunteer organizations
  - Gov't Organizations
  - NGOs
- ◆ **Coordination is crucial!**
  - ... but how?

<sup>1</sup> Van Dyk & Meghzifene, Semin Radiat Oncol 27:124-135; 2017

Multiple world-wide partnering organizations

By courtesy of Jake Van Dyk



**Thank you !**