



Challenges Facing Radiation Medicine Practices in Low and Lower-Middle-Income Countries:

The Case of AFRICA

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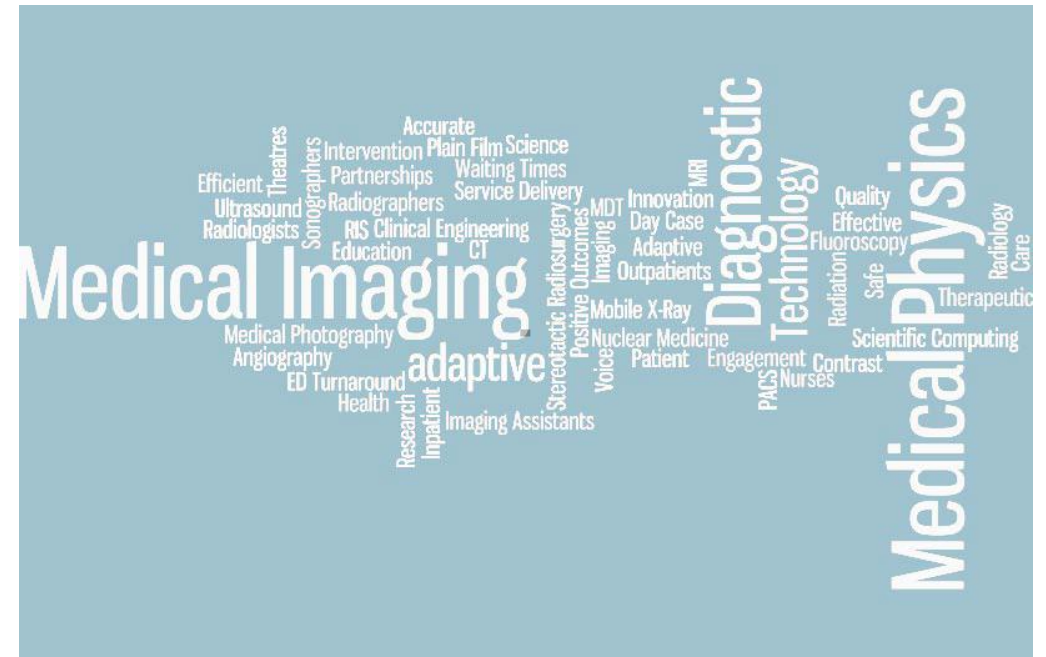
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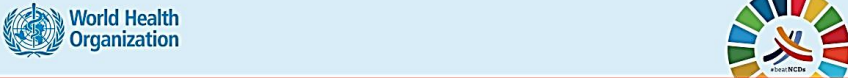
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Presentation Outline

- ▶ NCDs & the Cancer Situation in LMICs
- ▶ Radiation Medicine Practices
- ▶ Distribution of RT, NM and DR Resources
- ▶ Status of Radiation Oncology and Medical Physics in Africa
- ▶ Case Study – Medical Physics E&T in Ghana
- ▶ Challenges Facing Radiation Medicine in Africa
- ▶ Way Forward...
- ▶ Conclusion
- ▶ Acknowledgements

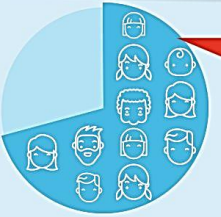


Non-Communicable Diseases



Noncommunicable diseases - NCDs - cause

7 in every 10 deaths worldwide*
from often avoidable causes

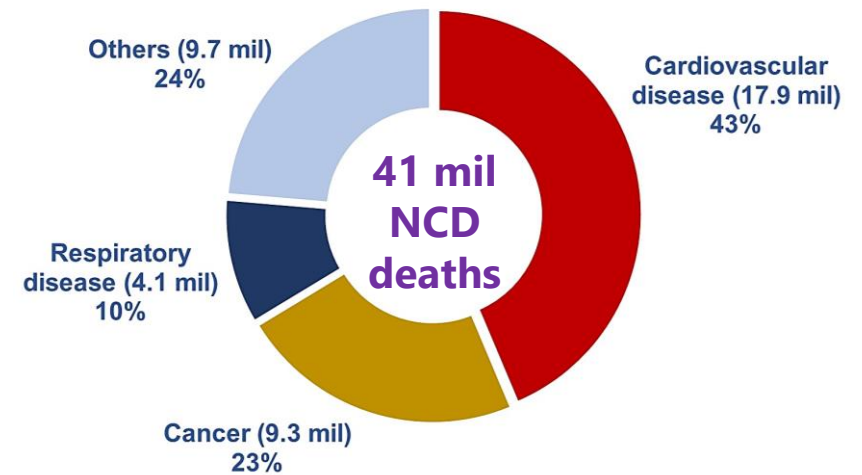


- Cardiovascular diseases
- Chronic respiratory diseases
- Cancer
- Diabetes
- Mental health conditions

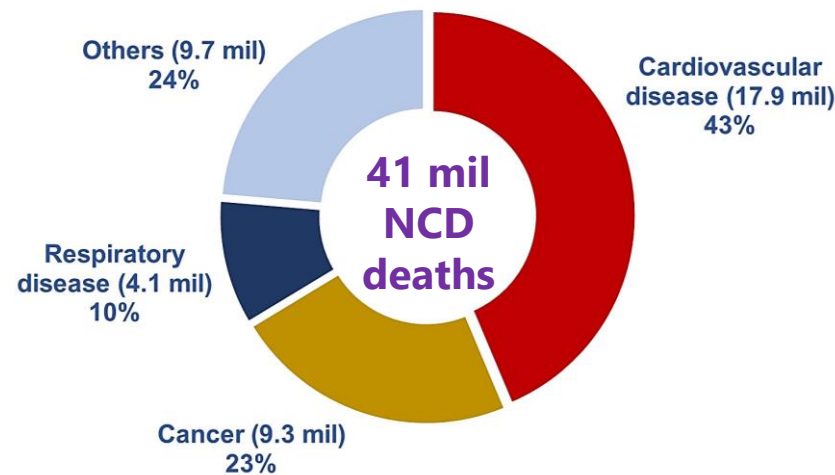
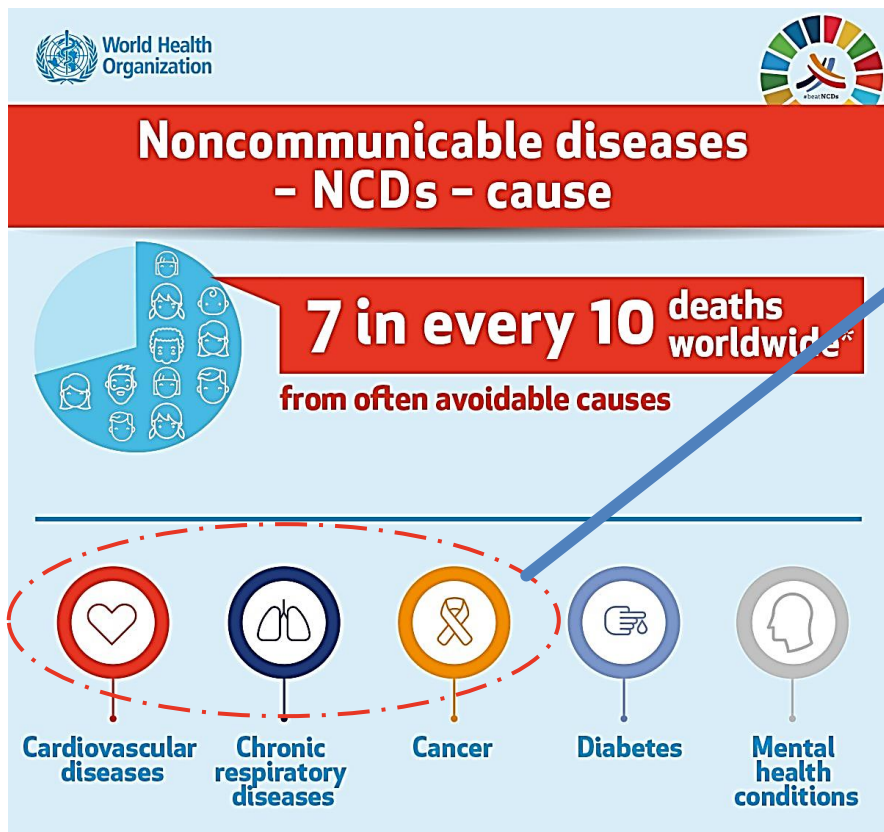
Key Facts

NCDs are responsible for

71%
of all deaths worldwide
(41 million people)

Non-Communicable Diseases



Cancer Situation in LMICs

Estimated age-standardized incidence rates (World) in 2020, all cancers, both sexes, all ages



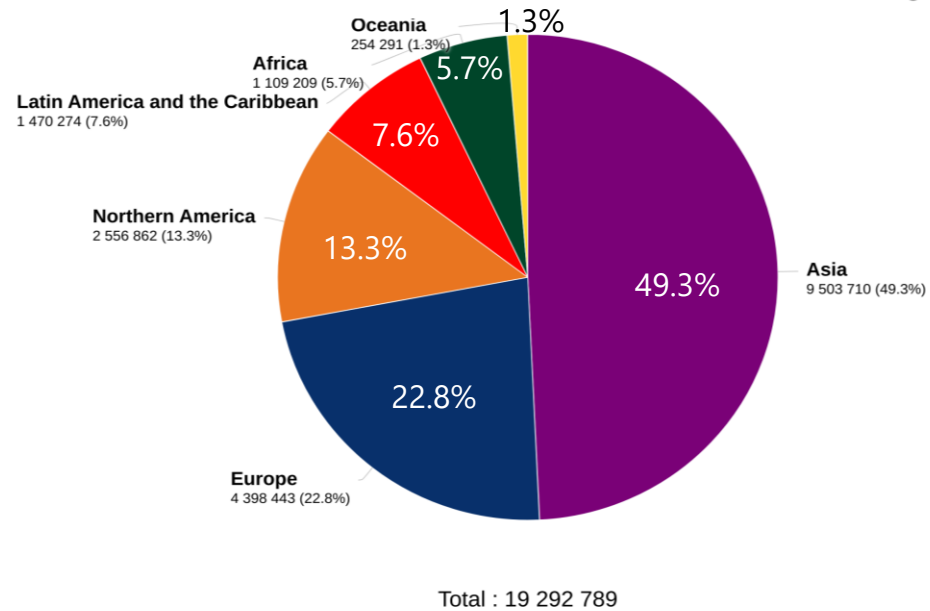
All rights reserved. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization / International Agency for Research on Cancer concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate borderlines for which there may not yet be full agreement.

Data source: GLOBOCAN 2020
Graph production: IARC
(<http://gco.iarc.fr/today>)
World Health Organization

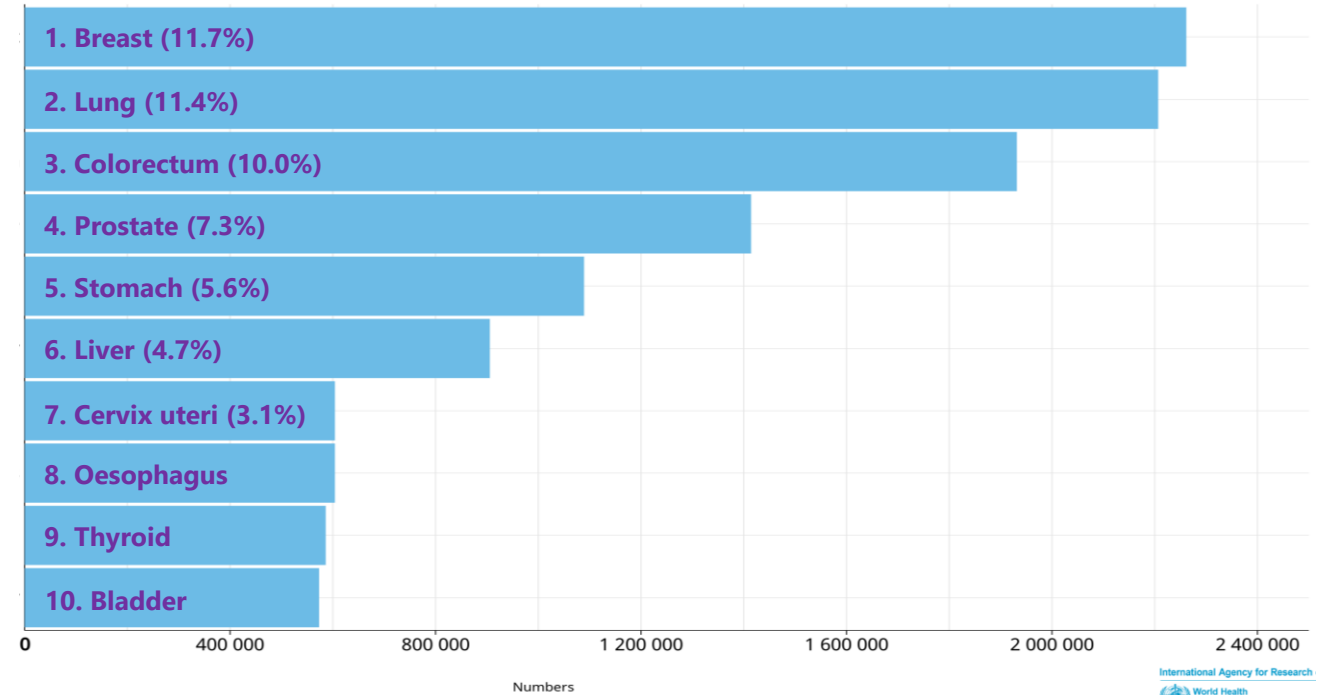


Cancer Situation in LMICs

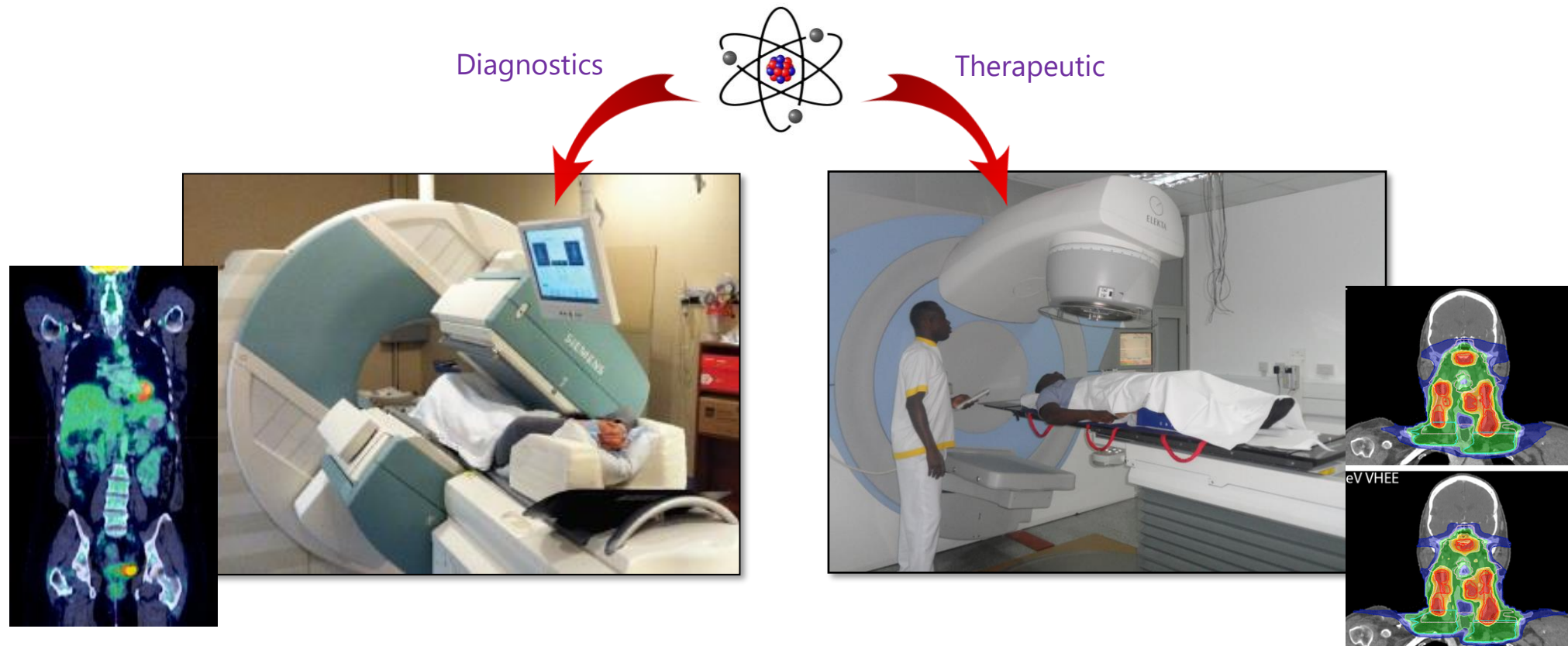
Estimated number of new cases in 2020, all cancers, both sexes, all ages



Estimated number of incident cases worldwide, both sexes, all ages

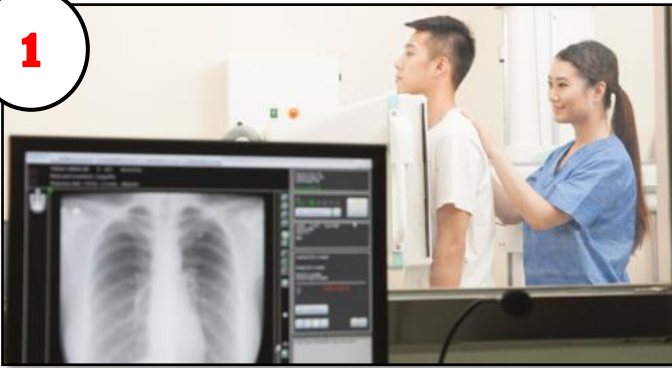


Radiation Medicine Practices



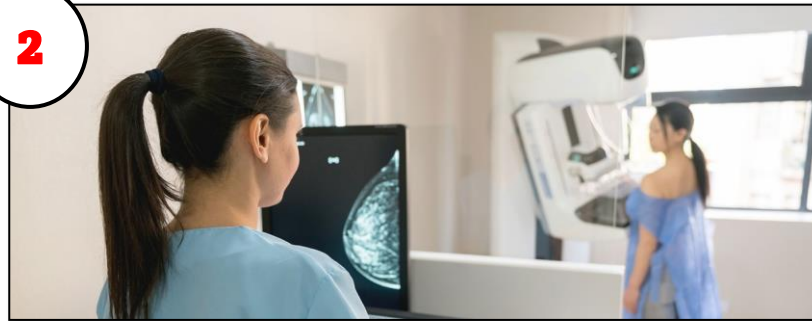
Radiation Medicine Practices

1



Planar X-ray

2



Mammography

3



CT scanning

4



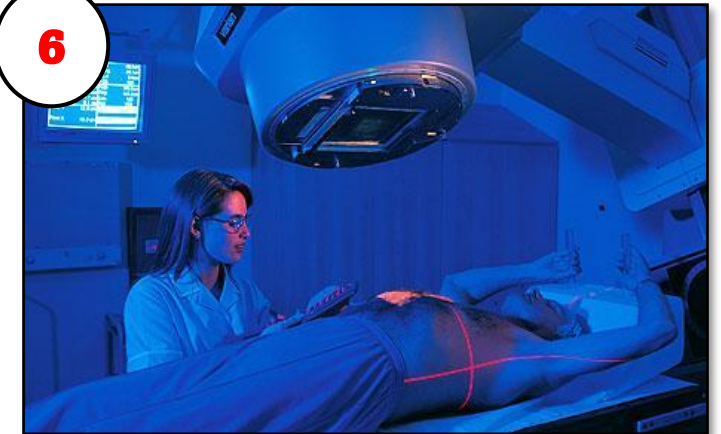
SPECT imaging

5



Brachytherapy

6

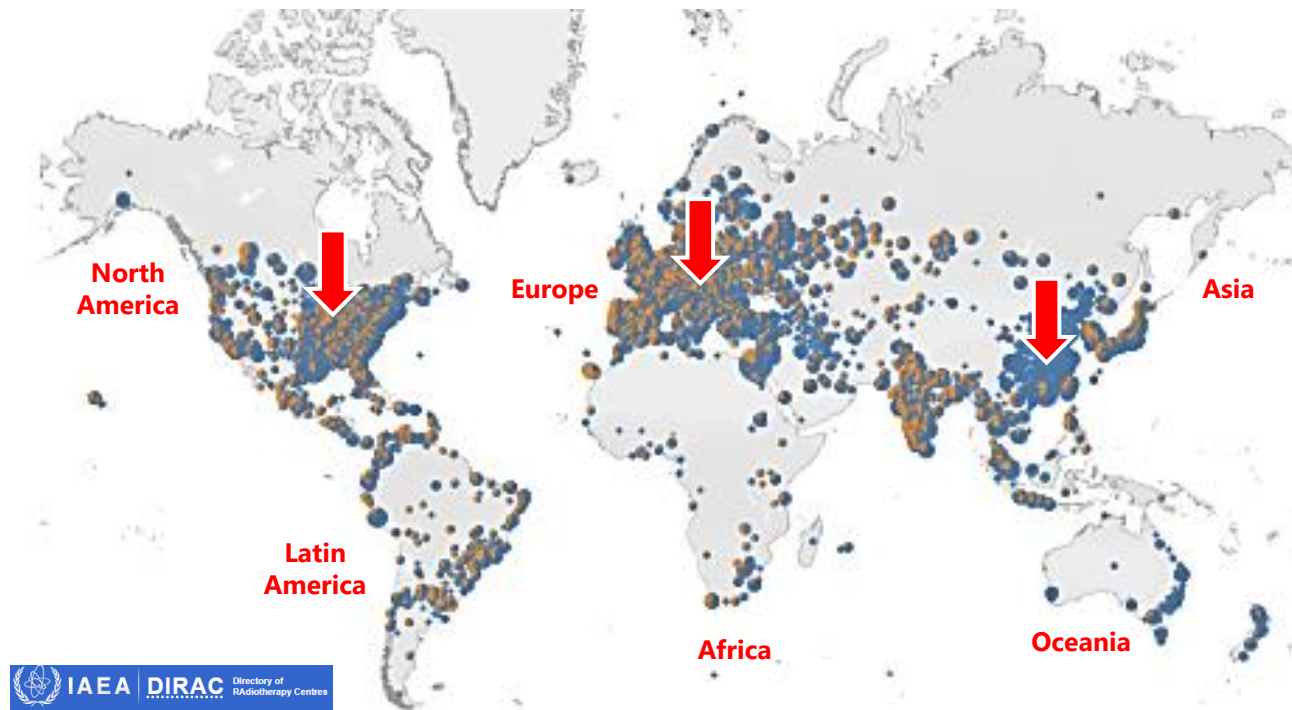


External Beam Radiotherapy



Distribution of Radiotherapy Resources

▶ Radiotherapy availability (IAEA DIRAC)



Equipment per regions

North America (USA & Canada)	5,016
Western Europe	3,735
East Asia	3,434
Eastern Europe and Northern Asia	1,558
Latin America & Caribbean	1,489
South Asia	1,138
Middle East	640
Africa	524
Southeast Asia	492
Southern and Western Pacific	277

USA+Canada (370 mil)
Western Europe (200 mil)

524
Radiotherapy
equipment in the
whole of Africa
(1.3 billion)



Distribution of Radiotherapy Resources

▶ Radiotherapy availability (IAEA DIRAC)

Region	Population (mil)	No. of RT Equipment	Population per RT Equipment
Western Europe	200	3,735	54,000
USA+Canada	370	5,016	74,000
Latin America & Caribbean	664	1,489	446,000
East Asia	1,688	3,434	492,000
Middle East	411	640	642,000
Southeast Asia	655	492	1,331,000
South Asia	1,978	1,138	1,738,000
Africa	1,370	524	2,615,000

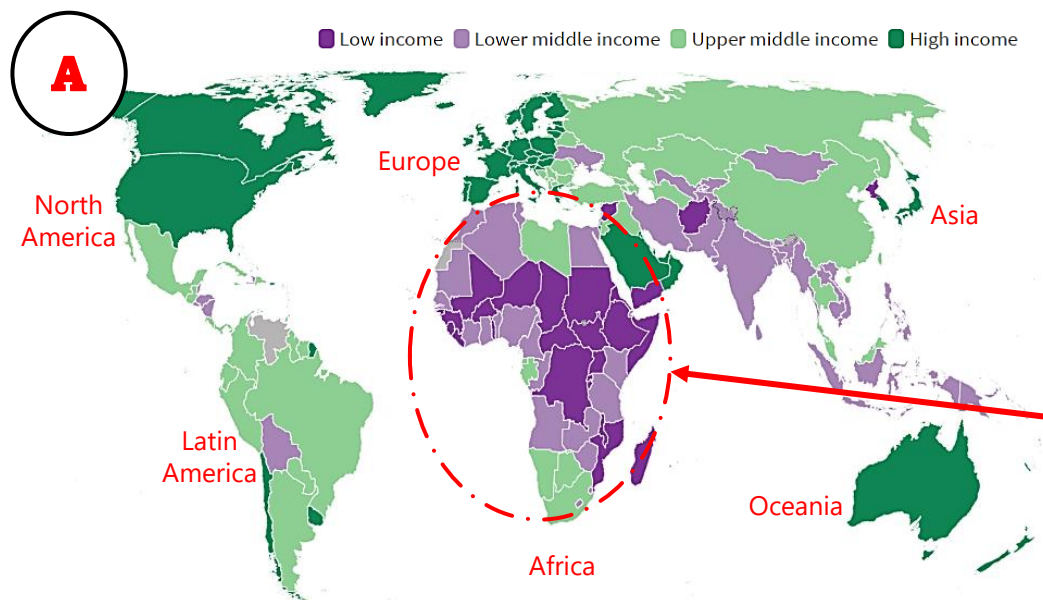
“

AFRICA needs 150% increase in radiotherapy equipment to achieve the basic requirement of 1 mil per RT machine

”



Distribution of Radiotherapy Resources



Group	July 1, 2021 (new)
Low income	
Lower-middle income	1,046 – 4,095
Upper-middle income	4,096 -12,695
High income	> 12,695



Number of Radiotherapy Machines Per Million People

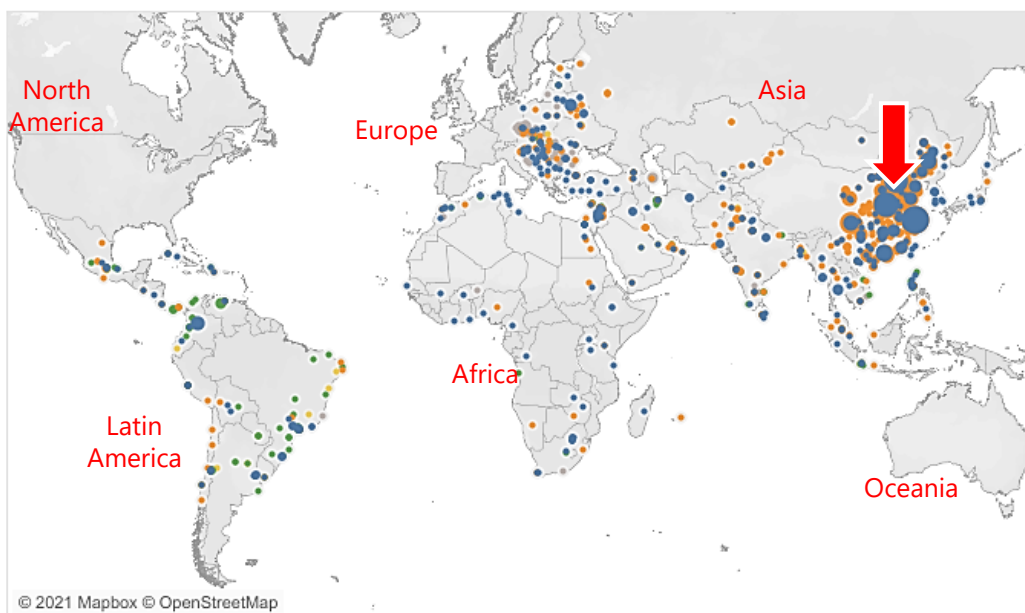


Distribution of Nuclear Medicine Resources

► Molecular imaging availability (IAEA NUMDAB)

Nuclear medicine centers

The graphs displayed show available country data, that is provided on a voluntary basis. It is focused on low- and middle-income countries, no data from high-income countries is included at this point.



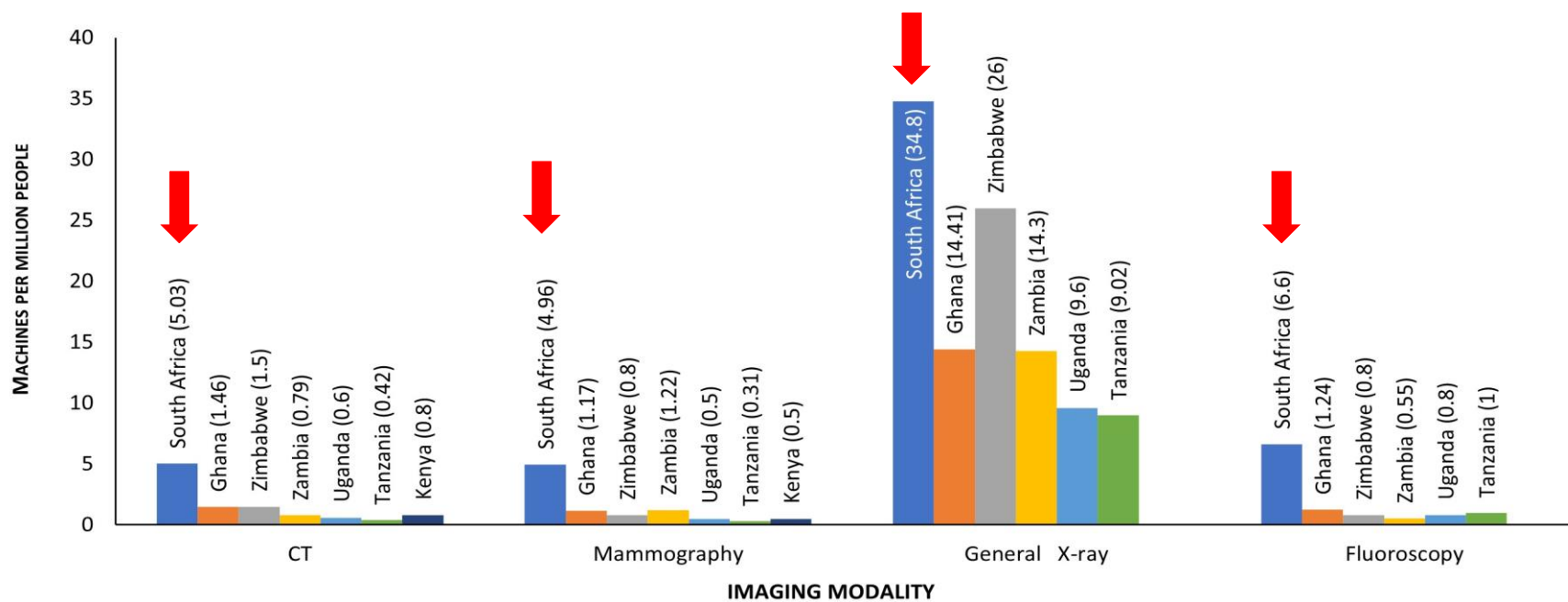
Equipment and Facilities per region (All)

SubRegionName	Institutio..	Planar-only gamma ca..	SPECT gamma ca..	SPECT-CT gamma ca..	Gamma Cameras	PET scanners	PET-CT scanners	PET and PET-CT sc..	Cyclotron
Grand Total	1,427	231	1,307	369	1,907	35	395	430	175
Africa	74	17	87	28	132	0	11	11	6
Asia	828	57	656	224	937	19	227	246	123
Eastern Europe and North..	225	103	151	46	300	4	42	46	11
Latin America & Caribbean	200	29	278	39	346	6	71	77	19
Middle East	100	25	135	32	192	6	44	50	16



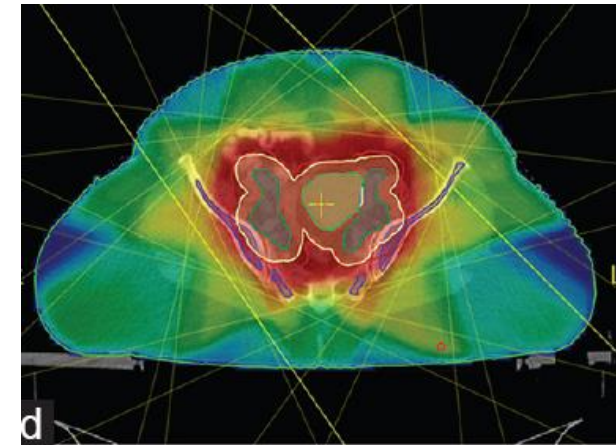
Distribution of Diagnostic Radiology Resources

▶ Diagnostic radiology availability (from literature)



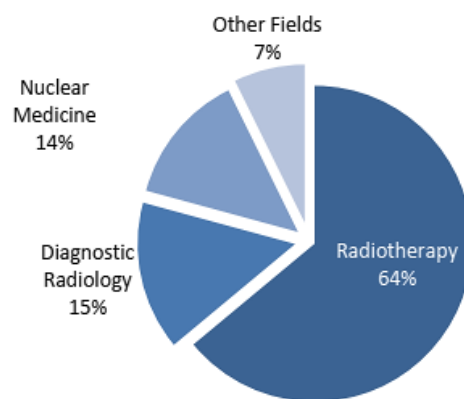
Status of Radiation Oncology in Africa

- ▶ 33 African countries have radiotherapy infrastructure.
- ▶ Non-uniform distribution of resources in the region (Egypt and South Africa alone make up over 50% of all radiotherapy resources).
- ▶ Most of the countries with RT resources have had smooth transition from 2D to 3D CRT.
- ▶ Introduction of advanced radiotherapy equipment (like linacs) have improved treatment techniques (IMRT and VMAT).
- ▶ At least 11 countries (Ghana, Egypt, Ethiopia, Tunisia, Tanzania, Senegal, South Africa, Morocco, Nigeria, Zambia, Zimbabwe) have training programmes for radiation oncologists. However, curricula for training is not harmonized.
- ▶ Radiotherapy technologists (RTT) and oncology nursing training has been introduced in a number of countries.

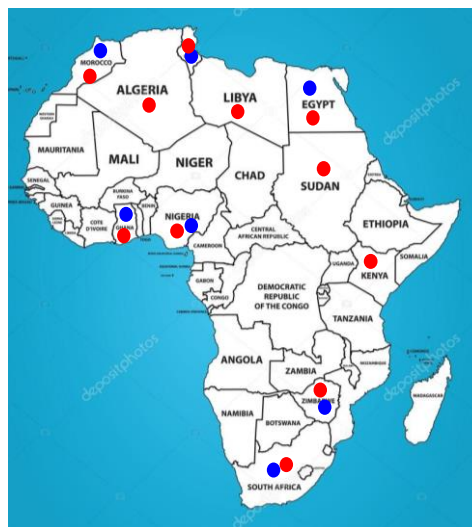


Status of Medical Physics in Africa

- ▶ 1,040 MPs in Africa (> 1.3 billion population). 30% Female
- ▶ Only 6 countries have legislative recognition for MPs. (Algeria, Ghana, Namibia, South Africa, Tanzania, Zimbabwe).
- ▶ There is harmonized E&T programme (by IAEA).
- ▶ Regional certification scheme being implemented by FAMPO.



Distribution of MPs



Countries with E&T programmes

MEDICAL PHYSICS INTERNATIONAL Journal, Special Issue, History of Medical Physics 3, 2020

MEDICAL PHYSICS DEVELOPMENT IN AFRICA – STATUS, EDUCATION, CHALLENGES, FUTURE

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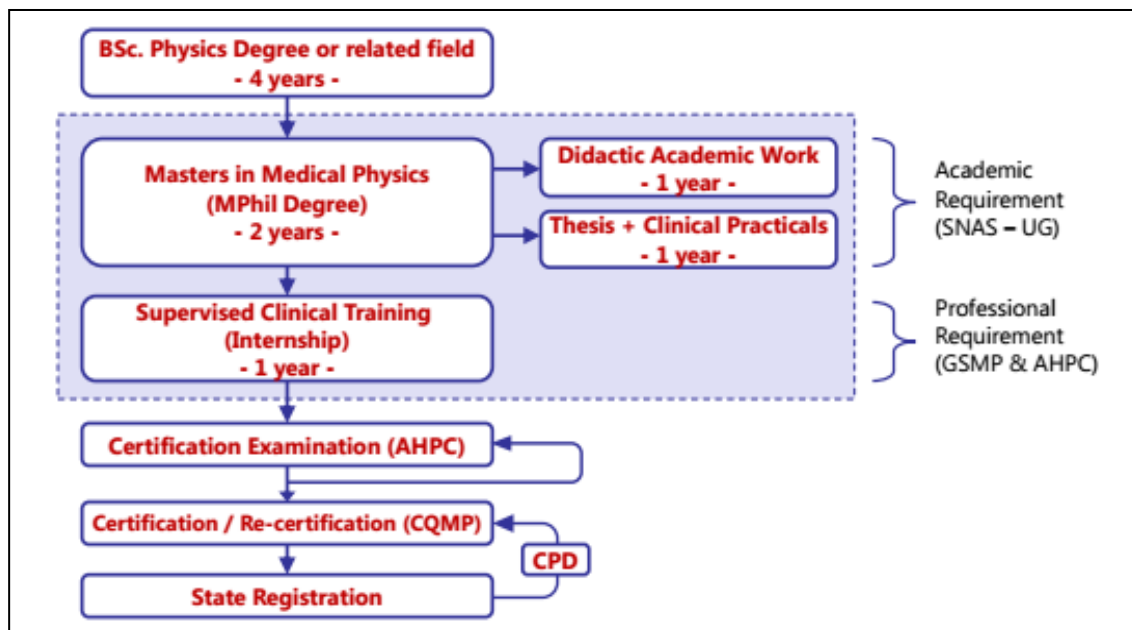
I. INTRODUCTION AND 10 YEARS OF FAMPO

Formation of FAMPO

At the 48th Annual South African Association of Physicists in Medicine and Biology (SAAPMB) meeting in Durban (South Africa) in 2008, the idea of establishing an African regional body of medical physics was mooted by the then IOMP Vice-President, Prof. Fridtjof Nuesslin. A letter of intent was prepared to the IOMP executive committee, after which a draft constitution was developed. The draft constitution was unveiled in March 2009. The first Executive Committee of FAMPO was elected at the African Radiation Oncology Group (AFROG) conference in Harare (Zimbabwe) in December 2009, with Ahmed ibn Seddik (Morocco) elected as President and Rebecca Nakatude (Uganda) as Vice-President. Other elected members were Khaled El-Shahat (Egypt) and Taofeeg Ige as Treasurer and Secretary-General respectively. In March 2010, the IOMP council approved FAMPO's application as the newest and youngest regional organization of the International Organization for Medical Physics (IOMP). As part of FAMPO 10th Anniversary celebrations, the IOMP Journal Medical



Case Study – Medical Physics E&T in Ghana

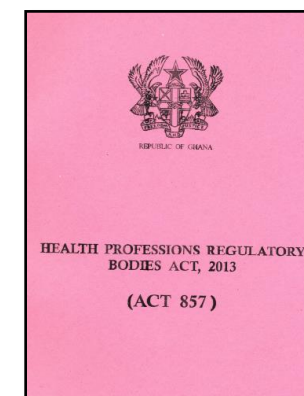


Clinical Training (Internship)

- 1 Year Residency Programme
 - ✓ 6 Months – Radiotherapy
 - ✓ 3 Months – Nuclear Medicine
 - ✓ 3 Months – Diagnostic Radiology

Regulatory Requirement:

- Health Professions Regulatory Bodies Act
 - ✓ Passage of ACT 857 in 2013
- Regulation of structured clinical training by:
 - ✓ Allied Health Professions Council of Ghana (AHPC)
 - ✓ Ghana Society for Medical Physics (GSMP)

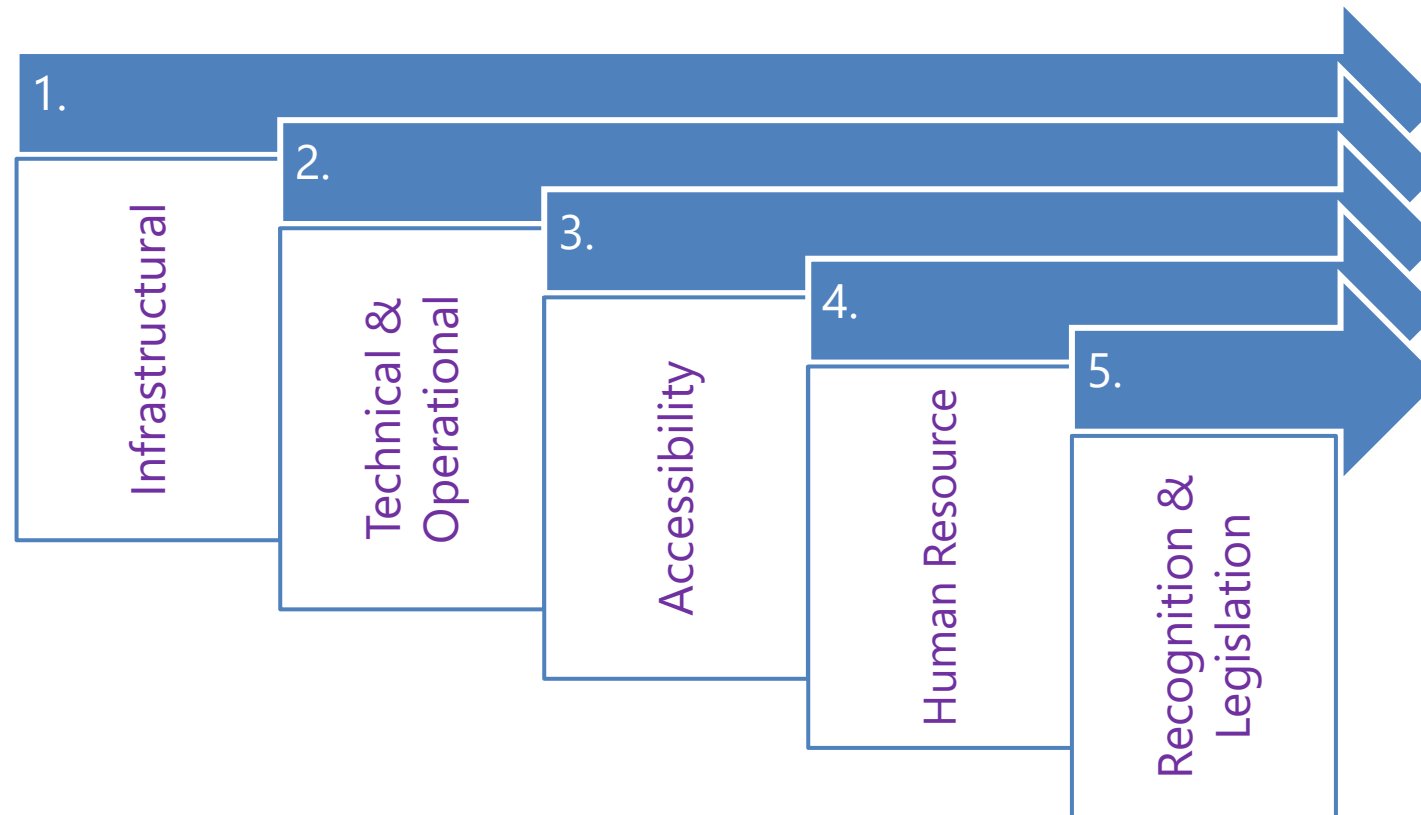


Studentship:

- Local and international students with background in Physics or related fields.
- Main sponsorship for foreign students - IAEA fellowships / Govt. scholarships.
- Nationalities of international students trained:
 - ✓ Benin, Burkina Faso, Eritrea, Ethiopia, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sierra Leone, Tanzania, Uganda, Zambia.



Challenges Facing Radiation Medicine in Africa



Infrastructural Challenges

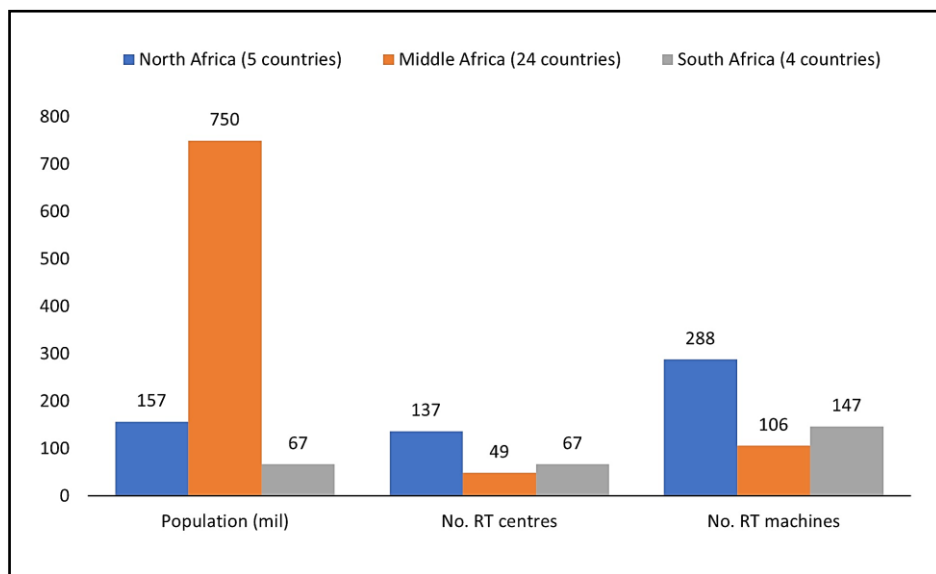
- ▶ Low prioritization of radiation medicine relative to other health services.
- ▶ Challenges with implementation of cancer control programmes.
- ▶ Lack of coverage of cancer care under health insurance schemes in several countries.
- ▶ Inadequate radiation medicine facilities.
 - ✓ *shortage of 5,000 radiotherapy units in LMICs (M. Samiei, 2013)*
 - ✓ *Minimum of 1,300 radiotherapy units needed in Africa*
- ▶ Unstable power (electricity) supply / frequent power cuts



Infrastructural Challenges

- ▶ Uneven distribution of radiation medicine facilities and resources.

✓ *E.g. PET/CT systems are available only in Egypt, South Africa, Morocco*



**Northern Africa
(5 countries)**

Population: 157 mil
No. RT centres: 137
No. RT machines: 288
Ave 27 centres/ctry

**Middle Africa
(24 countries)**

Population: 750 mil
No. RT centres: 49
No. RT machines: 106
Ave 2 centres/ctry

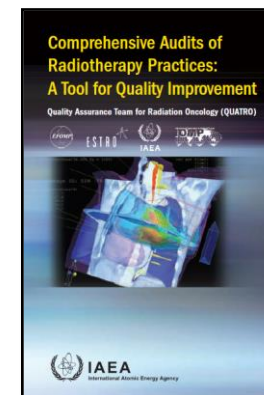
**Southern Africa
(4 countries)**

Population: 67 mil
No. RT centres: 67
No. RT machines: 147
Ave 17 centres/ctry



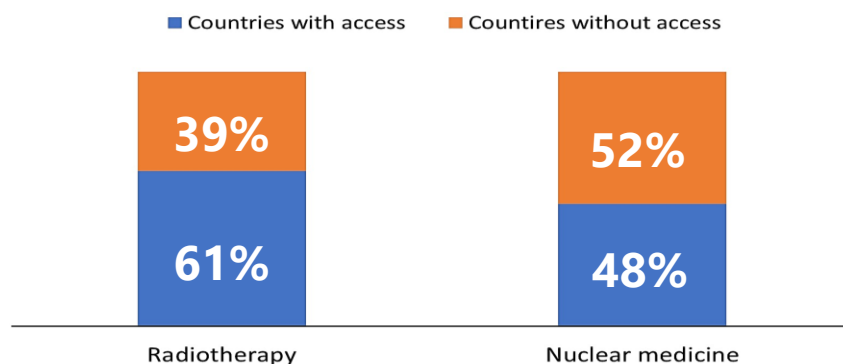
Technical & Operational Challenges

- ▶ Frequent breakdown of installed equipment.
- ▶ High equipment downtimes.
- ▶ Poor service contracts / after-sale service agreements.
- ▶ Absence of equipment service hubs.
- ▶ Inadequate skilled on-site service engineers for sophisticated radiotherapy and nuclear medicine equipment.
- ▶ Absence of local and national diagnostic reference levels.
- ▶ Absence of sustainable audit networks.
- ▶ Absence of regional clinical imaging guidelines.



Accessibility Challenges

- ▶ 52% (28/54) of African countries do not have access to molecular nuclear medicine services.
- ▶ 39% (21/54) of African countries do not have access to radiotherapy services.
- ▶ >60% of cancer patients in LMICs lack access to RT services.
- Low levels of actual radiotherapy utilization rates in some countries (e.g. 9% AUR reported Ghana, 2016).



ASTRO 2016: Unmet Need for Radiation Therapy Found Among Nearly Half of Eligible Cancer Patients in Nine Developing Countries

By The ASCO Post

Posted: 9/27/2016 1:55:00 PM

Last Updated: 9/27/2016 1:55:00 PM

Key Points

- The median optimal radiation therapy utilization for all countries was 52%. Optimal utilization rates ranged from a low of 47% for Costa Rica to a high of 56% for Tunisia.
- The median actual radiation therapy utilization rate was 28%, with a much broader range than for optimal utilization. The lowest rates of utilization were in Ghana (9%) and the Philippines (10.3%), while the highest utilization rates were in Tunisia (46%) and Uruguay (37%).

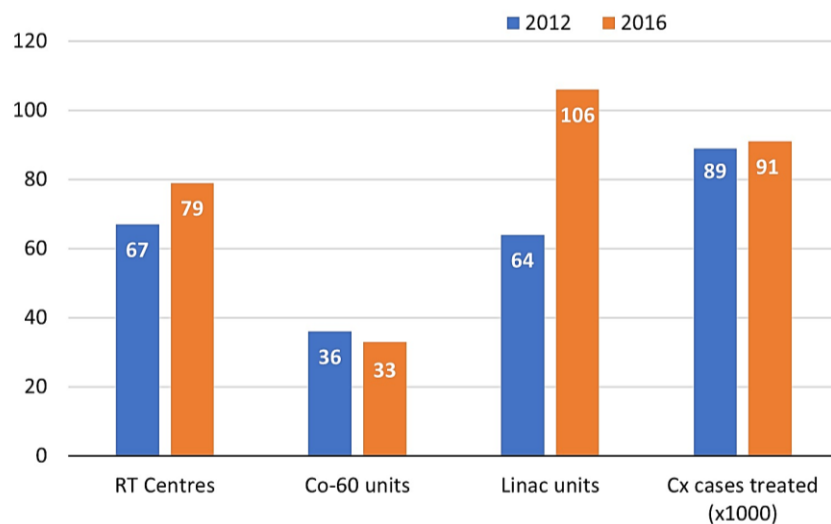
Although approximately 50% of cancer patients in developing countries need radiation therapy to treat their disease, up to half of these patients do not have access to it, according to [research presented by Rosenblatt et al](#) at the 58th Annual Meeting of the [American Society for Radiation Oncology \(ASTRO\)](#). Examining nine middle-income countries, researchers found that between 18% and 82% of patients who can benefit from radiation therapy in these countries do not receive the treatment.

Researchers at the [International Atomic Energy Agency](#) conducted this project to assess levels of optimal and actual radiation therapy utilization and calculated unmet radiation therapy need in developing countries. This study is the first scientific analysis of radiation therapy utilization in middle-



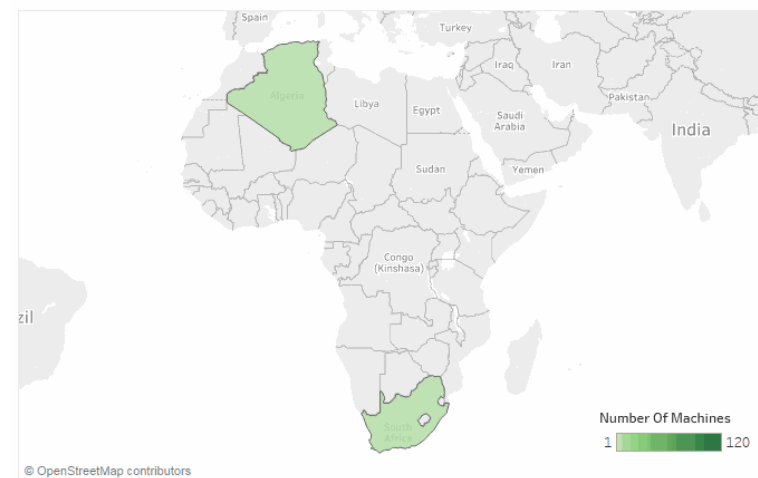
Accessibility Challenges

- ▶ Radiotherapy infrastructure Vs Access to treatment 2012 – 2016 (excl. S/AF and EGY)

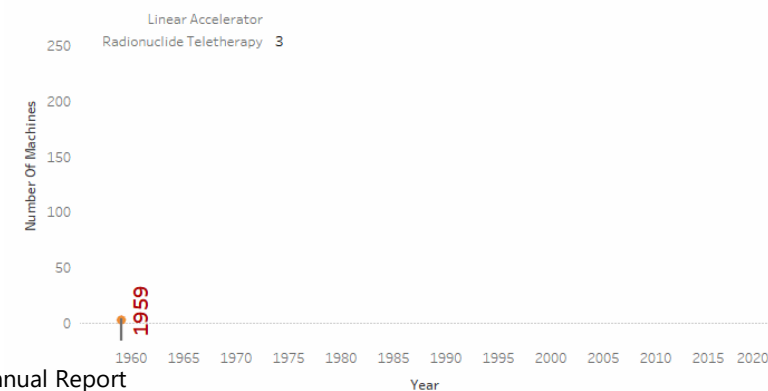


Despite increase in RT centres and a major shift to linacs, access to RT services has still been a challenge!

Total number of external beam radiotherapy machines in 1959



Year - 1959



Source: RAF6050 Annual Report



Legislation and Recognition Challenges

- ▶ Absence of legislative recognition for medical physics in most African countries.
- ▶ Minimal action on the implementation the BSS apart from awareness creation through national and regional scientific meetings.
- ▶ Legislative provisions not making it mandatory for the engagement of medical physicists in medical imaging facilities.



IAEA Safety Standards for protecting people and the environment

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

Jointly sponsored by
EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO

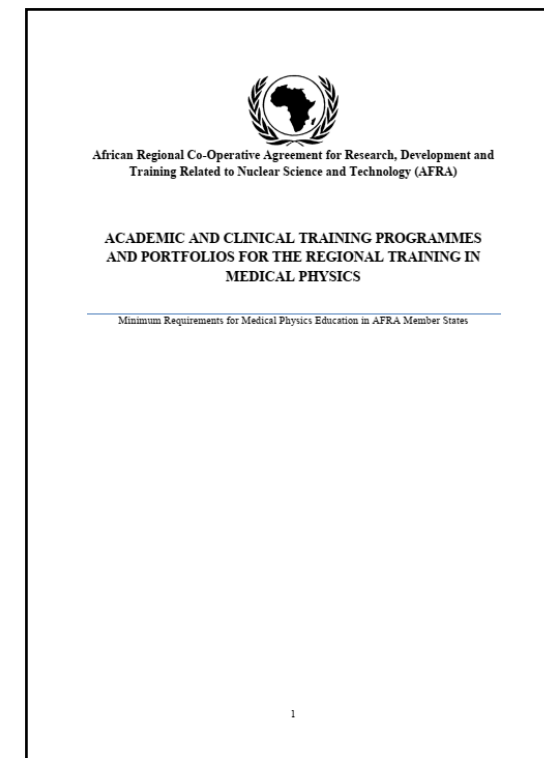
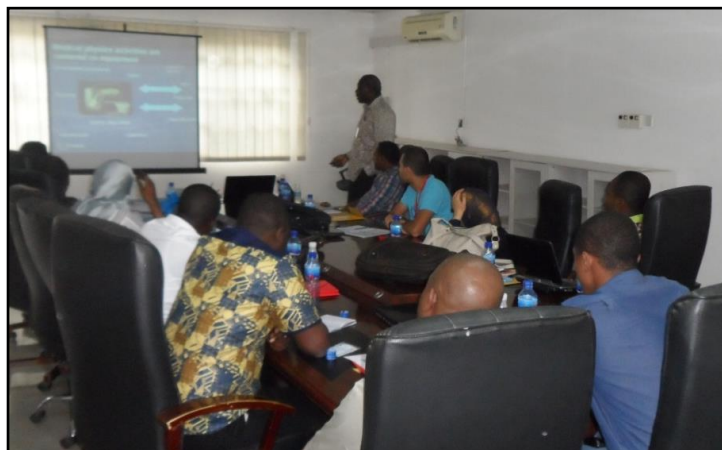


General Safety Requirements Part 3
No. GSR Part 3



Human Resource Capacity Challenges

- ▶ Inadequate human resource / personnel.
- ▶ Lack of job posts.
- ▶ Inappropriate remuneration for hired personnel.
- ▶ Inadequate E&T training programmes and facilities (academic and clinical).
- ▶ Lack of harmonized / standardized training syllabi (only exists for medical physics).



Way Forward...



Looking into the Future



Way Forward...

National and Regional Professional Bodies must...

- ▶ Encourage harmonized Education and Training syllabi for radiation medicine professionals.
- ▶ Support implementation of national and regional certification schemes for trained professionals.
- ▶ Support accreditation of academic and clinical training programmes regionally.
- ▶ Encourage the establishment of Regional Centres of Excellence for Education and Training in Africa.
- ▶ Encourage mentorship of sister centres in Africa by recognized Centres of Excellence.
- ▶ Organizing activities to support CPDs for radiation medicine professionals.

Governments, acting through MoHs must:

- ▶ Provide adequate resources and support for radiation medicine infrastructural development.



Conclusion

- ▶ Radiation medicine services in LMICs (esp. Africa) continue to face key challenges namely, **infrastructural, technical, accessibility, human resource** and **legislation/recognition**.
- ▶ The challenges contribute to the >60% cancer patients from LMICs not having access to radiotherapy and nuclear medicine services – **Unacceptable!**
- ▶ Solutions to the challenges should target the entire hierarchy of health service delivery from **prioritization, policy, planning, processes** to **procedures** (5Ps).
- ▶ National/Regional radiation medicine professional bodies must work in harmony with governments to **promote** radiation medicine training and improved practices within Africa.



Thank You..

