

Medical Physics status in Low and Middle Income countries (LMIC) and the place of medical physicists in LMIC Healthcare

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www.who.int/medical_devices/02_health_technology_assessment_laura_sampietro.pdf

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Medical devices arena



Medical devices have a huge potential to

- improve health status of people
- support people with disabilities

Are medical devices

- Available?
- Accessible?
- Appropriate?
- Affordable?

First Global Forum on Medical Devices | Bangkok, 9 September 2010



www.who.int/medical_devices/02_managing_the_mismatch_josee_hansen.pdf

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>90% Fail in the First 5 years



95% of all medical equipment in resource-limited settings are donated

Source: Malkin, R. Design of Health Care Technologies in the Developing World. Annu. Rev. Biomed. Eng. 2007.

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www.who.int/medical_devices/02_innovation_for_impact_kristian_olson.pdf

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Choosing medical devices ...



Factors

- Extreme diversity
- Context dependency
- Clinical guidelines
- Clinical outcome
- Lack of information
- Fascination with technology
- Costs

... is a complex process



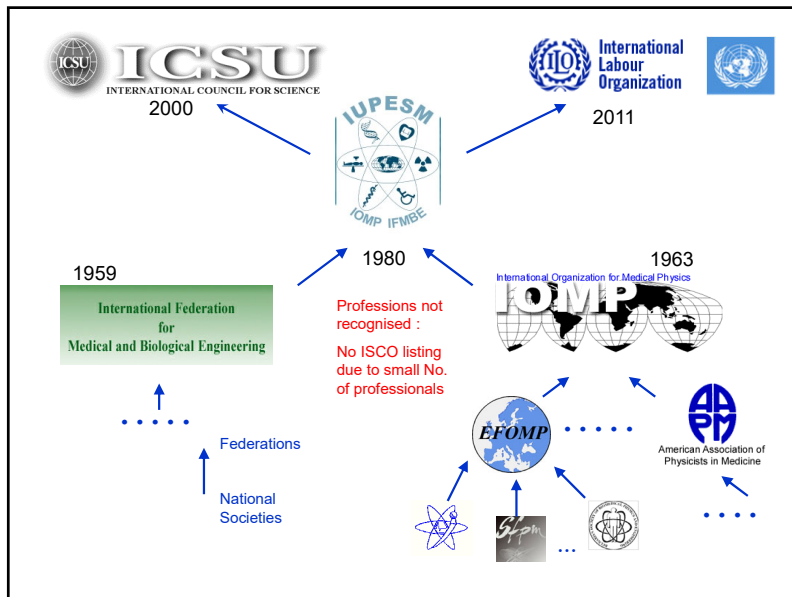
Medical Imaging devices are one of the most complex equipment of our time

First Global Forum on Medical Devices | Bangkok, 9 September 2010



www.who.int/medical_devices/02_managing_the_mismatch_josee_hansen.pdf

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International Scientific Unions list

IAU, International Astronomical Union
IBRO, International Brain Research Organization
ICA - cartography, International Cartographic Association
IGU, International Geographical Union
IMU, International Mathematical Union
INQUA, International Union for Quaternary Research
ISA, International Sociological Association
ISPRS, International Society for Photogrammetry and Remote Sensing
IUAES, International Union of Anthropological and Ethnological Sciences
IUBS, International Union of Biological Sciences
IUCr, International Union of Crystallography
IUFRO, International Union of Forest Research Organizations
IUFST, International Union of Food Science and Technology
IUGG, International Union of Geodesy and Geophysics
IUGS, International Union of Geological Sciences
IUPST, The International Union for History and Philosophy of Science and Technology
IUIS, International Union of Immunological Societies
IUMRS, International Union of Materials Research Societies
IUNS, International Union of Microbiological Societies
IUNS, International Union of Nutritional Sciences
IUPAB, International Union for Pure and Applied Biophysics
IUPAC, International Union of Pure and Applied Chemistry
IUPAP, International Union of Pure and Applied Physics
IUPESM, International Union for Physical and Engineering Sciences in Medicine
IUPHAR, International Union of Basic and Clinical Pharmacology
IUPS, International Union of Physiological Sciences
IUPsyS, International Union of Psychological Science
IUSS, International Union of Soil Sciences
IUTAM, International Union of Theoretical and Applied Mechanics
IUTOX, International Union of Toxicology
URSI, Union Radio Scientifique Internationale

2000: recognition of medical physics science as part of the science unions

One of the main aims of the Union between medical physicists and engineers (IUPESM) was the official recognition of our professions/sciences.

The was achieved after many years of discussions of the past ExComs with ICSU, ILO and UN.

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International Labour Organization

2011: recognition of medical physicists as unique profession/occupation : ISCO-08

Unit Group 2111
Physicists and Astronomers

Physicists and astronomers conduct research and improve or develop concepts, theories and operational methods concerning matter, space, time, energy, forces and fields and the interrelationship between these physical phenomena. They apply scientific knowledge relating to physics and astronomy in industrial, medical, military or other fields.

Tasks include –

- conducting research and improving or developing concepts, theories, instrumentation, software and operational methods related to physics and astronomy;
- conducting experiments, tests and analyses on the structure and properties of matter in fields such as mechanics, thermodynamics, electronics, communications, power generation and distribution, aerodynamics, optics

Examples of the occupations classified here:

- Astronomer
- Medical physicist
- Nuclear physicist
- Physicist

Some related occupations classified elsewhere:

- Radiation oncologist – 2212
- Radiologist – 2212
- Specialist physician (nuclear medicine) – 2212
- Radiographer – 3211

Note
It should be noted that, while they are appropriately classified in this unit group with other physicists, medical physicists are considered to be an integral part of the health workforce alongside those occupations classified in Sub-major Group 22: Health Professionals and others classified in a number of other unit groups in Major Group 2: Professionals.

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Africa

African Continent:
54 sovereign states
(49 UN members).

Population: One Billion
(15% of World's population).

Radiological (X-ray) equipment
in all countries

Radiotherapy equipment
(centres) - in 25 countries

Nuclear medicine equipment -
in c.20 countries

Sophisticated imaging – in c.10
countries

Limited number of medical
physicists

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African Medical Physicists distribution: DR(70) / NM(54) / RT (227) : ($\Sigma= 351$)

COUNTRIES (IOMP)	DR	NM	RT
ALGERIA	39	5	-
CAMEROUN	3	1	0
EGYPT	-	-	-
ETHIOPIA	4	1	3
GABON	3	0	3
GHANA	8	7	15
KENYA	-	2	8
LIBYA	-	-	-
MADAGASCAR	-	-	2
MAURITANIA	-	-	3
MAURITIUS	-	-	5
MOROCCO	-	4	46
NAMIBIA	-	-	2
NIGERIA	4	4	7
SENEGAL	-	-	2
SOUTH AFRICA	9	8	67
SUDAN	-	14	28
TUNISIA	-	-	17
UGANDA	-	-	5
UNITED REP OF TANZANIA	-	3	6
ZAMBIA	-	-	3
ZIMBABWE	-	5	5

Data from FAMPO Report of T.A. IGE, A. IBN SEDDIK, R. NAKATUDDE ad K. EL-SHAHAT, ICMP 2013, Brighton, UK

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African Medical Physicists distribution in 2020: $\Sigma= 1041$

Country	No. of MPs				Total
	Radiotherapy	Diagnostic Radiology	Nuclear Medicine	Other fields	
Algeria	112	4	13	0	129
Angola	4	0	0	0	4
Benin	0	1	2	0	3
Botswana	4	0	0	0	4
Burkina Faso	0	0	2	0	2
Cameroon	2	0	0	0	2
Congo DR	1	0	0	0	1
Cote d'Ivoire	1	0	1	0	2
Egypt	232	86	56	0	374
Eritrea	0	2	0	0	2
Ethiopia	2	1	1	0	4
Gabon	3	0	1	0	4
Ghana	32	8	6	12	58
Kenya	3	2	2	0	7
Libya	22	0	5	0	27
Madagascar	2	0	0	0	2
Malawi	2	0	0	0	2
Mauritania	3	0	3	0	6
Mauritius	4	1	0	0	5
Morocco	57	0	4	0	61
Namibia	0	0	2	0	2
Niger	0	0	2	0	2
Nigeria	40	10	4	46	100
Senegal	0	0	3	0	3
Sierra Leone	0	1	0	0	1
South Africa	86	17	13	20	136
Sudan	28	0	0	0	28
Tanzania	2	1	1	0	4
Tunisia	37	0	0	0	37
Uganda	6	3	0	1	10
Zambia	4	0	2	0	6
Zimbabwe	8	0	1	0	9
Total					1,041

Data from FAMPO Paper of IGE, HASFORD, TABAKOV, TRAUERNICHT et al, MPI Journal, 2020

2020:

33 MSc courses



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MOST IMPORTANT: TRAINING THE STAFF

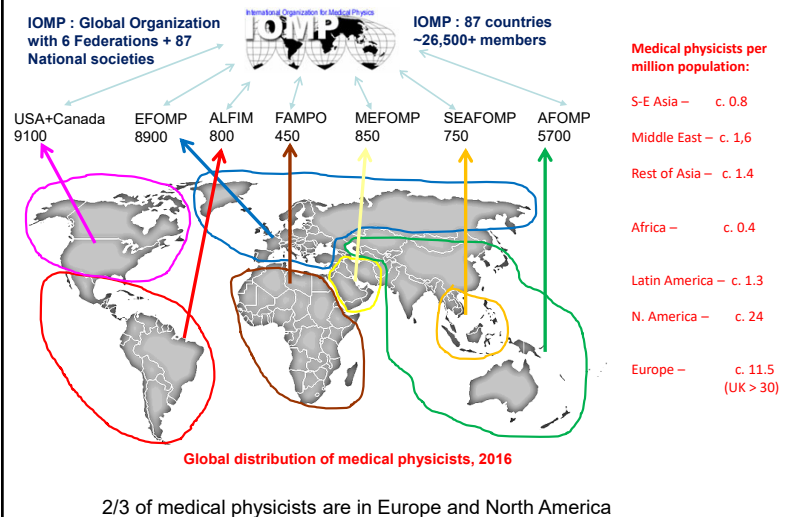
- What is the entry training level ?
- Do we need specialised courses ?
- What type of teachers ?
- Can we develop own training?
- Can we use e-Learning or other simulations?
- Can we use distant learning (and what language will be used)?
- How long will this training last (dynamic of development)?
- When the trainee will need updates?
- Who will employ and keep the trainee?
- Will he/she has some input regarding hospital/patient safety?



All these questions are linked directly to the healthcare of one country – these are easy to answer using the existing materials and trained staff!

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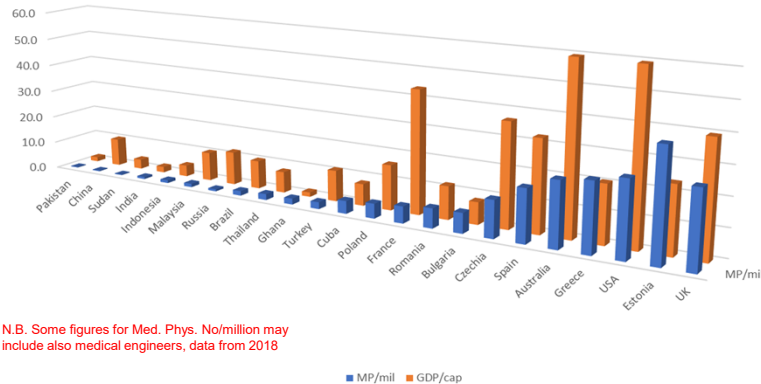
Why is the ICTP College on Medical Physics with such global importance ?



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- About 70% of all medial physicists are in Europe and North America (~1.1 Billion)
- The rest 30% medical physicists serve all other countries (~ 6.6 Billion population)
- Uneven distribution of workforce inside Federations – need for LMI countries support

Medical Physicists per Million and GDP/capita (k\$) - selection from various RO



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International College on Medical Physics, ICTP, Trieste, Italy

In 2002 transformed the College as "Train-the-Trainer"

2002 and 2004 - main students' achievements
Thailand, Iran, Nepal, Sudan, Ghana, Brazil, Cuba, Serbia, Estonia, Bulgaria, Macedonia

Hosted the 1st Internat. Conference on Med.Phys. e-Learning



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International College on Medical Physics, ICTP, Trieste, Italy

From 2002 educated c. 1500 students from 82 LMIC countries

About 1/4 of all LMIC med. physicists are College graduates

2006 and 2008 - main students' achievements
Thailand, Turkey, India, Morocco, Kenya, China, Bangladesh, Ethiopia, Jamaica, Slovenia

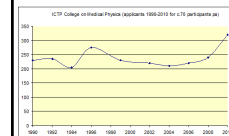
College graduates took active part in the MP Dictionary translations



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International College on Medical Physics, ICTP, Trieste, Italy

Became the most subscribed activity of ICTP, triggered an MSC



2010 and 2012 - main students' achievements
Albania, Russia, Qatar, Malaysia, Eritrea, Nepal, Armenia

Published book on Med.Phys. education



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International College on Medical Physics. ICTP. Trieste. Italy

Included special training programme with Trieste Hospital



2014 and 2016:

IOMP Appreciation Plaque presented to ICTP Director

The ICTP College addresses all medical physicists in the world for the International Day of Medical Physics.

IOMP accredits MSc at ICTP as a main place for education in MP for LMIC colleagues

The College in 2018 includes sessions on establishing e-learning courses





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2019: graduation of the MSc students of the International MSc in Trieste, supported by AIFM, IOMP, IAEA, EFOMP



Alongside the ICTP College:

Support for colleagues from Africa, Asia, L.America and other LMI countries.




Seminar for sharing experience



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2018 - 2024:

30 years ICTP College History

IOMP re-accredits MSc at ICTP as a main place for education in MP for LMIC colleagues

The College in 2018 includes sessions on e-learning Moodle, more practical sessions and management intro; Intro to AI





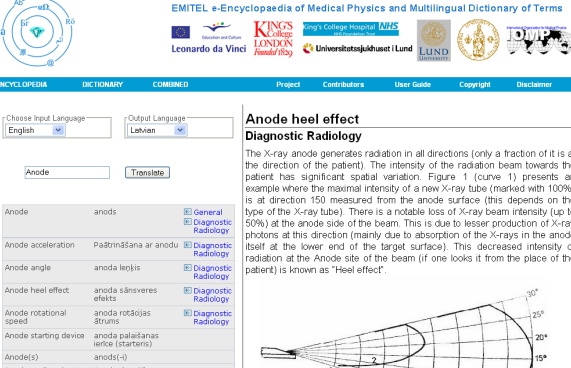

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Project EMITEL – Encyclopaedia of Medical Physics (2005-10) includes 320 specialists from 36 countries.

Used since 2010 until now by over 4000 specialists per month through its web site:

www.emitel2.eu



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How many medical physicists would be needed for a radiation medicine service?

Radiation in Healthcare

The use of radiation in healthcare is by far the largest contributor to the exposure of the general population from artificial sources

The global annual effective dose per capita has increased by about 100% from 1993 to 2008

Annually worldwide



3,600 million X-ray exams
(> 300 million in children)



37 million nuclear
medicine procedures



7.5 million radiation
oncology treatments

(UNSCEAR Report 2008; IOMP, FN presentation)

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Workforce necessary for Radiotherapy:

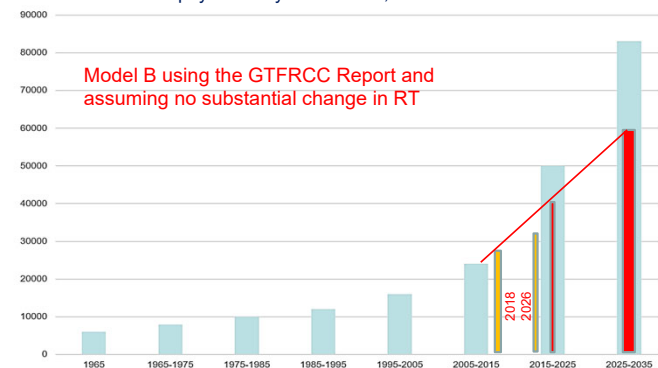
2035 Report of the Global Task Force on Radiotherapy for Cancer Control (GTFRCC)

Needs to achieve adequate healthcare in the field of oncology until 2035:

- In countries with low and middle income – needed about 22,100 medical physicists
- In countries with high income - needed about 17,200 medical physicists.

Expanding global access to radiotherapy - Rifat Atun et al, The Lancet Oncology, Vol.16, No.10, p1153, Sep.2015

- Medical Physicists outside Radiotherapy are c. 1/3 of workforce, i.e. growth + about 20,000
- TOTAL additional medical physicists by 2035 : ~59,000



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