



Challenges in Pediatric radiotherapy

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Why is there a need?

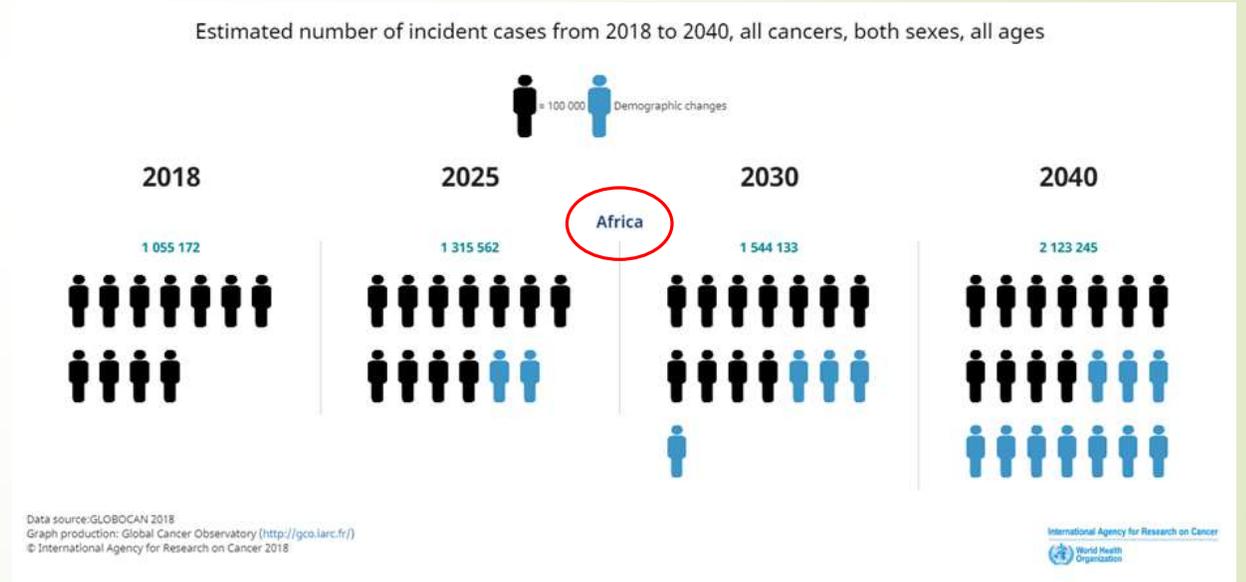
World

Africa



18.1m

29.5m

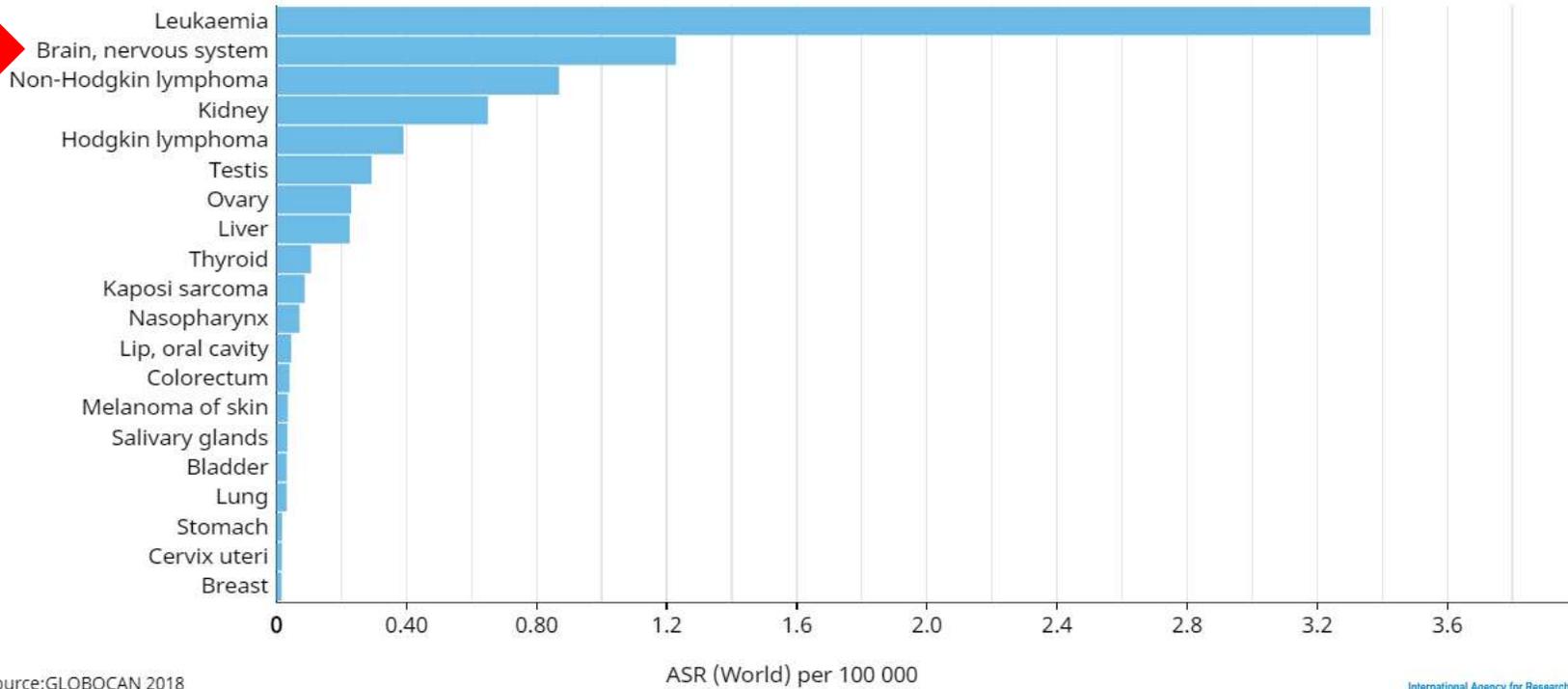


1.055m

2.12m

What cancers do kids get?

Estimated age-standardized incidence rates (World) in 2018, worldwide, both sexes, ages 0-14



Data source: GLOBOCAN 2018
Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
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ACCESS TO RADIOTHERAPY

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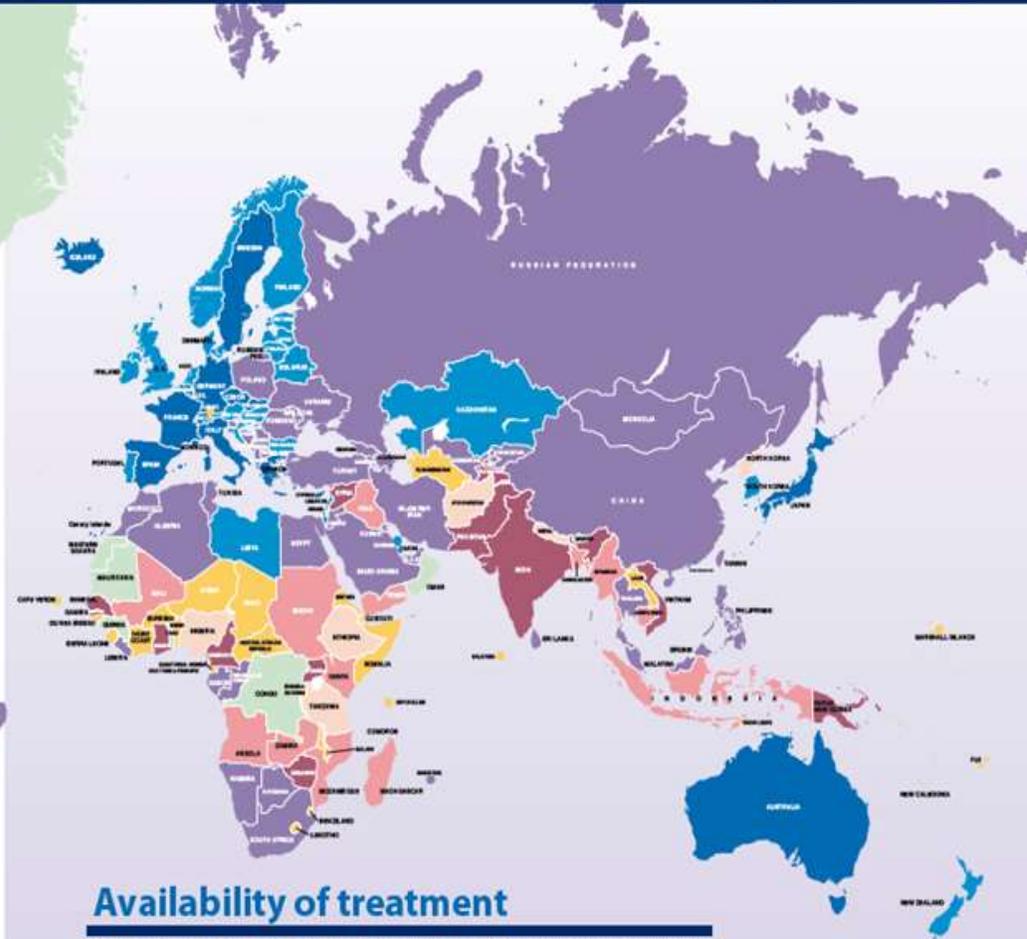


Radiotherapy is an essential part of the treatment of cancer

Over 30 African and Asian countries have no access to radiotherapy

There is a shortfall of over 5000 radiotherapy machines in the developing world

IAEA has initiated PACT to comprehensively address this urgent problem



Availability of treatment

Number of people served by a single radiotherapy centre (latest available data 1995-2003)

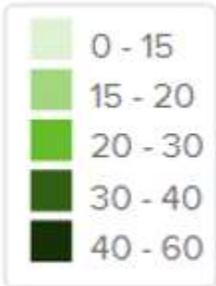
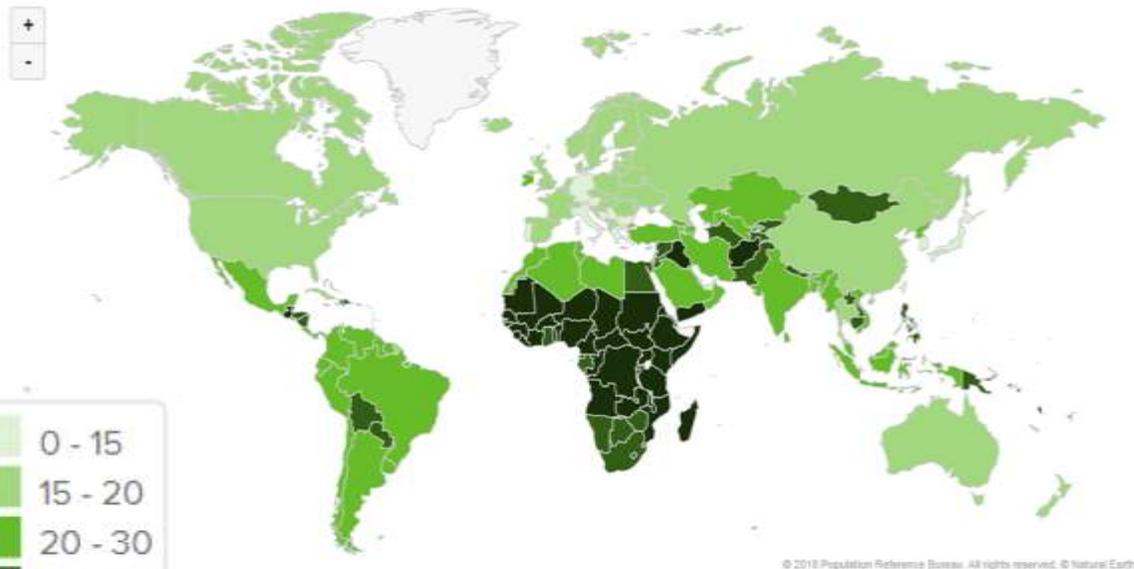
- | | |
|---|--|
|  below 500 000 |  10-19.9 million |
|  500 000-999 999 |  20 million and above |
|  1-4.9 million |  no centre |
|  5-9.9 million |  no data |

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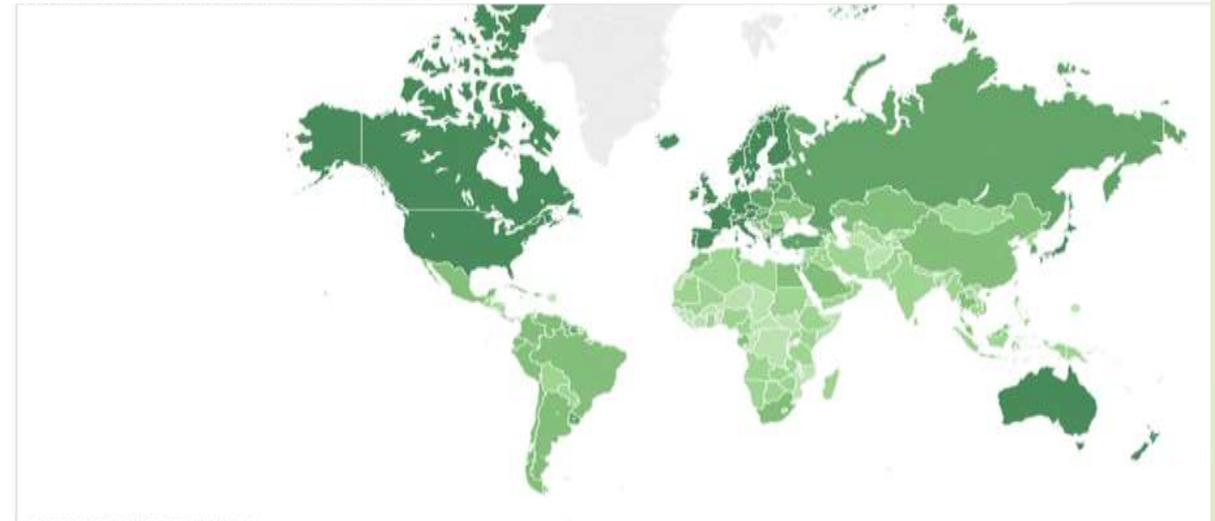
Where are the children?

Percent of Population Ages <15, 2018



Number of Radiotherapy Machines Per Million People

(Updated on : 8/9/2018 9:02:32 AM)



From a radiation perspective...How do children differ from adults?

- Different diseases
- Survive longer
 - Severity of late effects
- Techniques of radiotherapy
- Anaesthesia
- Time

} Disease incidence and epidemiology



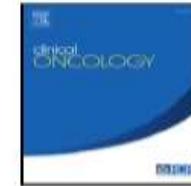


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Overview

The Benefits of Providing External Beam Radiotherapy in Low- and Middle-income Countries



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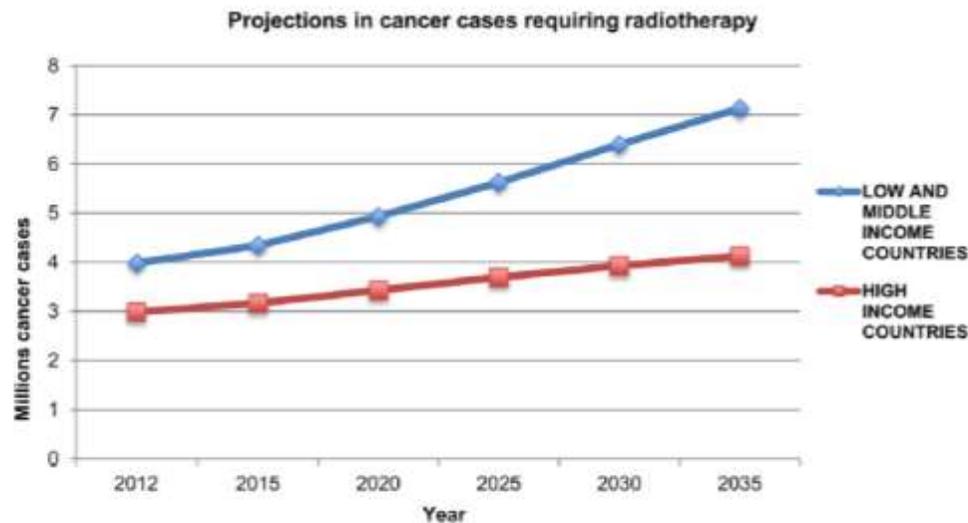
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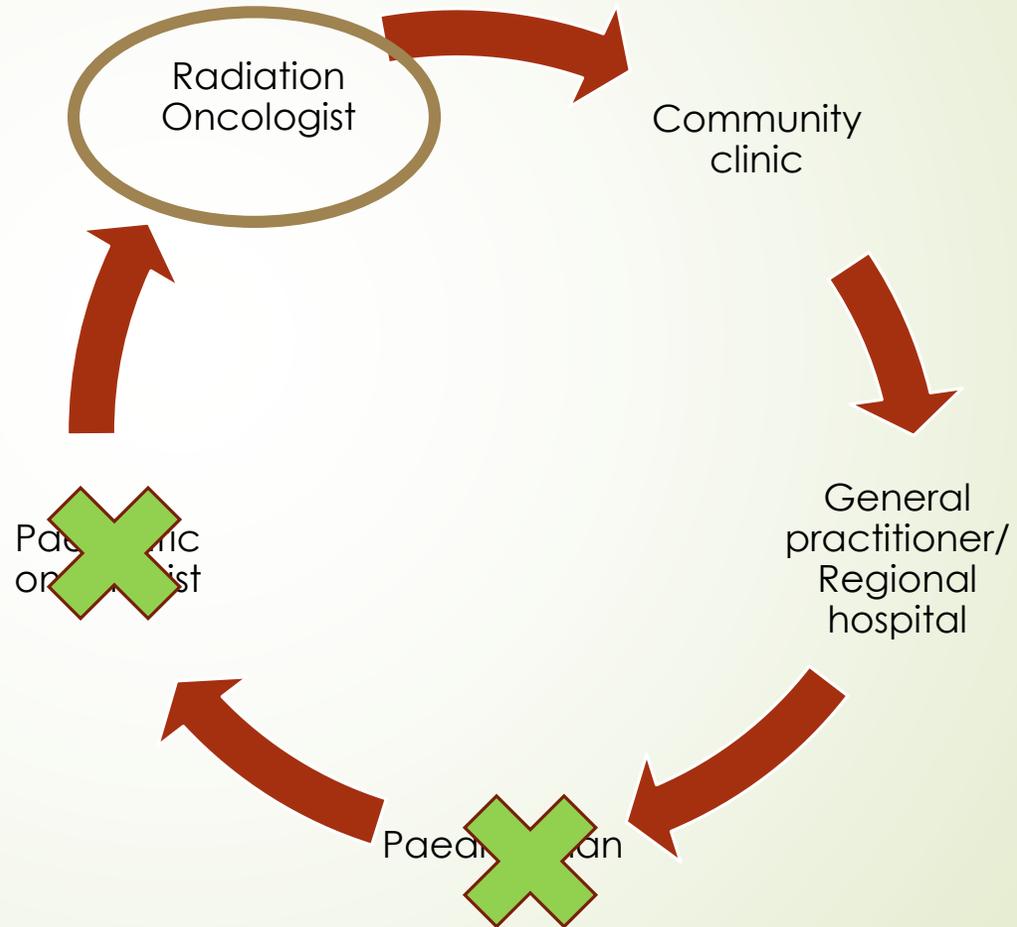


Projections in cancer cases with an indication for radiotherapy to 2035, low- and middle-income countries versus high-income countries.

What is the impact of providing radiotherapy?

Where do radiation Oncologists fit into things?

Adults
Children
Radiation
Chemo
Palliative care
Haematology



How is radiotherapy delivered?

Planning process

Sedation
Immobilization
Localization
 Simulation
 CT
 Clinical
Planning
 2D
 3D

Treatment process

Type of RT?
Energy required
Set up
QA

**Children need
time, time, time!**

Sedation vs. anesthesia

- ▶ Who needs it?
 - ▶ Anyone who can't lie still!
 - ▶ Almost all kids < 5 years old
 - ▶ Most kids 5-6 yrs old
 - ▶ A few kids > 6 yrs
- ▶ Maximum sedation is necessary for cast making/planning.
- ▶ Less sedation may be possible at subsequent treatment dates.
- ▶ Anesthesia is seldom easily available

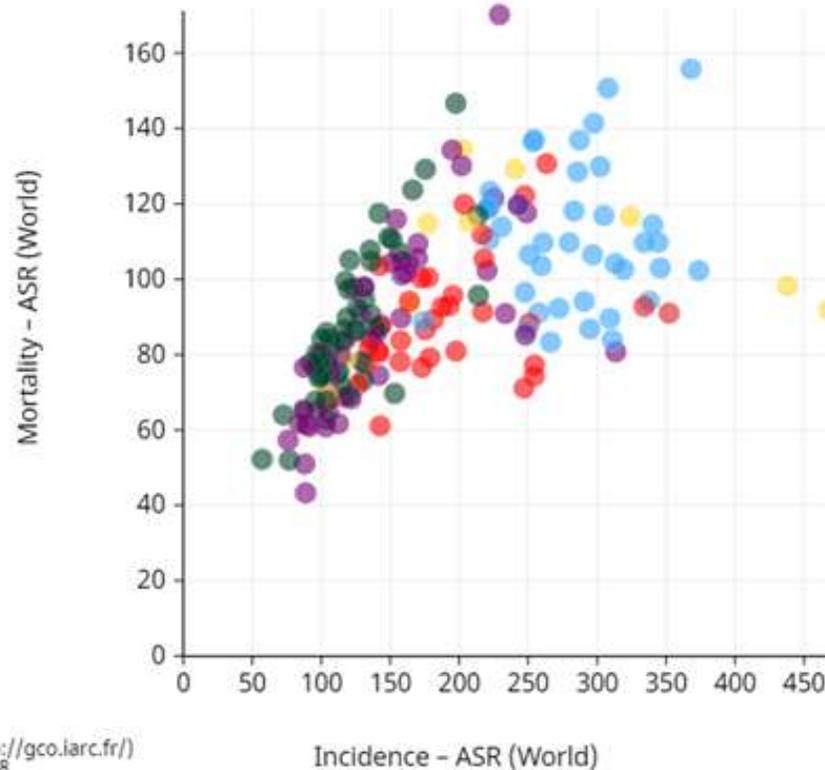




Cancer is more deadly in the LMICs!

Mortality – ASR (World) vs Incidence – ASR (World), all cancers, in 2018, both sexes, all ages

- Africa
- LAC
- North America
- Asia
- Europe
- Oceania



Data source: GLOBOCAN 2018
Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
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LMIC pediatric oncology what is the context?

- At least 179,000 children < 15 years are diagnosed with cancer each year:
- HIC Incidence = 140/1m Mortality 30/1m
- LMIC Incidence = 70-100/1m Mortality 50-70/1m
- 80% live in LMICs, and these children account for most of the 90,000 deaths that occur.

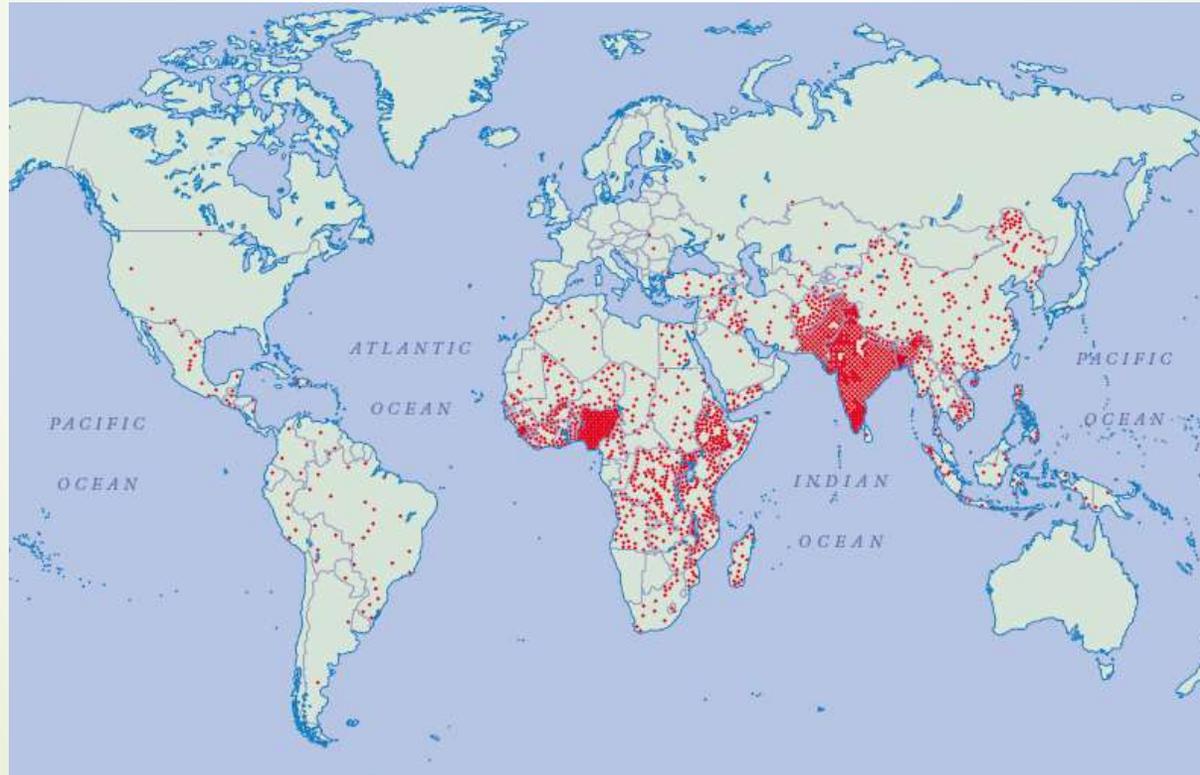
So why haven't LMICs prioritised children's cancer?

- More than 80% of children with cancer who live in LMIC don't have access to modern treatment and enjoy much lower survival rates.
- Before 2000 more than 10 million children died annually ...

(90% of them in
42 countries ...)

- ❑ Prematurity
- ❑ Intrapartum death
- ❑ Pneumonia
- ❑ Diarrhoea
- ❑ Malaria

And health priorities
are focused on these
conditions.

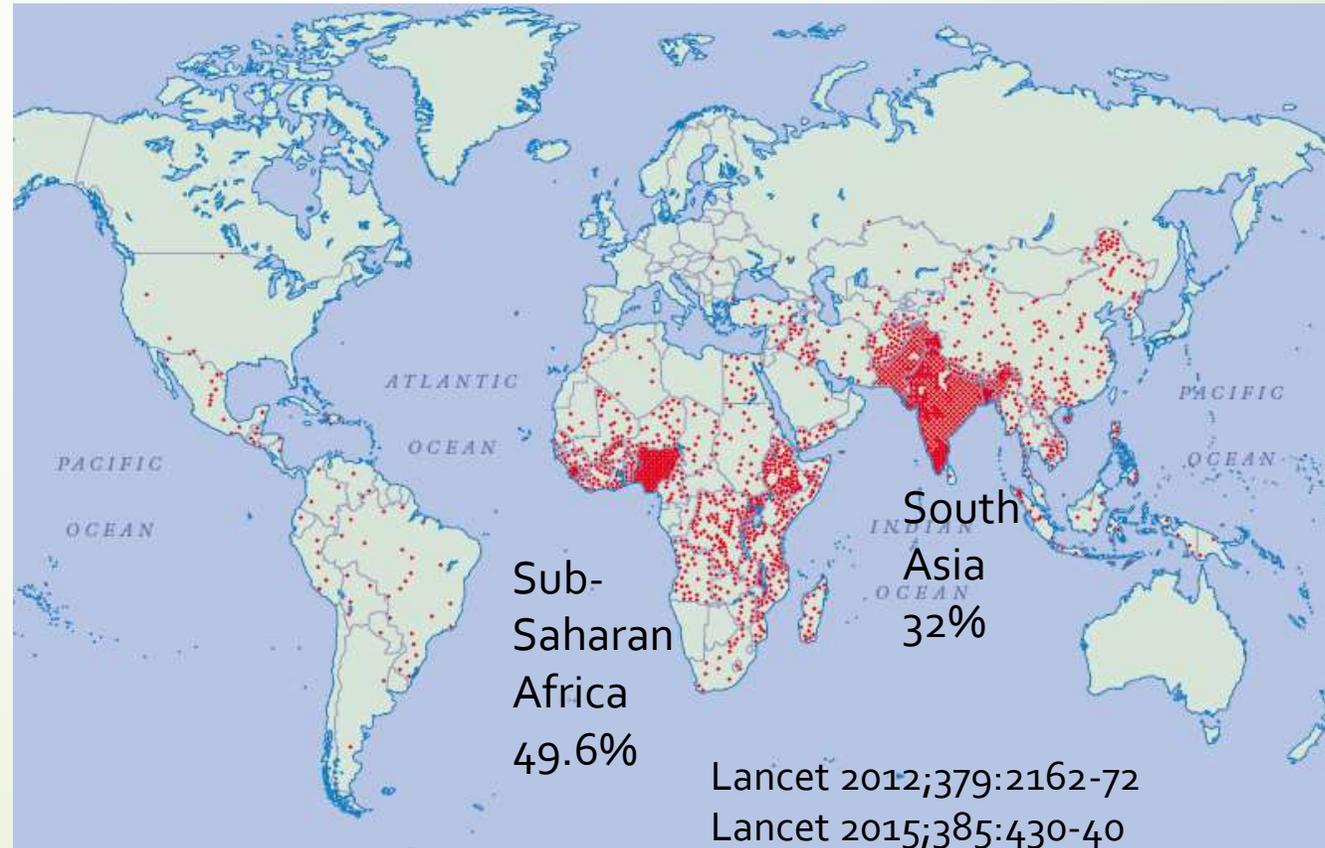


Global Under
5 Mortality 4/10/2018

...But we are getting better.....

	<u>2000</u>	<u>2010</u>	<u>2013</u>
Global Under 5 Mortality	9.9m	7.6m	6.3m

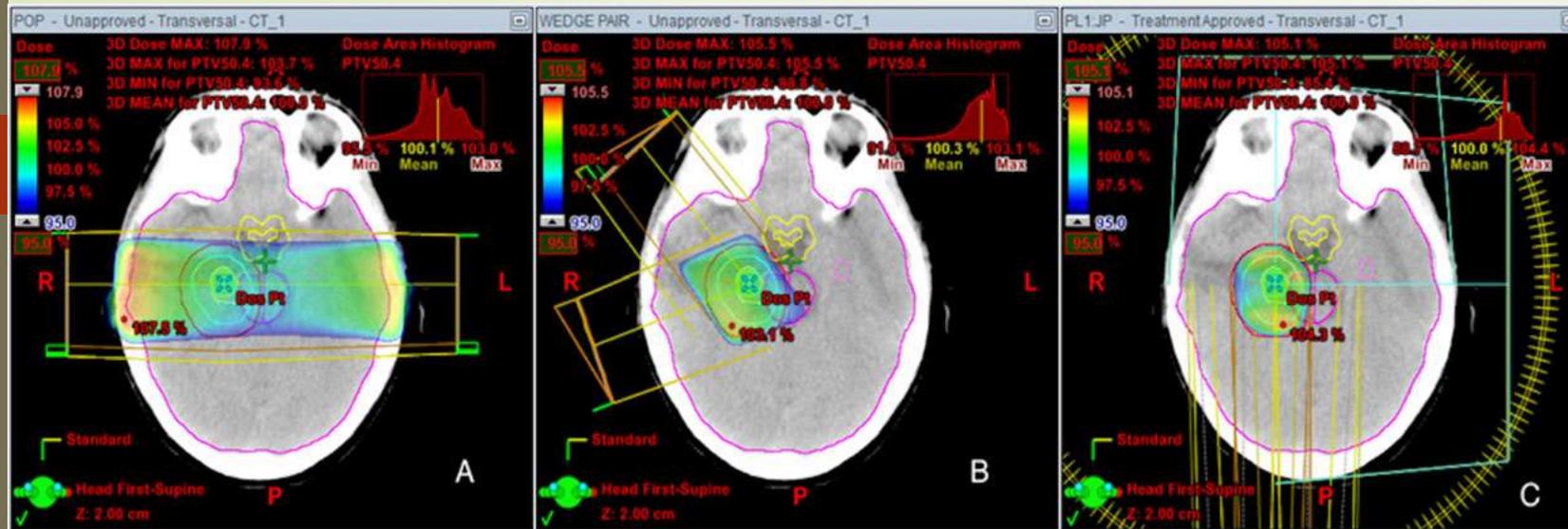
So that is very encouraging!



Adapting treatment regimens for use in LMIC

- Adapted diagnosis
- Adapted staging
- Adapted risk stratification
- Adapted treatment
- Adapted response evaluation
- Adapted follow-up

Service line	Level 0	Level 1	Level 2	Level 3	Level 4
General description					
Pediatric cancer unit general description*	Pilot project	Some basic oncology services	Established pediatric oncology program with most basic services and a few state-of-the-art services	Pediatric oncology program with all essential services and most state-of-the-art services	Pediatric oncology center of excellence; state-of-the-art services and some highly-specialized services (e.g. photon or proton beam radiation therapy, MIBG therapy, phase I studies)
Typical settings	Centers in LIC in disadvantaged areas	Centers with relatively greater resources in LIC, disadvantaged areas in lower MIC	Centers with relatively greater resources in lower MIC, disadvantaged centers in upper MIC	Many centers in upper MIC, most centers in HIC	Selected super-specialty centers that offer very advanced and high-quality tertiary and quaternary care
Radiation therapy					
Radiation therapy facilities	None	Cobalt machine	Cobalt machine*/Linear accelerator *Cobalt machine with 3-D planning capability in areas with poor electricity supply	Linear accelerator with fully integrated planning system	Proton beam facility; advanced photon radiotherapy
Radiation therapy planning tools	None	2D planning	3D planning available to most patients	3D planning, full conformal therapy available, intensity-modulated RT and/or VMAT available to some patients	All specialized techniques, including proton beam, radiosurgery, VMAT etc.
Radiation Oncologists	None	Radiation Oncologists with adult expertise	Radiation Oncologists with some pediatric experience	Radiation Oncologists with pediatric expertise	Pediatric radiation oncologist with highly specialized disease-specific expertise
Anesthesia for RT	None	Sedation only	Sedation/anesthesia from general anesthesiologist available for some pediatric patients	Sedation/anesthesia from Pediatric anesthesiologist available for most pediatric patients	Experienced pediatric anesthesiologist routinely available for all pediatric patients requiring RT
Radiation therapy personnel (Medical physicists/ RTTs)	None	Few personnel, no pediatric expertise	Adequate personnel with some pediatric expertise	Adequate personnel with advanced technique and pediatric expertise	Subspecialty expertise in specific pediatric cancer types (e.g. brain cancers)
Radiation therapy effective access	None	Radiation therapy available to some patients some of the time; frequent delays	Conformal radiation therapy available to most patients most of the time; occasional delays	Modern radiation therapy options reliably available to all patients in a timely way	Full range of specialized radiation therapy options available to all patients



Adapting the technology to available resources.....

Protocol development is critical

Pre-treatment preparation including anesthetic requirements
Pre-treatment imaging
Specification of treatment prescription: <ul style="list-style-type: none">Volume specificationAbsorbed dose prescriptionFractionation and treatment time
Relation to concomitant therapies <ul style="list-style-type: none">SurgeryDrug therapy
Treatment planning <ul style="list-style-type: none">Treatment techniqueDose computationTreatment plan evaluationImage guidance schedule and tolerancesIn-vivo-dosimetry
Quality management
Pre treatment patient-specific dosimetry

Once you have chosen a protocol:
You must fastidiously use it!
You must collect all the data
You must audit your outcomes
And you must adjust based on those outcomes!

As NICE in the UK points out an AUDIT CYCLE is ...
AUDIT – ADJUST – AUDIT

And then you must publish it!

Online Networks

- P
- P
- P

Organizations	Education Initiatives
PROS LMIC Resources & Forum	www.intpros.org
Pediatric Radiation Oncology in LMIC working group of SIOP-PODC	Monthly meetings at www.cure4kids.org
Chart rounds	Scheduled meetings between leaders at cancer treatment institutions and physicians & physicists in various locations to discuss patient management & treatment plans. www.chartrounds.com
AFRONET	Multidisciplinary virtual tumor



Support for NGOs ,
advocacy groups
and awareness
campaigns



Kids Kicking Cancer
Power Peace Purpose



**INTERNATIONAL
BRAIN TUMOUR
ALLIANCE**



Thank you to
Jeannette
for her slides

Our Paediatric MDT
at RXH/GSH

Radiotherapy
team

Our patients

