International Cancer Expert Corps

Partnering to transform global cancer care

Treatment, not Terror. A unique cancer treatment paradigm for developing novel linear accelerators for resource- limited settings

C. Norman Coleman, MD
Senior Scientific Advisor on behalf of colleagues and collaborators
International Cancer Expert Corps
Washington DC, USA
Geneva, CH

Presentation International Conference on Accelerators for Research and Sustainable Development: From Good Practices Towards Socioeconomic Impact.
23 May 2022

*__Disclaimer__: Opinion of the presenter- not related to my position at the US National Cancer Institute
Conflict of interest: none

International Cancer Expert Corps

Partnering to transform global cancer care

Global, multi-disciplinary partnership

Miles A. Pomper[1], Graeme Campbell Burt[1,2], Suzie Sheey[1,3], Deepa Angal-Kalinin[1,4], Taofeeq Ige[5], C Norman Coleman[1], Eugenia Wendling[1], Manjit Dosanjh[1,6].

[1] International Cancer Expert Corps, USA, Geneva
[2] Cockcroft Institute and Lancaster University, UK
[3] University of Oxford, UK
[4] STFC Daresbury Laboratory, Warrington, UK
[5] National Hospital Abuja, University of Abuja, Abuja, Nigeria
[6] CERN, Geneva, Switzerland

International Cancer Expert Corps

Partnering to transform global cancer care

Outline and key points of presentation

- **Synergy -** seemingly disparate groups coming together bring unique solutions, particularly to recalcitrant problems (healthcare inequality)
- **Defining the gaps-** developing alternative technology for radioactive sources addresses both potential terrorist actions and decreases inequality that leads to instability
- **ICEC**- systems approach to cancer care. Cancer care is integral part of a healthcare system: Flex-Competence
  - The technology *must meet the need*!
- **World peace at a Linac meeting**!: Addressing shortfall in global cancer care has a very broad global impact.

International Cancer Expert Corps

Partnering to transform global cancer care

Office of Radiological Security (ORS)
US Department of Energy

- Radioactive sources play an important role in commercial, medical, and research applications.
- However, if a high-activity radioactive source falls into the wrong hands, it could be used for a radiological dispersal device ("dirty bomb") or in other acts of terrorism. ORS works…to provide users of radiological materials with world class security technologies, expertise, training, source recovery, and alternative replacement strategies. ORS focuses its resources on the security of widely used, high-activity sources including cesium-137, **cobalt-60**, americium-241, and iridium-192.

https://www.energy.gov/nnsa/office-radiological-security-ors

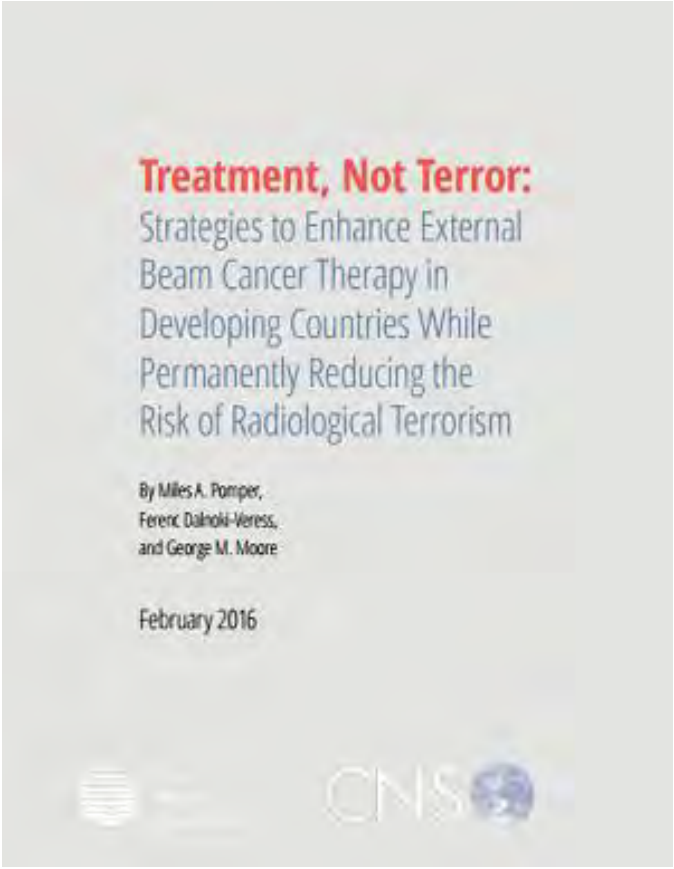
International Cancer Expert Corps

Partnering to transform global cancer care

New paradigm: Treatment, not Terror (Pomper et al.)

Energy policy, global security, non-proliferation, oncology, physics, engineering.

- Cobalt-60 is a mainstay of cancer care in Low- Middle Income Countries (LMICs). To remove it without alternative technology is detrimental to the people with cancer.
- The alternative technology challenge now includes the capacity and capability for sustainable cancer care programs.
- ICEC defines this as an *Expertise Challenge* involving the machine and how it is used for human health.



https://www.nonproliferation.org/treatment-not-terror/

Coleman CN. J Glob Oncol. 2017 Dec;3(6):687-691.

International Cancer Expert Corps

Partnering to transform global cancer care

Growing Global Cancer Crisis

- 2018 Globally - 18 million new cancer cases and 9.6 M deaths per year
- By 2040- projected - 27.5M cases and 16.3M deaths
- 70% of deaths in LMICs
- The *complete spectrum of cancer care* needed: Prevention, screening, diagnosis, treatment and long-term follow-up
- ~60% of all cancer patients can benefit from radiotherapy (RT) for cure or palliation
- Solution requires expertise (workforce capacity) and enabling technology.

International Cancer Expert Corps

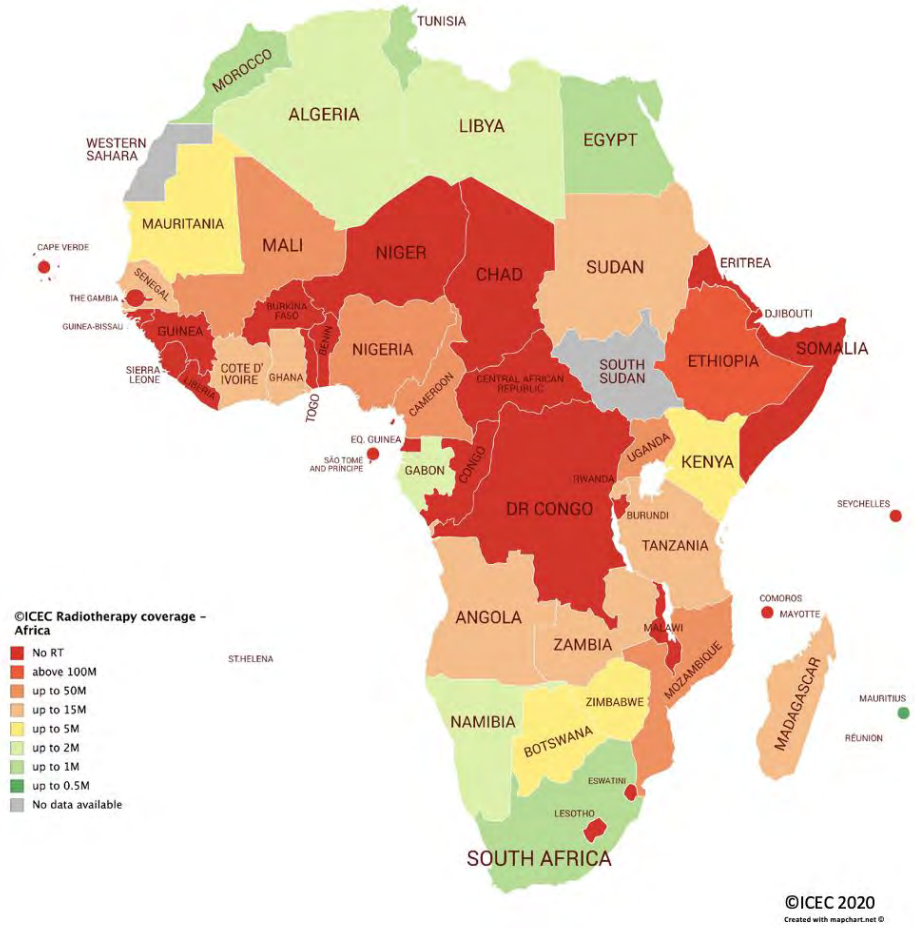
Partnering to transform global cancer care

Access to radiation therapy, particularly LINACs is an excellent metric of the gap in comprehensive cancer care.

Map showing the number of people per functioning machine in countries in Africa

Country	LINACs	Population	People per LINAC
Ethiopia	1	115 M	115,000,000
Nigeria	7	206 M	29,000,000
Tanzania	5	59.7 M	11,900,000
Kenya	11	53.9 M	4,890,000
Morocco	42	36.9 M	880,000
South Africa	97	59 M	608,000
UK	348	67 M	195,000
Switzerland	72	86 M	119,000
US	3827	331 M	87,000

- **28** countries have LINAC-RT facilities
- **12** countries only one facility
- **27** no LINACs for RT
- **385** RT-LINACs for > **1 billion** people
- **Nigeria** has 85 radiation and clinical oncologists and only a few trained linear accelerator maintenance engineers for its nearly 200 million people



International Cancer Expert Corps

Partnering to transform global cancer care

LINACs need to work in challenging environments

Workshops addressing the problem

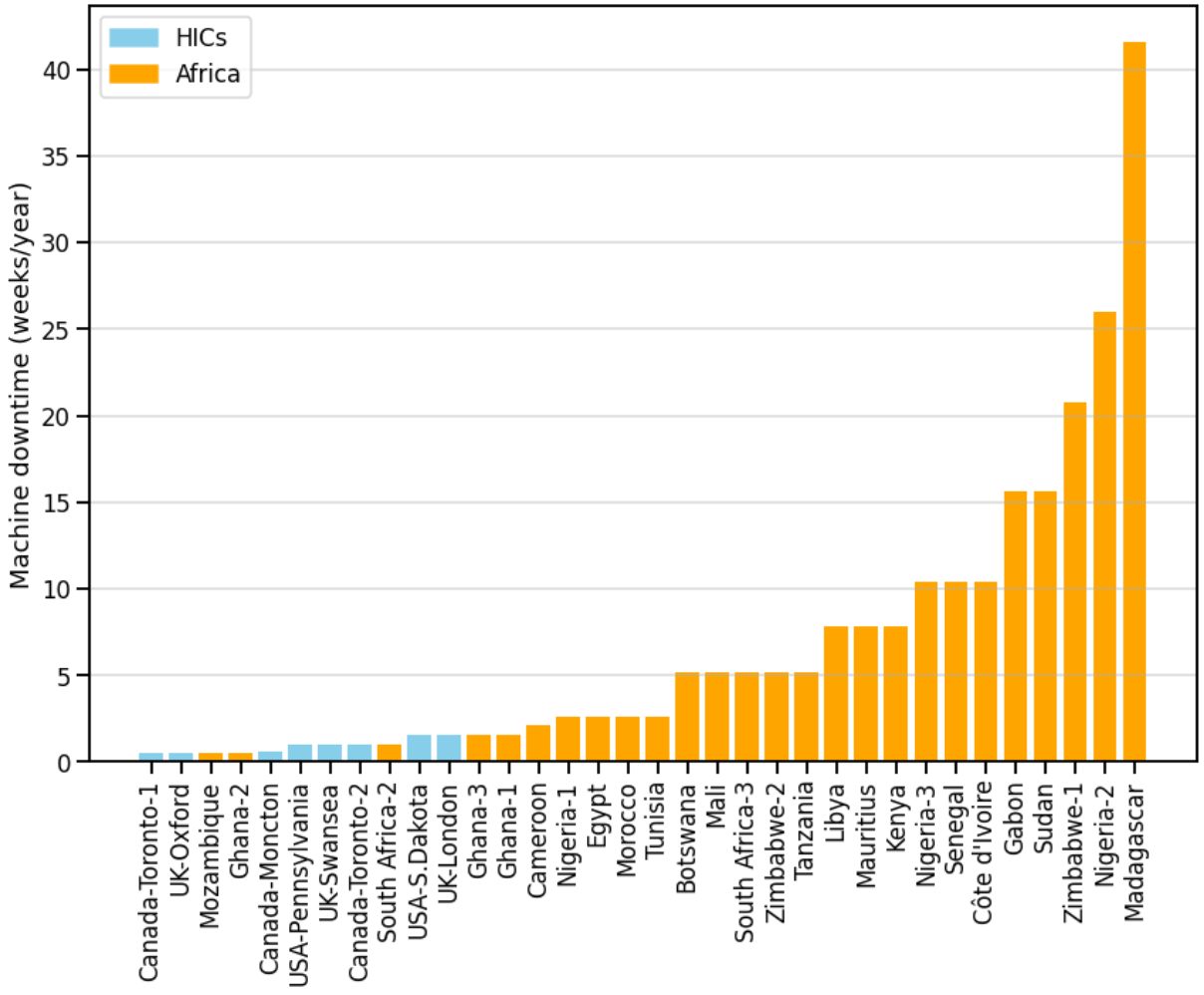
Changing the global radiation therapy paradigm.

Pistenmaa DA, Dosanjh M, Amaldi U, Jaffray D, Zubizarreta E, Holt K, Lievens Y, Pipman Y, Coleman CN; Workshop Participants. **Radiother Oncol**. 2018 Sep;128(3):393-399. PMID: 29921460.

Developing Innovative, Robust and Affordable Medical Linear Accelerators for Challenging Environments.

Dosanjh M, Aggarwal A, Pistenmaa D, Amankwaa-Frempong E, Angal-Kalinin D, Boogert S, Brown D, Carlone M, Collier P, Court L, Di Meglio A, Van Dyk J, Grover S, Jaffray DA, Jamieson C, Khader J, Konoplev I, Makwani H, McIntosh P, Militsyn B, Palta J, Sheehy S, Aruah SC, Syratchev I, Zubizarreta E, Coleman CN. **Clin Oncol**. 2019 Jun;31(6):352-355. PMID: 30798993.

Downtime in weeks: Comparison Africa and HICs



International Cancer Expert Corps

Partnering to transform global cancer care

International Cancer Expert Corps

ICEC is a recognized 501c3 non-profit organization based in the US (2014)

Mission:

- Reduce mortality and improve the quality of life for people with cancer in LMICs & indigenous and geographically underserved populations in HICs and regions worldwide

- ICEC uses a global mentoring network of cancer professionals working with local and regional in-country groups to develop and sustain expertise for better cancer care.

International Cancer Expert Corps

Partnering to transform global cancer care

Understanding Technology Gaps to Increase Access to Radiation Therapy

- ICEC – leveraging ***trusted partnerships*** to identify gaps and develop solutions to increase access medical linacs for challenging environments
  - **Gather information** from African hospitals/facilities regarding challenges faced in providing radiotherapy in Africa [1]
  - **Identify** the key technological challenges with those who work with them day-to-day
  - Remember that machines don't treat patients, **people do.**
  - **Educate, mentor, sustain expertise** through *exponential growth*.
  - **Use metrics** to assess impact and guide growth

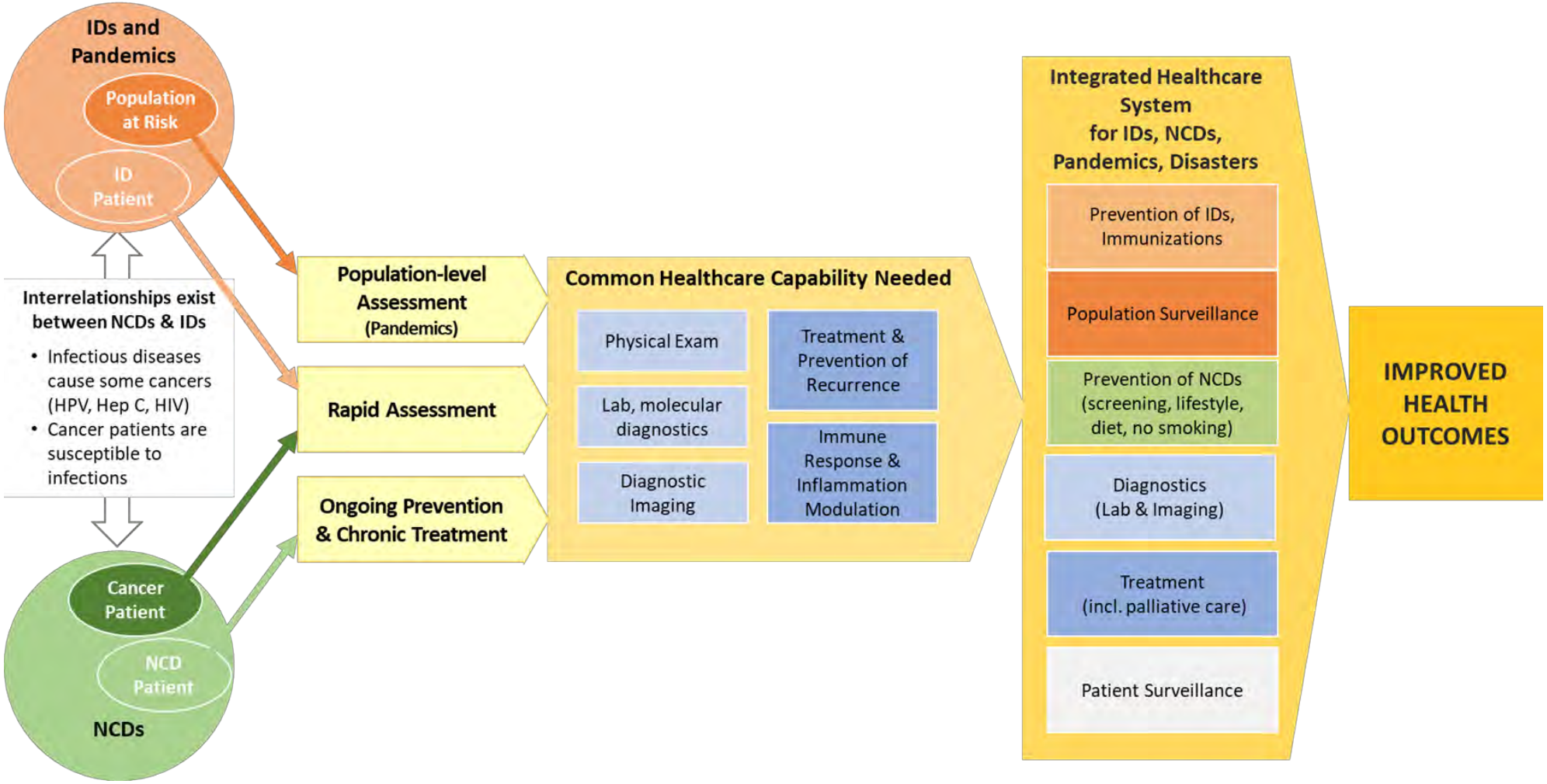
[1] Ige TA et al., Surveying the Challenges to Improve Linear Accelerator-based Radiation Therapy in Africa: a Unique Collaborative Platform of All 28 African Countries Offering Such Treatment, Clinical Oncology, https://doi.org/10.1016/j.clon.2021.05.008

International Cancer Expert Corps

Partnering to transform global cancer care

ICEC's Healthcare solution: Flex competence

Figure 1: A Dual Capacity Health System with Flex-competence

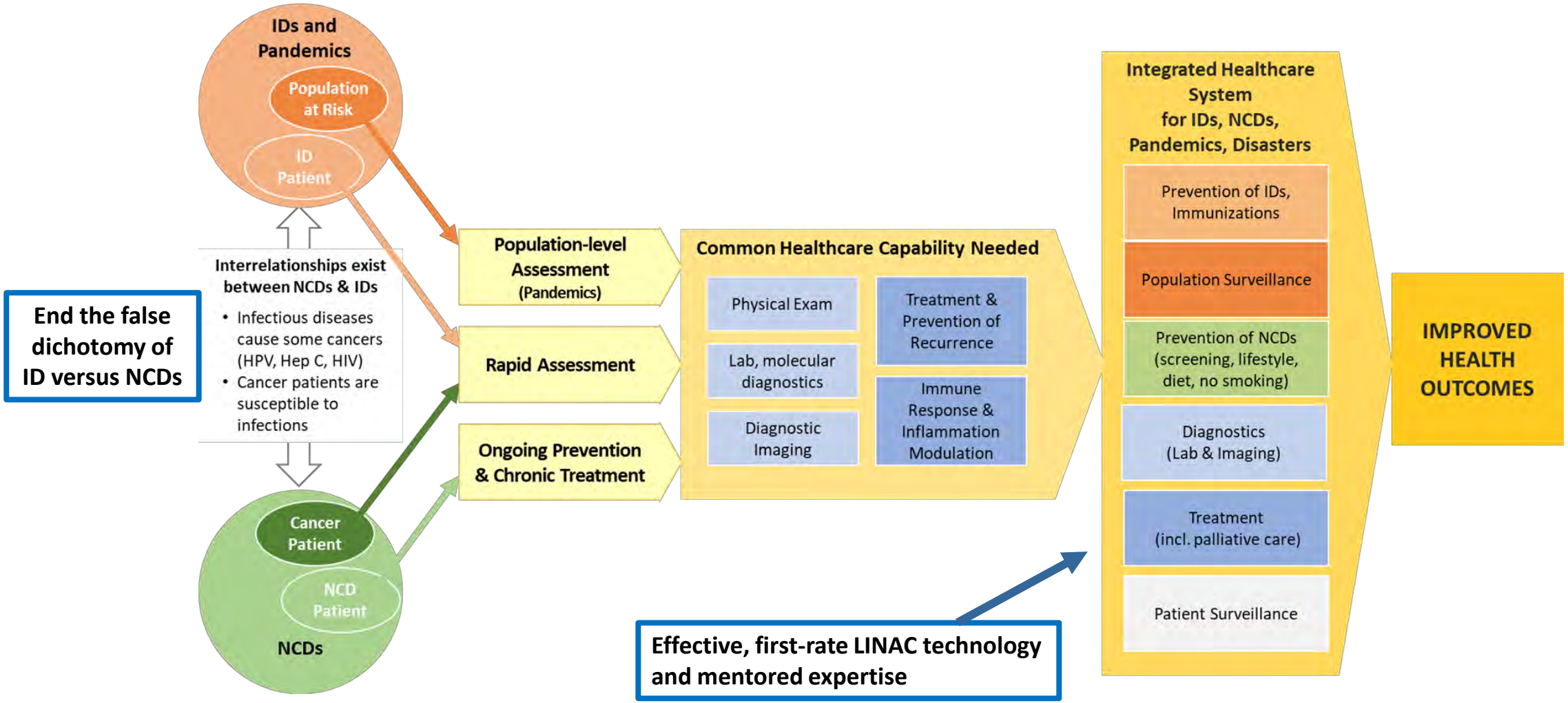


International Cancer Expert Corps

Partnering to transform global cancer care

ICEC's Healthcare solution: Flex competence

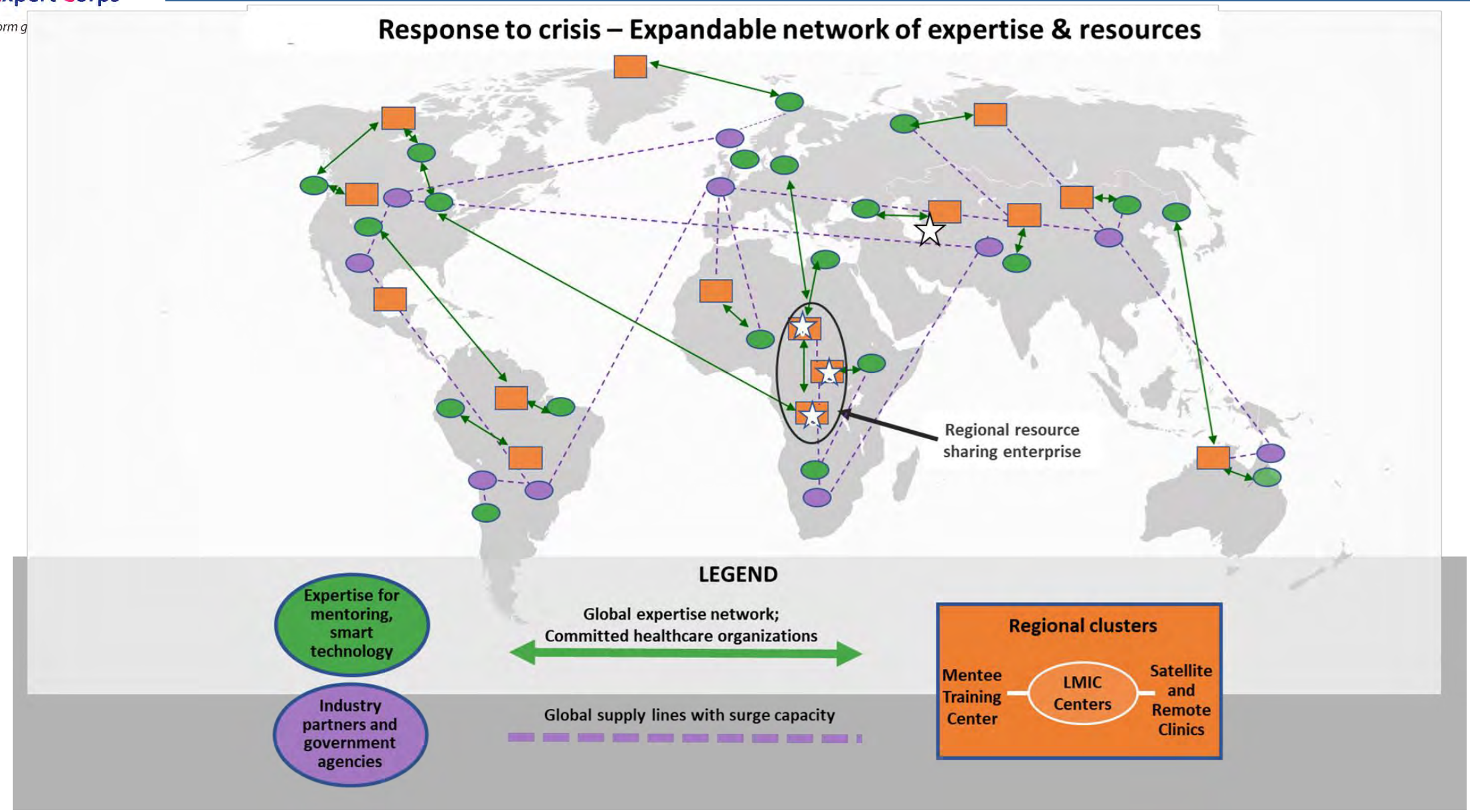
Figure 1: A Dual Capacity Health System with Flex-competence



International Cancer Expert Corps

Partnering to transform g

ICEC's Healthcare solution: Global network



International Cancer Expert Corps

Partnering to transform global cancer care

Radiotherapy benefits health and the economy

The Lancet Oncology Commission

Lancet Oncol, 2015, 16: 1153

Expanding global access to radiotherapy

Rifat Atun, David A Jaffray, Michael B Barton, Freddie Bray, Michael Baumann, Bhadrasain Vikram, Timothy P Hanna, Felicia M Knaul, Yolande Lievens, Tracey Y M Lui, Michael Milosevic, Brian O'Sullivan, Danielle L Rodin, Eduardo Rosenblatt, Jacob Van Dyk, Mei Ling Yap, Eduardo Zubizarreta, Mary Gospodarowicz

Our results provide compelling evidence that investment in radiotherapy nc only enables treatment of large numbers of cancer cases to save lives, but also brings positive economic benefits.

Atun

Jaffray

Gospodarowicz

The verdict is in: the time for effective solutions to the global cancer burden is now **C Norman Coleman, Bruce D Minsky*

Lancet Oncol, 2015, 16: 1146

Global Task Force for Radiotherapy for Cancer Control:

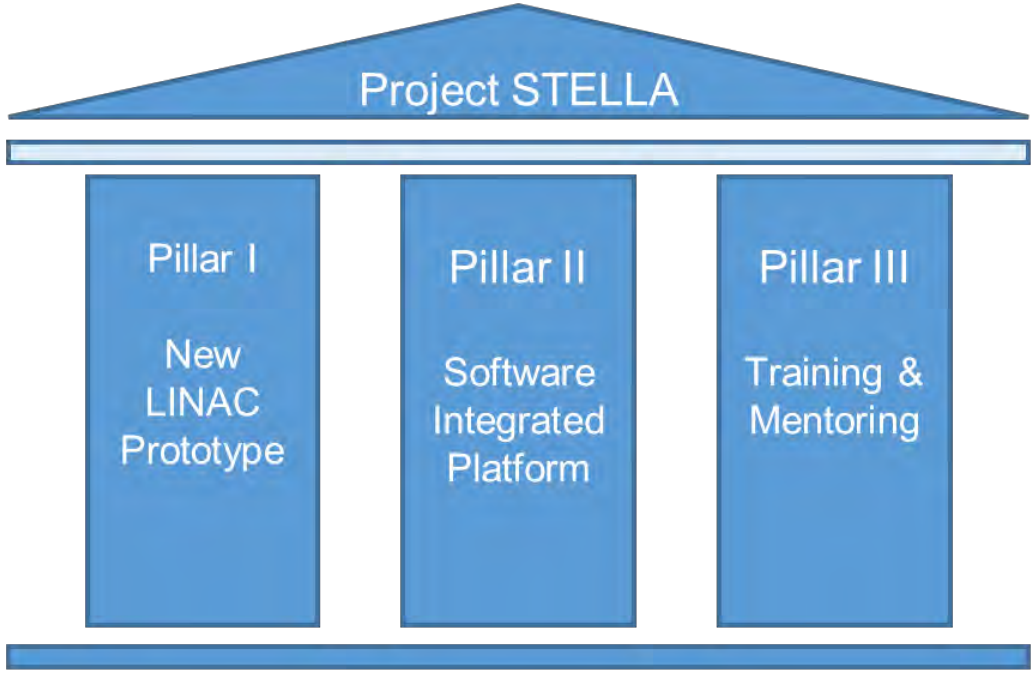
"Our results provide compelling evidence that investment in **radiotherapy not only enables treatment of large numbers of cancer cases to save lives, but also brings positive economic benefits**."

International Cancer Expert Corps

Partnering to transform global cancer care

STELLA

(Smart Technologies to Extend Lives with Linear Accelerators)



International Cancer Expert Corps

Partnering to transform global cancer care

CERN

UKRI Science and Technology Facilities Council

Collaboration with

Lancaster University

UNIVERSITY OF OXFORD

International Cancer Expert Corps

Partnering to transform global cancer care

Getting the job done……

Broad spectrum of expertise for complex systems solution

Medical

- Radiation, medical & Pediatric oncologists
- Palliative care
- Surgeons including subspecialists
- Nurses
- Pathologists
- Radiologists
- General internists
- Primary care
- Infectious diseases
- Gerontologists
- Pharmacologists
- Psychologists
- Public health
- Emergency medicine

Science, non-MD

- Prevention and screening
- Epidemiologists
- Medical physicists
- Technologists
- Basic & translational scientists
- Medical education
- Treatment guidelines
- Statisticians
- Social scientists
- Political scientists
- Regulatory Affairs specialists
- Pharmacists
- Data-management and big-data science

Support

- Educational tools
- Finance
- Hospital/medical administration
- International policy
- Patient advocacy
- Economists
- Sociologists
- Social workers
- Cultural experts
- Diplomats
- Communications
- Cancer survivors
- Information tech (IT)
- Legal
- Development

International Cancer Expert Corps

Partnering to transform global cancer care

Conclusions

- **Synergy -** Need for safe alternative technology has brought together LINAC physicists, engineers, IT experts with experts in cancer care. We address communicable and non-communicable diseases and infrastructure for public health crises.
- **Gaps and solutions-** defined "on-the-ground" with innovative Flex-competence healthcare model.
- ***The technology*** *must meet the need*
- World peace at a LINAC meeting! Effectively addressing global cancer care has broad global health impact.

"It's too hard"- is not the answer. Physicists prove that.

International Cancer Expert Corps
Partnering to transform global cancer care

“It always seems impossible until it's done.”

Nelson Mandela