

# Establishment of a National Medical Cyclotron for Sustainability and Self-Reliance in PET Radiopharmaceutical Production for Cancer Imaging, Research and Development in the Philippines

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## ACCELERATORS FOR RESEARCH AND SUSTAINABLE DEVELOPMENT

From good practices towards socioeconomic impact



**23–27 May 2022**

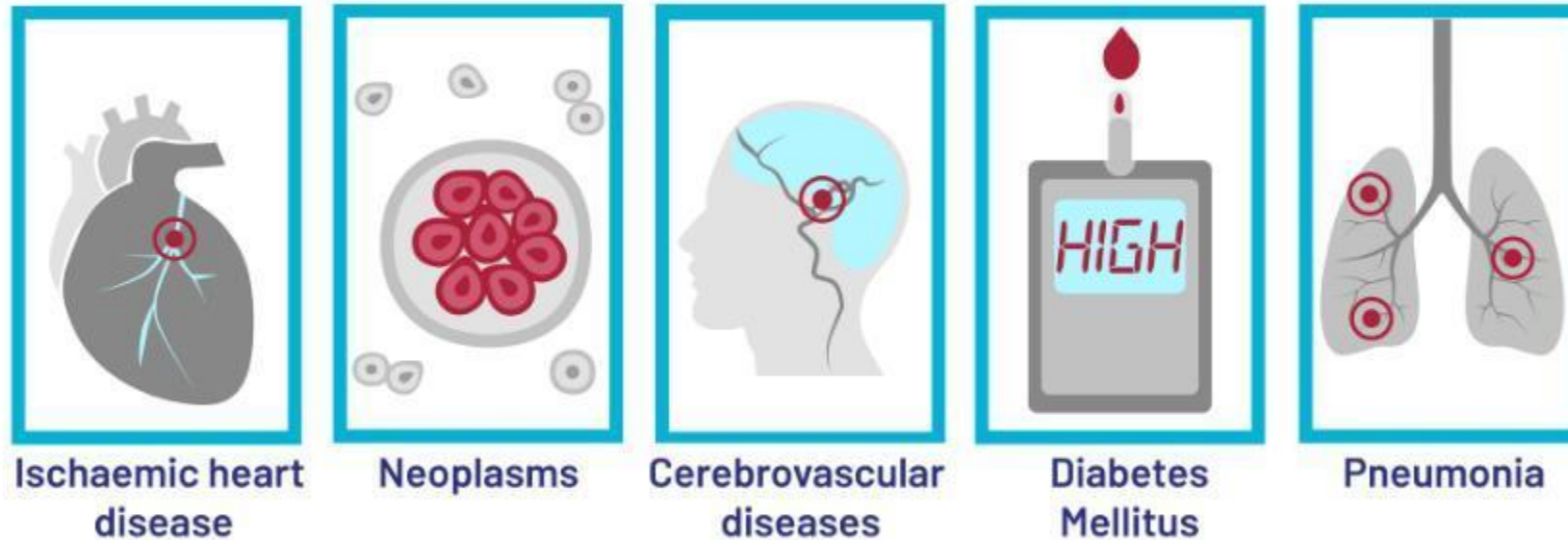
IAEA Headquarters, Vienna, Austria

# Current Situation in the Philippines

- **2nd killer after heart disease in 110 million population**
- High cost of cancer staging, diagnoses and treatment management (₱60,000 – 80,000 [≈ US\$1,500] in one scanning) condemns poor people sick from cancer
- By time of diagnosis, most poor cancer patients are at Stage 4 with virtually no hope of treatment



## Top five causes of deaths in the PH



Source: Philippine Statistics Authority

Ischemic heart diseases were still the leading cause of death in 2020

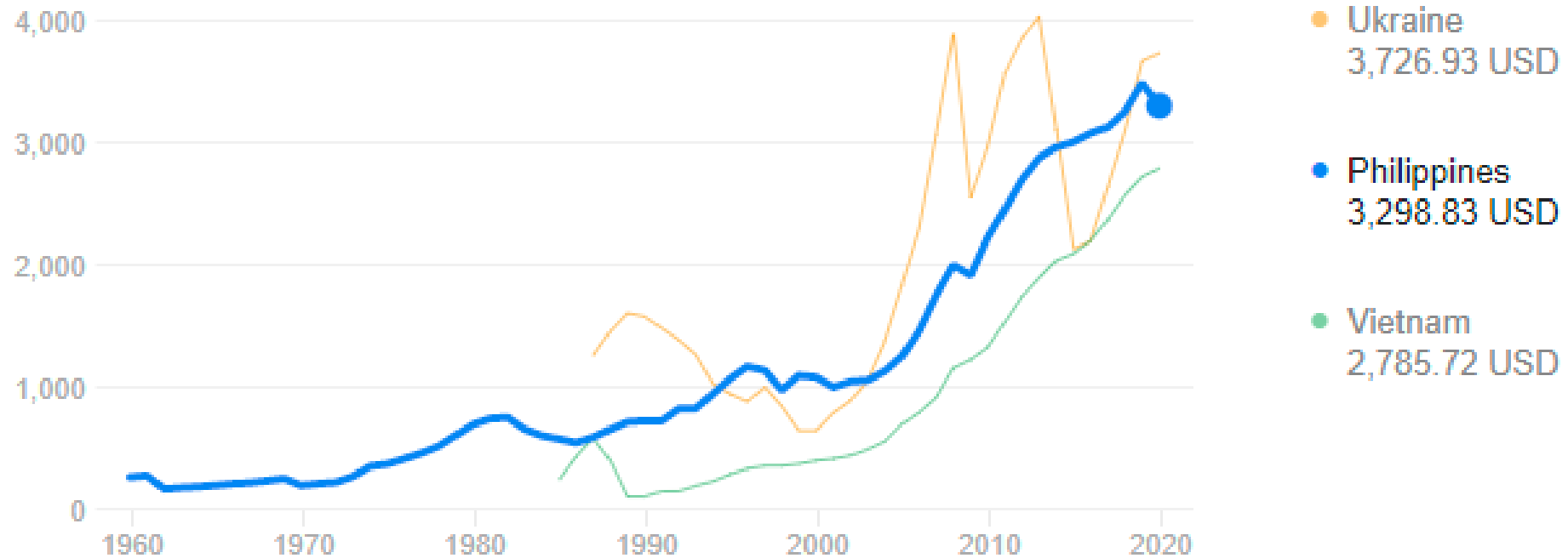
Neoplasms came in second with 62,300 deaths, which is equivalent to **10.8 percent of deaths**

# Big Problem in Philippines Inequitable Wealth Distribution



Cost of one PET-CT SCAN US\$ 1,500<sup>[L]</sup><sub>[SEP]</sub> = 1/2 GDP PER CAPITA!

3,298.83 USD (2020)



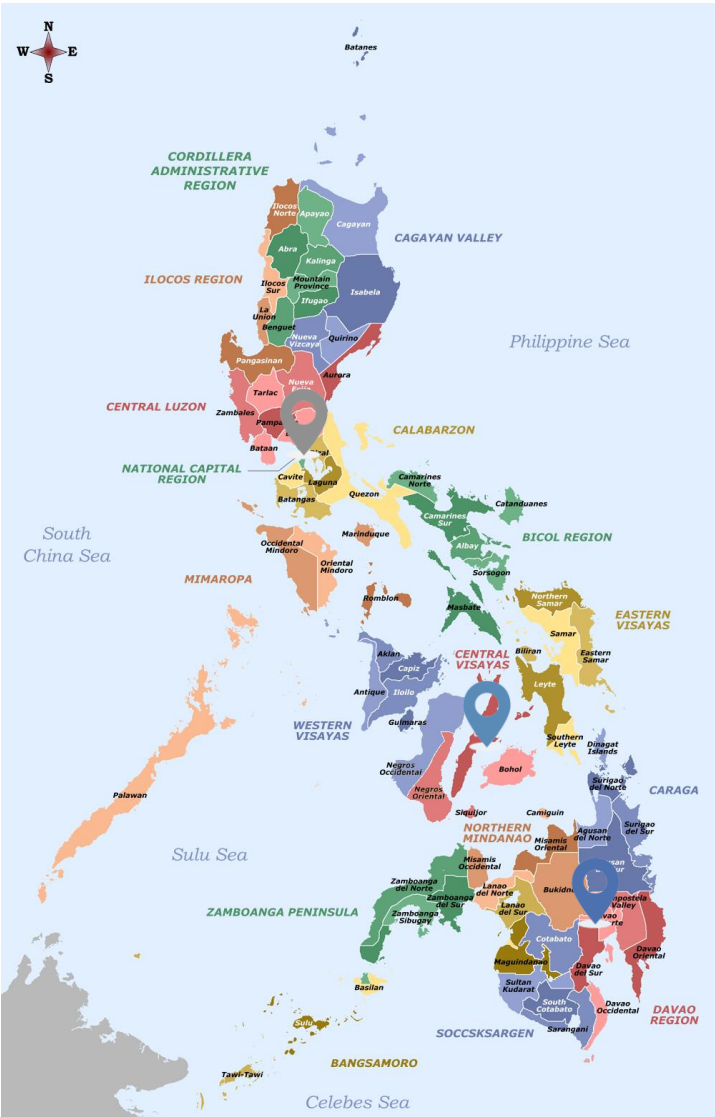
# Many medical doctors don't prescribe PET scans for poor patients

- National health insurance doesn't pay for nuclear medicine diagnostic procedures
- Limited number of medical cyclotrons for PET radiopharmaceuticals (only 4 in the country)
- Limited number of PET-CT diagnostic and imaging facilities (only 12 in the country)



# Medical Cyclotrons in the Philippines

<b>National Capital Region</b> (Population: 12,877,253)
2 private (SLMC, PHMC)
1 public-private partnership (NKTl)
<b>Central Visayas Region - Cebu City</b> (Population: 922,611)
1 private (CHMC)
1 government (VSMC)
<b>Davao Region – Davao City</b> (Population: 1,632,991)
1 government (planned)



# Cyclotron and PET/CT Infrastructure

HOSPITAL	TYPE	RADIONUCLIDE	MAKE	ENERGY	RADIOCHEMIST
St. Luke's Medical Center QC	Private	F18, N13	GE Minitrace	9.6 MeV	1
National Kidney Transplant Institute (NKTi) (under Khealth Corporation) (GMP certified)	Public	F18	GE PET Tracer 880	16.5 MeV	1
Perpetual Help Medical Center (Neo Isotope World)	Private	F18	IBA Cyclone 18/9 Cyclotron	18 MeV	1
Chong Hua Hospital	Private	Currently installing	Sumitomo HM-12S	12 MeV	
Vicente Sotto Medical Center, Cebu	Public	Cyclotron bunker currently constructing			
Southern Philippines Medical Center, Davao	Public	Cyclotron bunker currently constructing			
Cardinal Santos Medical Center	Private	**With PET/CT facility but no Cyclotron			
Angeles University Foundation, Pampanga	Private	**With PET/CT facility but no Cyclotron			





# Clinically used PET radiopharmaceuticals in the Philippines

RADIOPHARMACEUTICAL	PRODUCED BY
<ul style="list-style-type: none"><li>[18F]FDG</li></ul>	SLMC, NKTI, PHMC
<ul style="list-style-type: none"><li>[68Ga]DOTATATE</li></ul>	SLMC
<ul style="list-style-type: none"><li>[68Ga]PSMA</li></ul>	SLMC
<ul style="list-style-type: none"><li>[<sup>13</sup>N] NH<sub>3</sub></li></ul>	SLMC**
<ul style="list-style-type: none"><li>[18F]F-PSMA</li></ul>	NKTI

*\*\*Licensed but not routinely produced*



# Bringing down the cost of PET/CT scans – Government establishment of PET imaging facility under PNRI

- PNRI is initiating the development of a PET imaging facility together with a cyclotron facility. This is in response to the passage of laws pertaining to universal health care, universal health insurance and intensified cancer prevention and treatment laws. The facility is envisioned to be operational in the next 4-5 years
- Main features:
  - 4 PET-CT imaging cameras
  - 16.5 -20 MeV cyclotron with two to four beamlines for different targets
  - Supplementary labs for PET radiopharmaceutical research
  - Facilities for PET and cyclotron training for personnel



# Gradual Government Funding + Public Private Collaboration

- Building for cyclotron and 4 PET CT and research facilities now being built
- Philippine government funded but will explore asking assistance from IAEA for purchase of cyclotron and PET CT scans and training of staff
- Operation of facility to be Public-Private partnership (to avoid shutdowns when repairs needed because of overbearing laws on purchasing of parts replacement using government funds)



# Funding request through project proposals

- Funding will have to be justified yearly from Office of Budget and Management
- Project targets poor cancer patients helped it gain traction
- Senior budget official has cancer



**Program Title:**

INNOVATING NUCLEAR MEDICINE RESEARCH AND SERVICES: Development of Emerging PET Radiopharmaceuticals for Early Cancer Staging and Assessment of Biologic Functions in Cancer Cells

**Program Leader/Coordinator:**

CARLO A. ARCILLA, Ph.D.  
PNRI Director

**Components:**

Project Title	Duration
1. Development of National Capacity in the Production and Quality Control of PET Radiopharmaceuticals for Cancer Staging (Carlo A. Arcilla, Ph.D.)	5
2. Development of Diagnostic PET Facilities for Health Care Management and Applications (Thomas Neil Pascual, MD)	5
3. Research Development and Innovations for Emerging PET Radiopharmaceuticals (Joanna Michelle Chua)	5
4. Enhancement of Synergy Among Industries, Governments, Academe and Innovators for Sustainability and Resilience Through Collaborations and Technology Transfer (Gregory R. Ciocson)	5



# Strategic Impacts

Increased supply of radiopharmaceuticals



Streamlined cancer services for poor



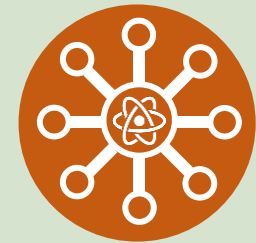
National Training Center for Cyclotron Operations and Radiopharmaceutical Production



Opportunities for Public-Public and Public-Private Collaboration



Center of Nuclear Medicine Research and Development in Asia



# PET Radopharmaceutical Facility's medical cyclotron specifications

Proton beam energy	16.5 MeV – 20 MeV		
Deuteron beam energy	9 MeV		
Proton beam current	100-130 $\mu$ A (max 65 $\mu$ A for F-18)		
Deuteron beam current	60 $\mu$ A		
Number of beam lines	1		
Number of targets	6		
Type of targets	Liquid	Gas	Solid
Radionuclides intended to be produced	F-18	C-11 N-13	Cu-64 Sc-43





*Artist's sketch · Nuclear Medicine Research and Innovation Center*





Groundbreaking · Nuclear Medicine Research and Innovation Center · January 31, 2022





*Construction work in progress*



# Staff involved the establishment of the Cyclotron and PET/CT facility



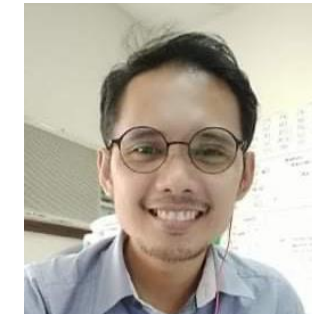
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Preciosa Corazon Pabroa, PhD  
Chief,  
Nuclear Services Division



Dr. Thomas Neil Pascual  
Science & Technology Fellow III



Isotope Techniques Section Staff

# Best Practices

**BEST  
PRACTICE**

Prospects of Public-Private partnership for sustainable operation

**BEST  
PRACTICE**

Stakeholders engagement in the development of the project

**BEST  
PRACTICE**

Solicitation of committed and strong government support

**BEST  
PRACTICE**

Continued collaboration with IAEA to ensure state-of-the art technical support in cyclotron-produced radiopharmaceuticals



Thank you

Acknowledgement:

*TC Regional Project RAS0080 – Promoting Self-Reliance and Sustainability of National Nuclear Institutions*

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