Production and Demand of Medical Radioisotopes in Indonesia

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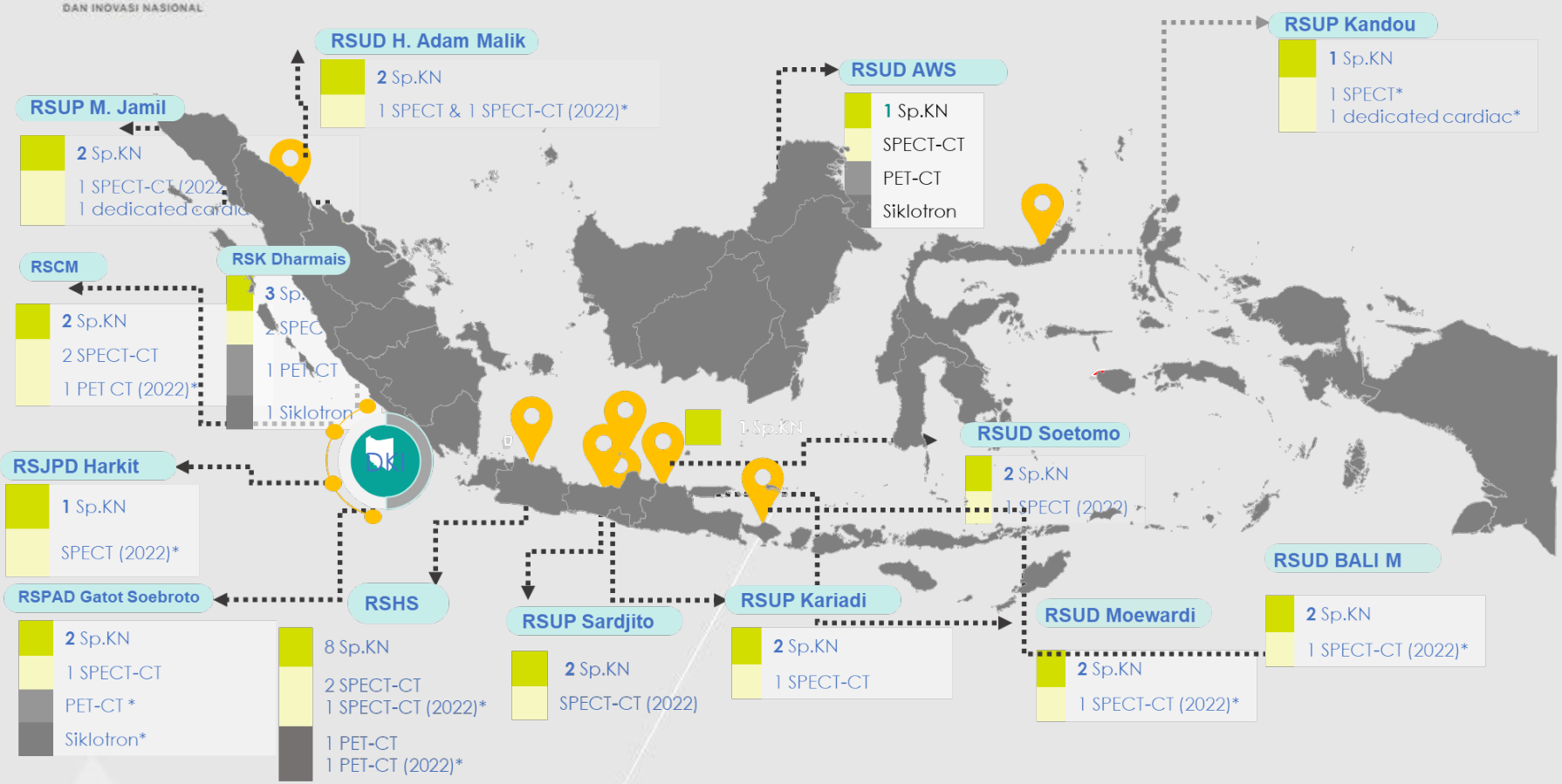
Outlines

- Nuclear Medicine Centers
- Radioisotope production facilities
- Medical Radioisotopes
- Radiopharmaceuticals used
- Future Collaboration Needs

Nuclear Medicine Centers



- Indonesia has **30 nuclear medicine centers, and 14** are active services
- Currently, there are **17 SPECT**, **12 SPECT/CT**, and **5 PET/CT**
- The Indonesia Ministry of Health plans to increase nuclear medicine centers at least 1 center in each province

Radioisotope production facilities

1. Research Reactor

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BATAN → (2021) → Research Organization for Nuclear Energy (ORTN)

"Triga Mark II" in Bandung

(250 KW upgraded to 2 MW)

"Kartini" reactor in Yogyakarta

(300 KW)

"G.A Siwabessy" multi-purpose reactor in Serpong (30 MW)

→ **RIs Production**

Reactor-based Medical Radioisotopes

No	Radioisotopes	Half life	Nuclear Reaction	Application
1	Iodine-131 (^{131}I)	8.0 d	^{130}Te(n,γ)^{131}Te→^{131}I	diagnosis dan therapy
2	Samarium-153 (^{153}Sm)	46.3 h	^{152}Sm(n, γ)^{153}Sm	therapy
3	Lutetium-177 (^{177}Lu)	6.7 d	^{176}Lu(n, γ)^{177}Lu	therapy
			^{176}Yb(n, γ)^{177}Yb → ^{177}Lu	
4	Phosphorus-32 (^{32}P)	14.3 d	^{32}S(n,p)^{32}P	therapy dan radiotracer
5	^{99}Mo/^{99m}Tc (neutron activation)	66 h/6 h	^{98}Mo(n, γ)^{99}Mo →^{99m}Tc	diagnosis
6	Gold-198 (Au-198)	2.7 d	^{197}Au(n, γ)^{198}Au	Radiotracer
7	Iridium-192 (Ir-192)	73.8 d	^{191}Ir(n, γ)^{192}Ir	therapy
8	Gadolinium-153 (Gd-153)	242 d	^{152}Gd(n, γ)^{153}Gd	Radiotracer
9	Scandium-46 (Sc-46)	83,8 d	^{45}Sc(n, γ)^{46}Sc	Radiotracer
10	Holmium-166 (Ho-166)	26,8 h	^{164}Dy(n, γ)^{166}Ho	therapy
11	Rhenium 186/188 (Re-186/188)	90,6 d / 17,0 h	$^{185/187}$Re(n, γ)$^{186/188}$Re	therapy

Radioisotope production facilities
2. Cyclotron

2010 — Cyclotron 9.6 MeV and PET/CT at Gading Pluit Hospitals

2011 — Cyclotron 18 MeV and PET/CT at MRCCC Siloam Hospital

2012 — Cyclotron 11 MeV and PET/CT at Dharmais Cancer Hospitas

2019 — Cyclotron 18 MeV and PET/CT at AWS Hospital

^{18}F

SPECT Diagnostic Radiopharmaceuticals

Radiopharmaceuticals	Application
[^{99m}Tc]Tc-MDP	Bone scintigraphy
[^{99m}Tc]Tc-MIBI	Cardiac scan
[^{99m}Tc]Tc-Pertechnetate	Thyroid scintigraphy, Meckels Diverticulum scan
[^{99m}Tc]Tc-DTPA	Renal Scan , Cisternography
[^{99m}Tc]Tc- MAG3, DMSA	Renal Scan
[^{99m}Tc]Tc-HMPAO	Brain
[^{99m}Tc]Tc-Nanocolloid	Lymphoscintigraphy, Sentinel Lymph Node
[^{99m}Tc]Tc-MAA &Technegas	Ventilation-Perfusion Scan
[^{99m}Tc]Tc-Ethambutol	Tuberculosis diagnosis
[^{99m}Tc]Tc-PSMA	PSMA Scan
[^{99m}Tc]Tc-HYNIC TOC	Somatostatin Receptor Scan
[^{131}I]I	Thyroid scan

PET Diagnostic Radiopharmaceuticals

Radiopharmaceuticals
[^{18}F]FDG
[^{18}F]Na-F
[^{18}F]F-PSMA
[^{18}F]FLT
[^{18}F]FDOPA
[^{68}Ga]Ga-PSMA
[^{68}Ga]Ga-DOTA-TOC

Therapeutic RIRPs

RIRPs
^{131}I
[^{131}I]I-MIBG
^{153}Sm
[^{177}Lu]Lu-PSMA
[^{177}Lu]Lu-DOTA

Future Collaboration Needs

1. Development of n.c.a $^{176}Yb/^{177}Lu$
2. Research and development of cyclotron-based radioisotope production
   - ^{89}Zr
   - ^{67}Ga, ^{68}Ga
   - ^{64}Cu
   - ^{123}I
   - ^{225}Ac

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Thank you
for your attention