



Kick-off on Biosensor CCA diagnosis



Innovation of photonic and electrochemical biosensors for cholangiocarcinoma diagnosis

ກອງປະຊຸມສຳມະນາໂຄງການ ຮ່ວມມືພັດທະນາເຕັກໂນໂລຊີໄຫມ່ ຊຸດກວດຈັບ ແລະ ບົ່ງມະຕິມະເຮັງທໍ່ນໍ້າບີ

KKU-CMU-NCCL-NICT



ຮ່ວມມືກັນລະຫວ່າງ NICT Japan, ມະຫາວິທະຍາໄລຂອນແກ່ນ, ມະຫາວິທະຍາໄລຊຽງໄຫມ່ ແລະ ສູນມະເຮັງ-ໂຮງຫມໍມິດຕະພາບ

Champadeng VONGDALA MD, MPH



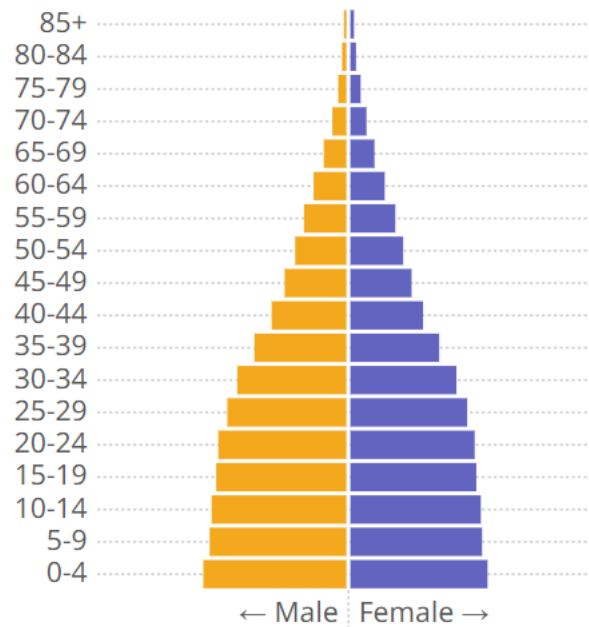
2020

Population by age and sex. Lao People's Democratic Republic

Population 7,371,468 million in (2020)

GDP per capita US\$ 2,625 (2019)

Life expectancy 68.5 years (2019)





SOCIOECONOMIC/POLITICAL CHARACTERISTIC

National Government

- Single party government under the Lao People's Revolutionary Party
- Governance, economic and legislative reform ongoing since 1986
- Provincial governments gaining local power through decentralization

Economy

- With most of the population living as farmers, Laos is highly dependent on foreign aid and has a large trade deficit.
- Major trade partners: Thailand, Vietnam, China
- Tax collection systems are weak, leaving the government with permanent budget problems.

CANCER CONTROL & CANCER REGISTRY TIMELINE IN LAOS

2008

- Pathology Unit, UHS (Seen Cervical, Breast, Gastric-Colon Cancer)
- Started to recognizing on cancer in Laos
- CanReg4 Pathology-based

2014

- imPACT Review Mission from IAEA Team (RT Center Initiated)
- Started Cancer unit under Mittaphab Hospital
- Recognized in high cancer burden with only palliative care support

2017

- Enactment from MoH, Sept. 2017 on the Cancer Center Act.
- CanReg5 Training in Central Hospital Level (initiation)
- Education and training related-oncology, numbers for cancer workforce

2021

- PM's decree 2021, separated cancer center from Mittaphab hospital.
- NCDs guideline, LAOPEN handbook which included cancers
- Re-survey the imPACT Review Mission from IAEA Team (2022)

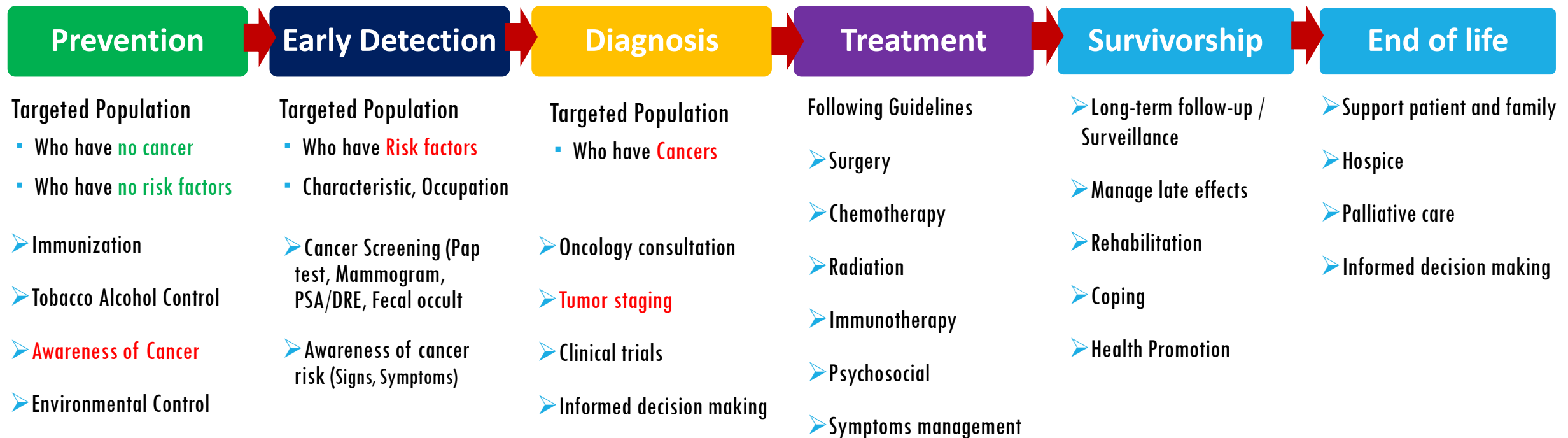
2024

- Official separate independent Cancer Center from Mittaphab Hospital
- Finding budget for capacity building (Comprehensive Cancer Center)



CANCER CONTROL CONTINUUM PUBLIC HEALTH CONCEPT

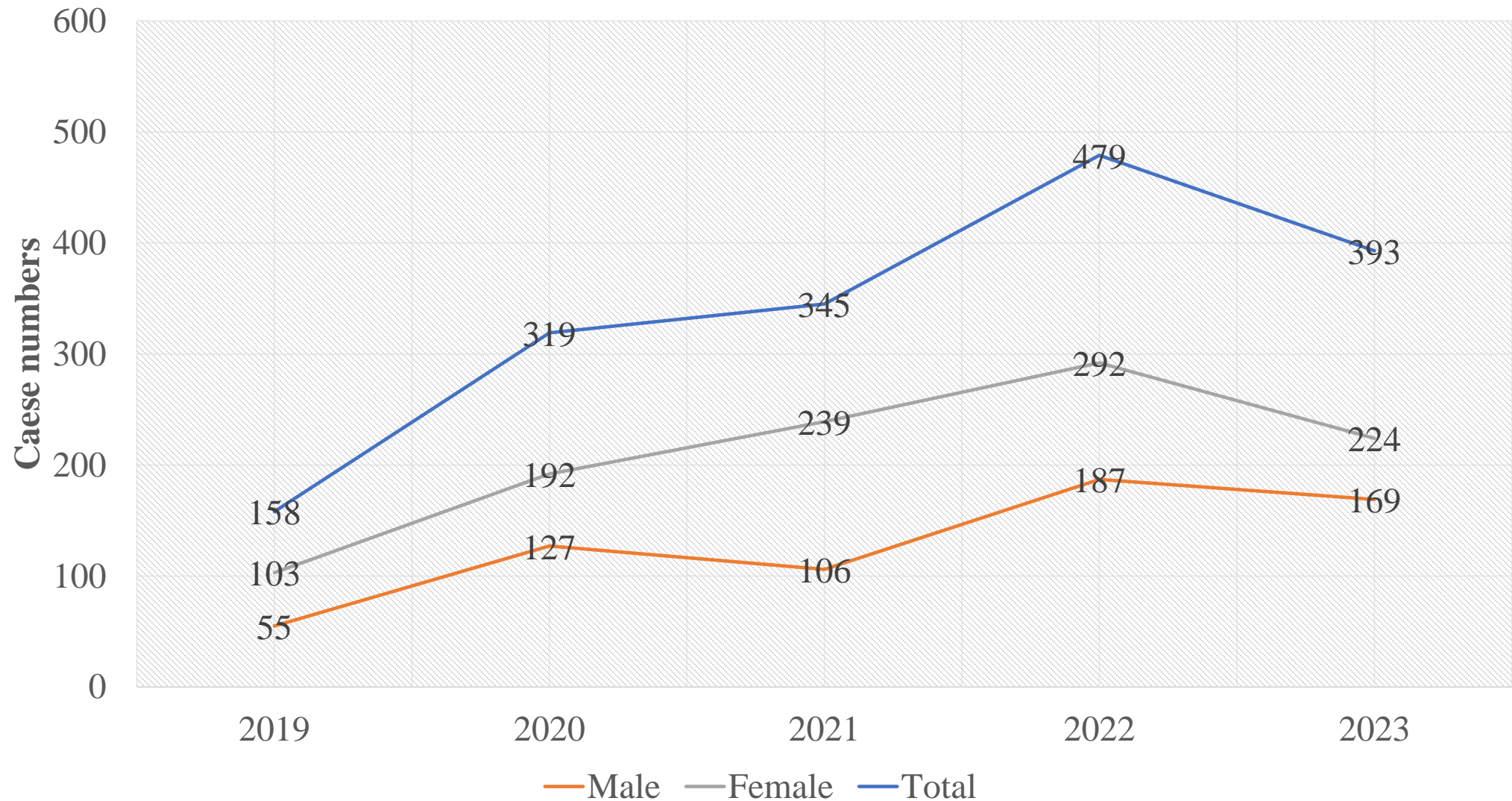
Considering not only one patient, but as a whole population including healthy person



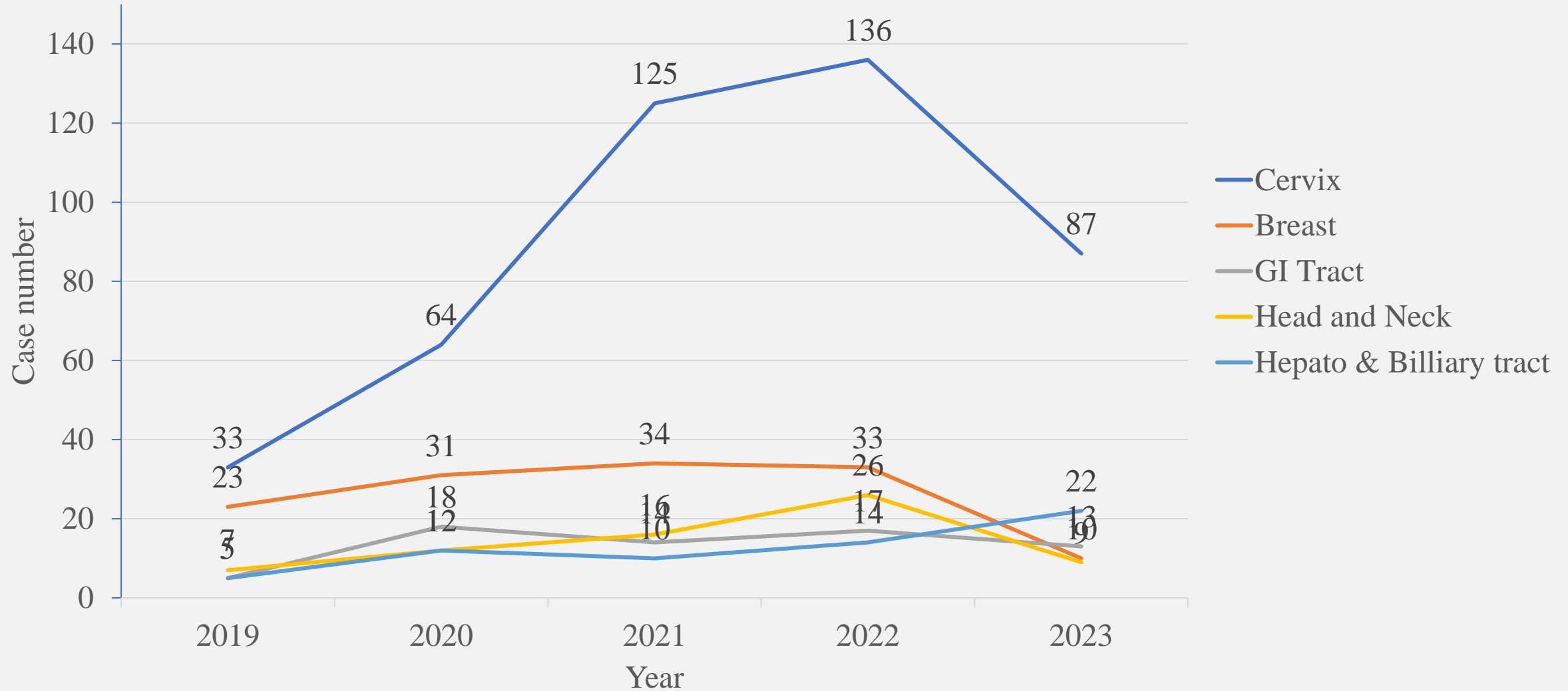


CANCER CENTER, VIENTIANE CAPITAL, LAOS

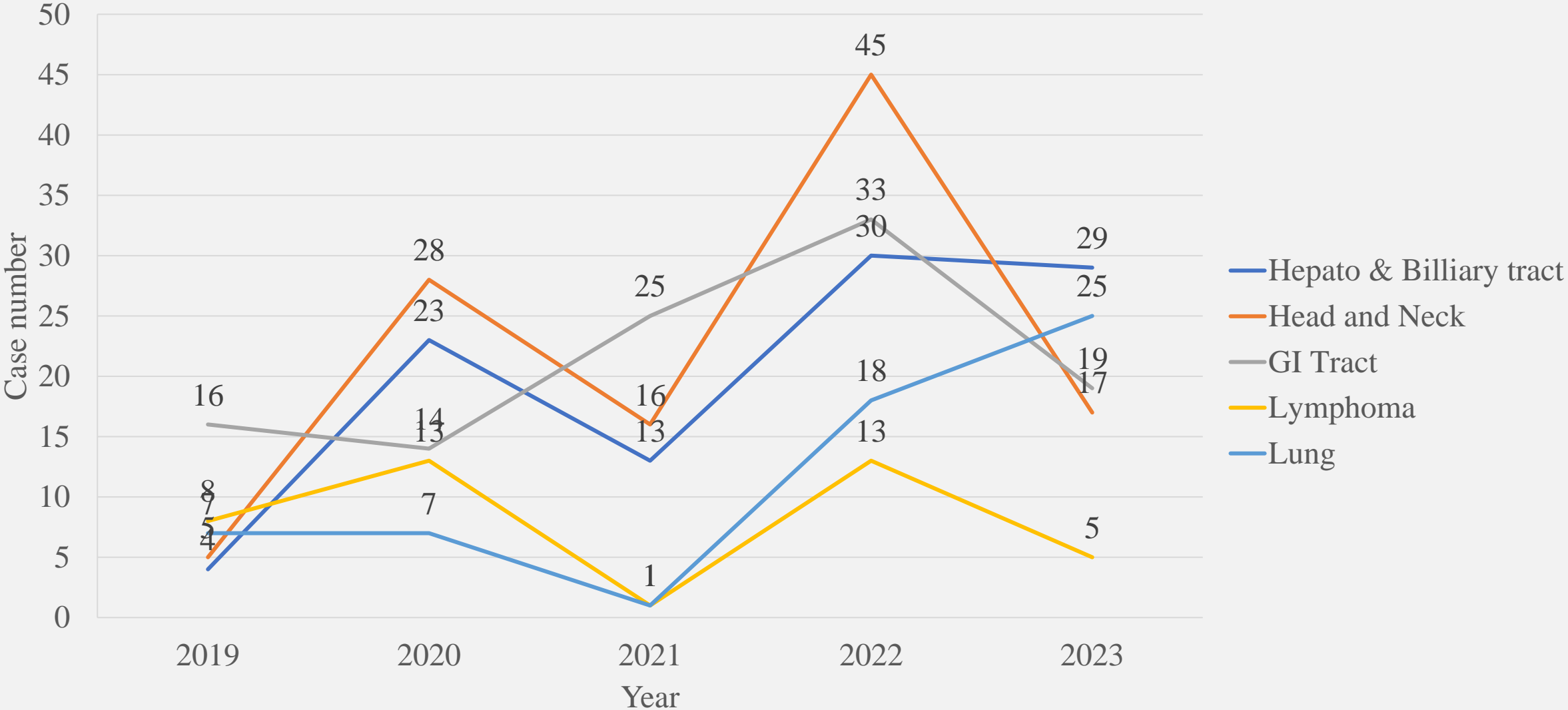
Total Cancer Registration 2019-2023



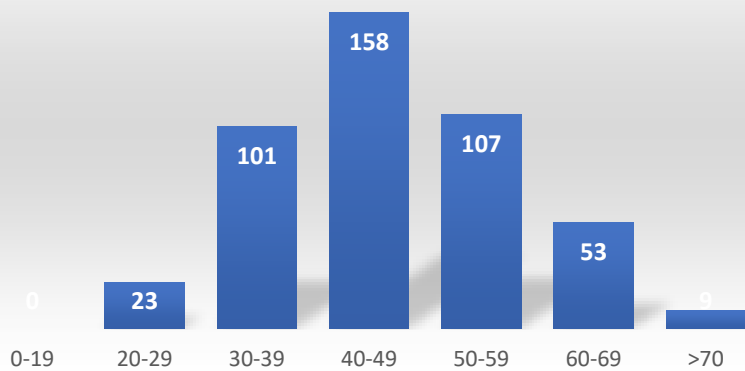
Top 5 Common Cancer, Female



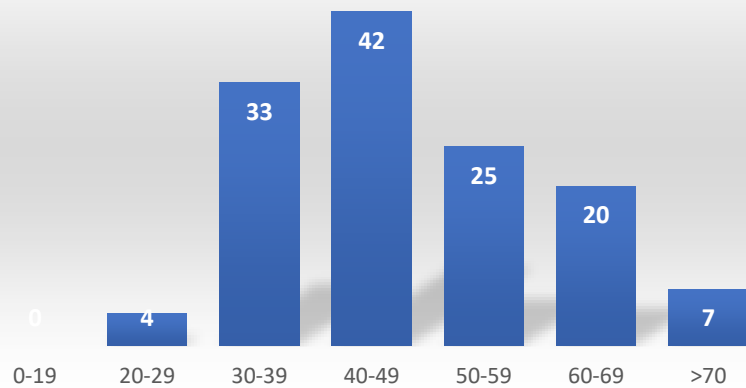
Top 5 Common Cancer, Male



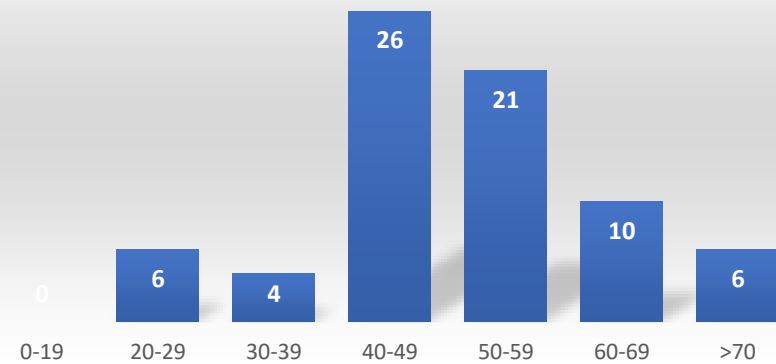
Cervix



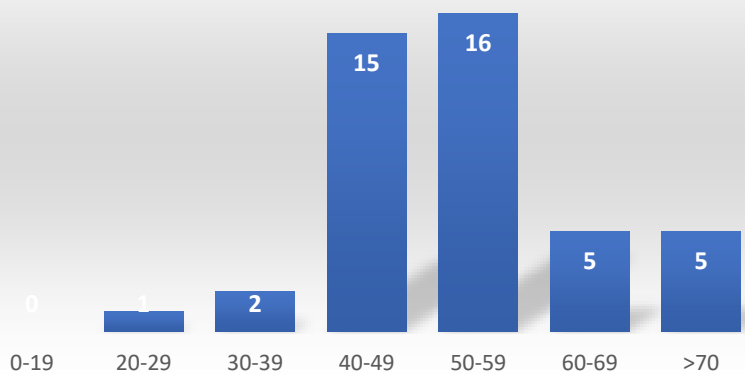
Breast



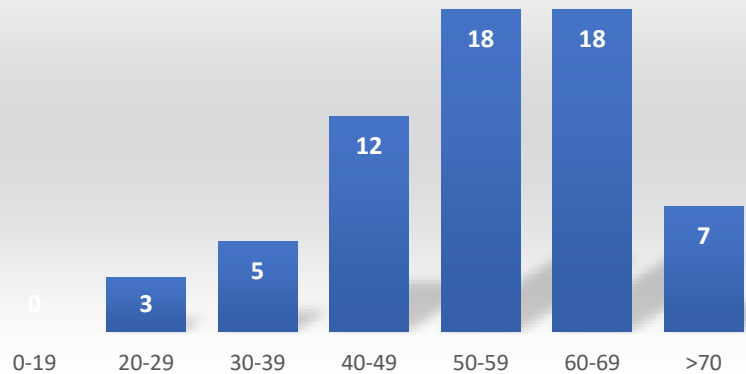
NPC



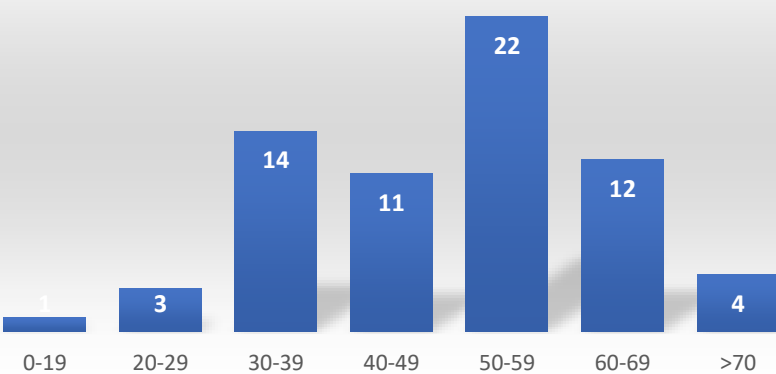
Lung



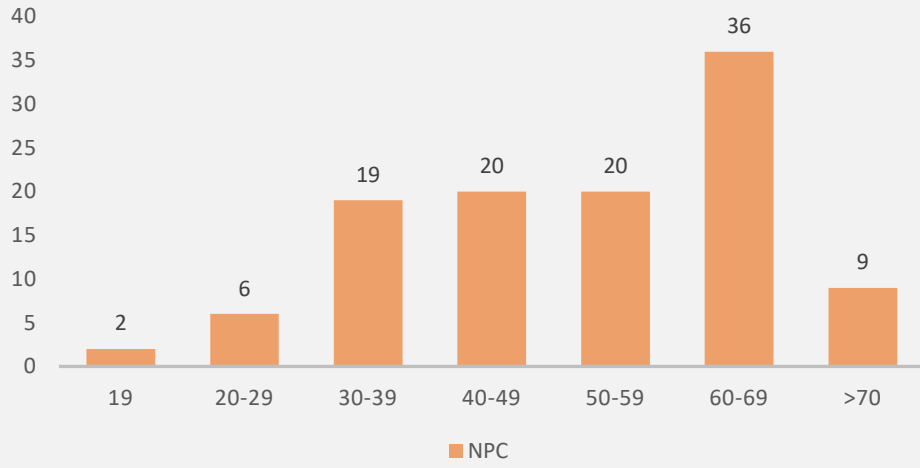
Hepatobiliary



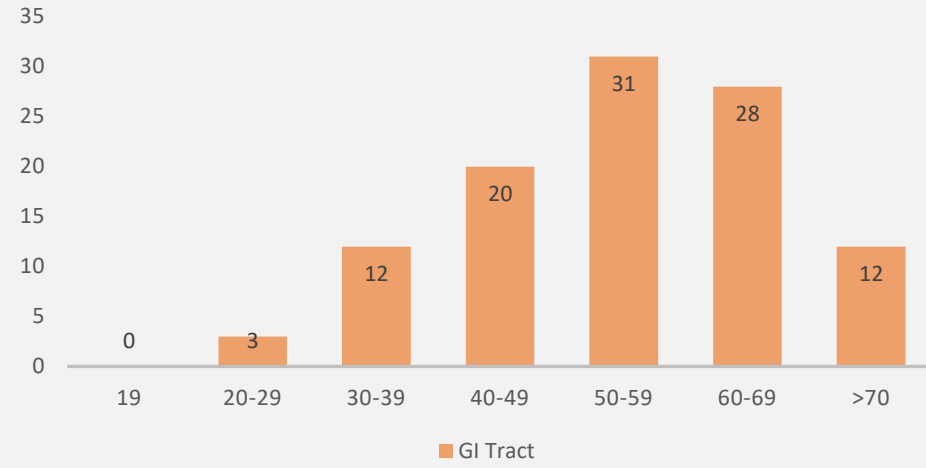
GI Tract



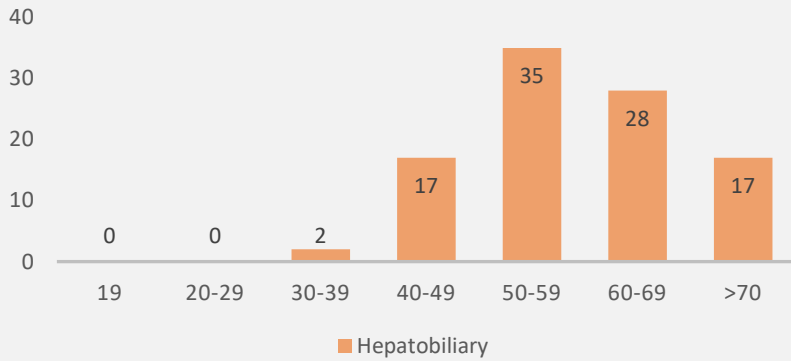
NPC



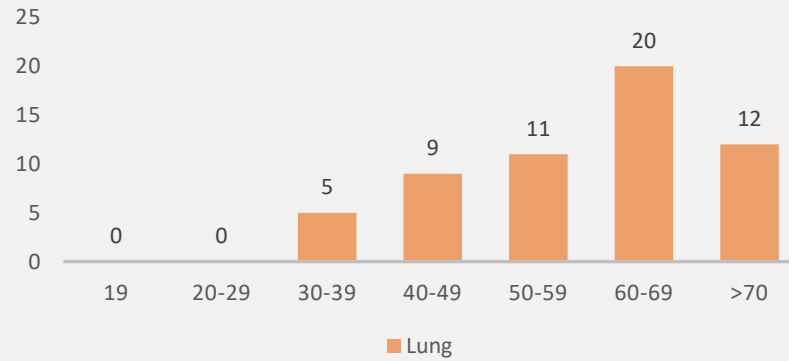
GI Tract



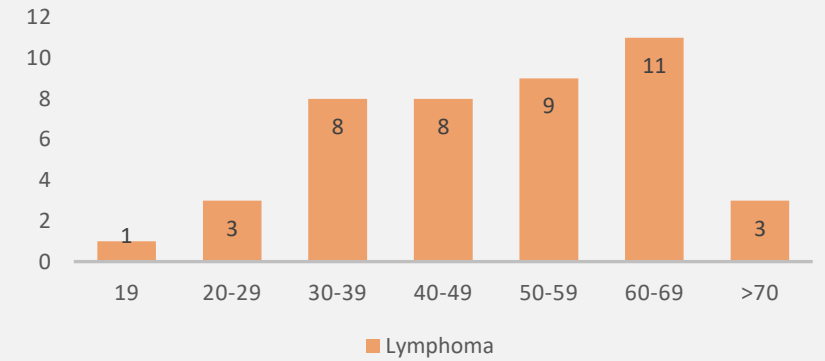
Hepatobiliary



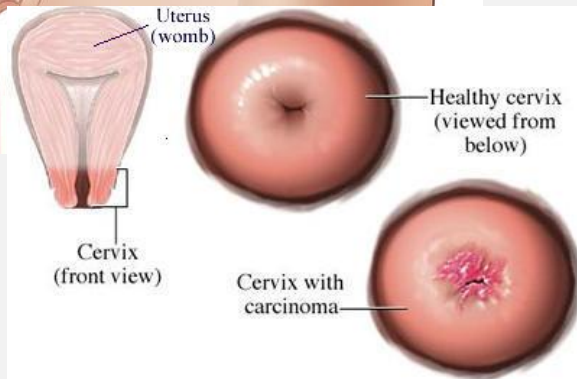
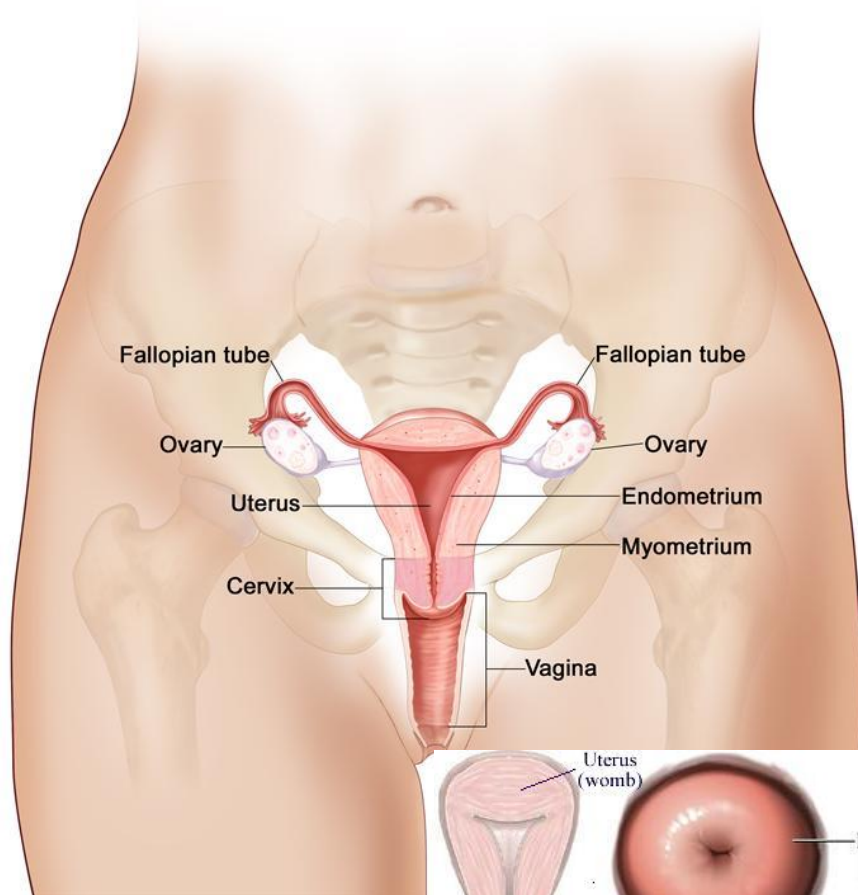
Lung



Lymphoma

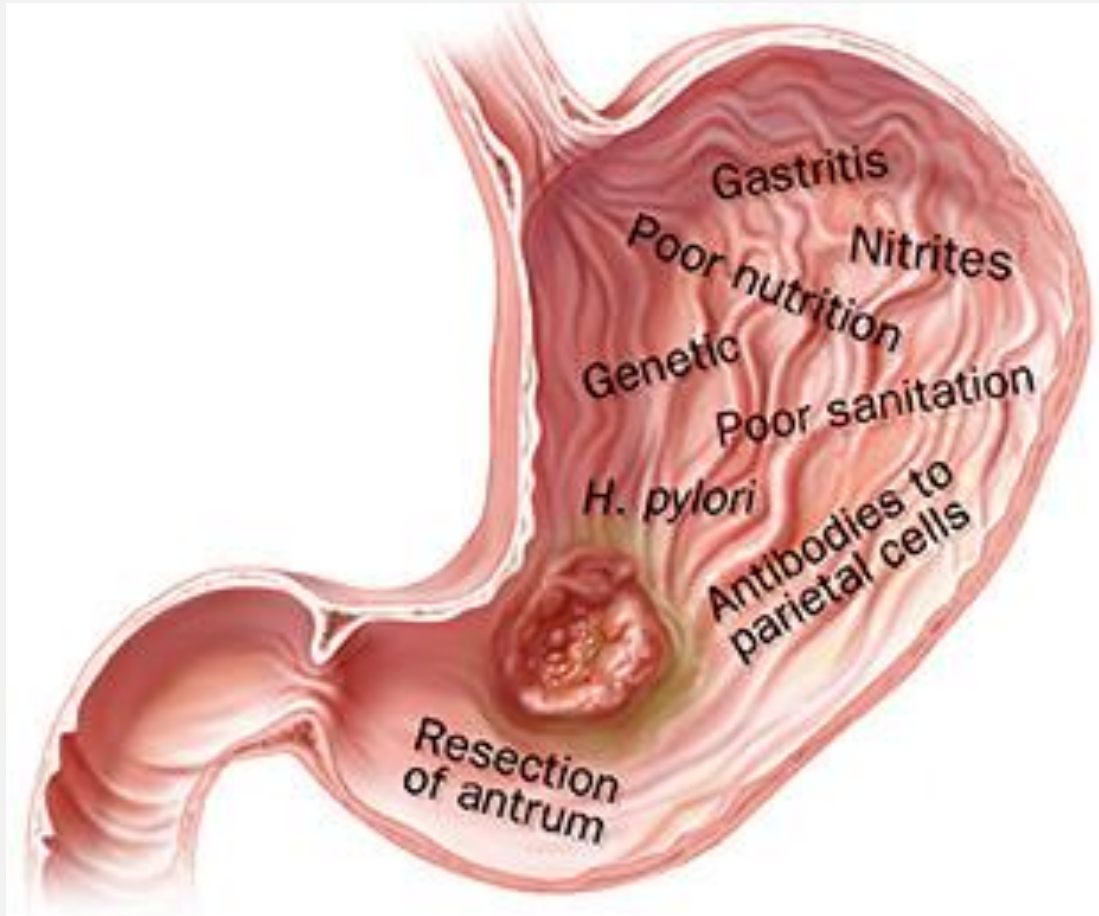


CA CERVIX AND RISK FACTORS



1. HPV infection: >80% by HPV infection (Type 16, 18, 45 and others)
2. Others: Sexually transmitted disease, Chlamydia, genetic tumor suppressor genes, oral contraceptive pills.

GASTRIC CANCER AND RISK FACTORS



1. [Helicobacter pylori >90%](#)
2. Age
3. Diet (ex. salty foods, preserved meats)
4. Tobacco smoking



Cancer Center Lao PDR
Est. 2017



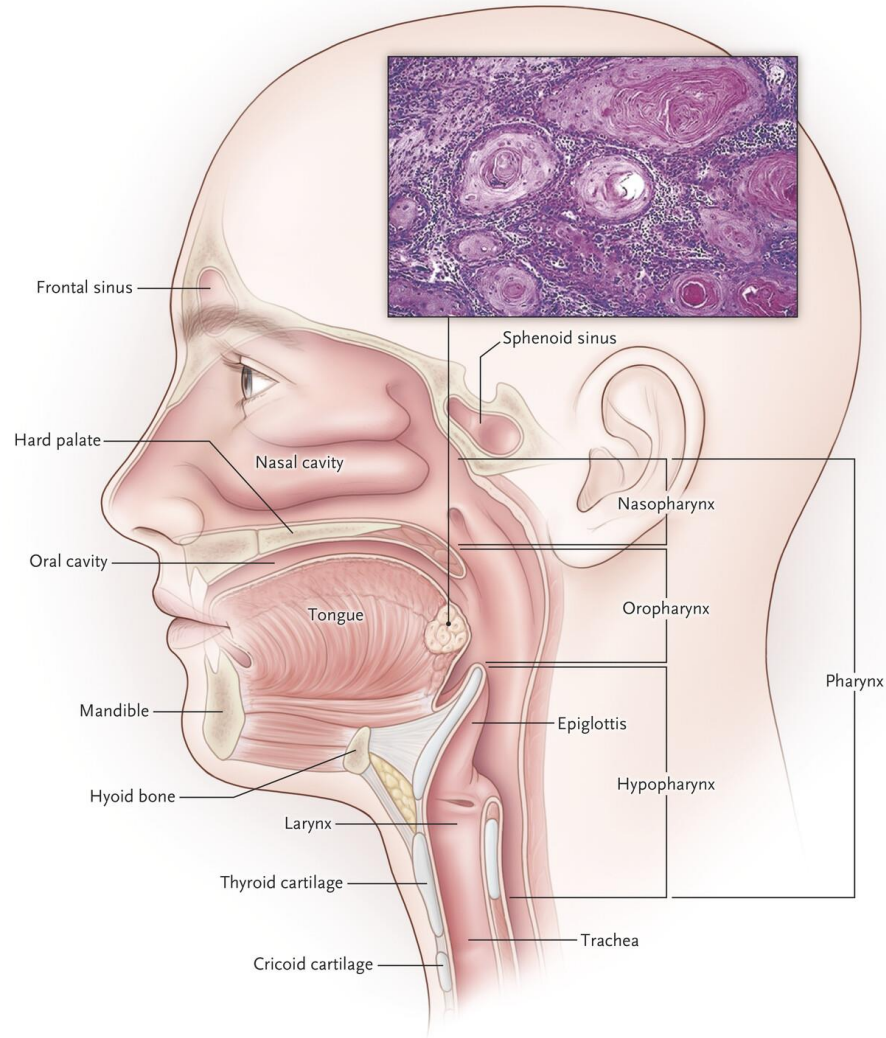
HIGAN-Project
Gastric Cancer Screening

OLYMPUS

21ST MARCH 2024 STARTED GASTRIC CANCER SCREENING FIRST CASE BY OUR SELF IN CANCER CENTER

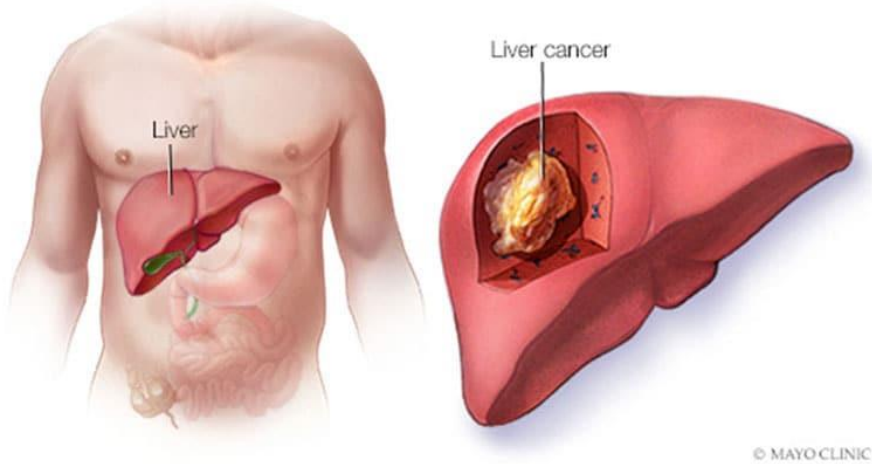


HEAD AND NECK CANCER AND RISK FACTORS



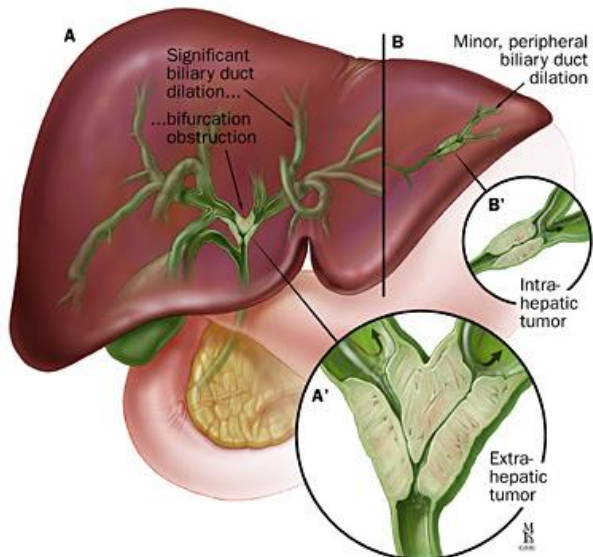
1. Strong association with Tobacco and alcohol
2. Tobacco chewing (betel nuts)
3. Increasing risk with HPV and EBV infections

HEPATOBIILIARY CANCER



© MAYO CLINIC

1. Hepatocellular Carcinoma, HCC (Hepatitis B, C virus), Alcohol, Fatty Liver, Aflatoxins
2. Cholangiocarcinoma, CCA (Parasitic infection *Opisthorchis Viverrini*, OV)



HEPATOBIILIARY IN LAOS

1. Hepatocellular carcinoma (HCC) and Cholangiocarcinoma (CCA) is among the common cancer in Laos and still under diagnosis
2. Main risk factors are Viral Hepatitis Infection, Liver fluke infection, Opisthorchis Viverrini (OV), Alcohol consumption
3. Cancer awareness on risk factors is low
4. Cancer Screening only episodic / mass screening once or twice a year
5. Access to definitive diagnosis very limited
6. Most of HCC / CCA patients are under diagnosis and presented in late stages

HEPATOBIILIARY RISK FACTORS IN LAOS

Adult risk factors	Total	
	Males	Females
HBV/ HCV Infection	HBsAg(+): 8.6%	
	HCV(+): 2.6%	
Parasite Infection	76.6%	
Alcohol consumption per capita	12.5L	2.3L

HEPATOBIILIARY CANCER IN LAOS

Age & Sex

- Risk increases with age
- Risk is higher among males than females in most of countries

Hepatitis B & C Infection

- HBV/HCV infection increases risk of hepatocellular carcinoma (HCC)
- An estimated 90% of liver cancer cases in developing countries are caused by HBV/HCV infection

Parasite Infection

- Highly pathogenic liver fluke increases the risk of bile duct cancer, cholangiocarcinoma (CCA)
- *O. viverrini* are classified as type I carcinogens by the IARC, WHO

Alcohol

- Risk is 16% higher in people who heavily drink alcohol (3+ drinks per day) compare to non-drinkers

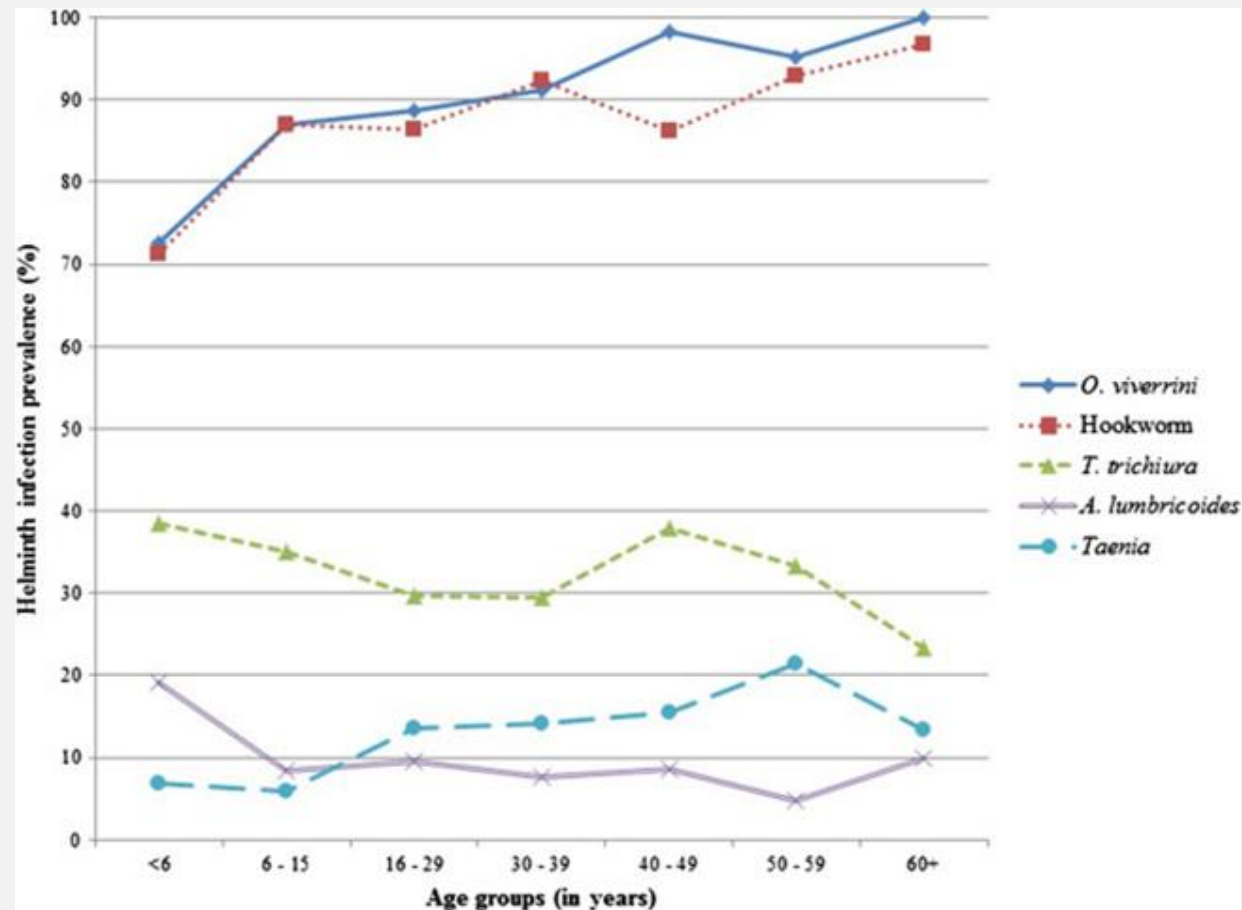
Example – Prevention (Education) NO RAW FISH Campaign

- People in Laos have a **low level of awareness of worm infections**. They usually eat raw fish dishes as a part of their daily diet (75.4%).
- The prevalence of ***O. viverrini*** and **hookworm** is **88.7%**, **86.6%** respectively. Most individuals are co-infected with *O. viverrini* and hookworm. (Laymanivong et al., 2014)

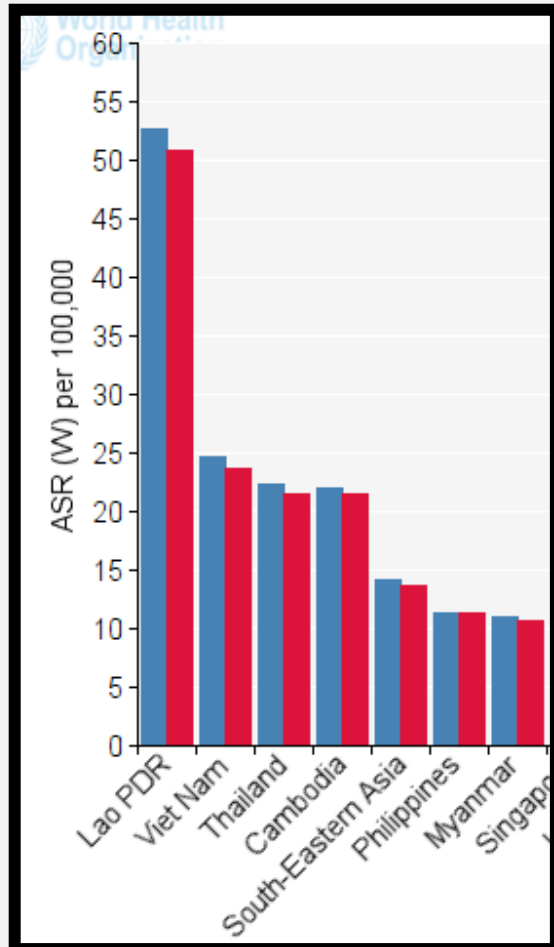


PARASITIC INFECTION IN LAOS

- *O. viverrini* and soil-transmitted helminths (STH) infections have a high prevalence in Laos. (Laymanivong et al., 2014)



PARASITIC INFECTION IN LAOS

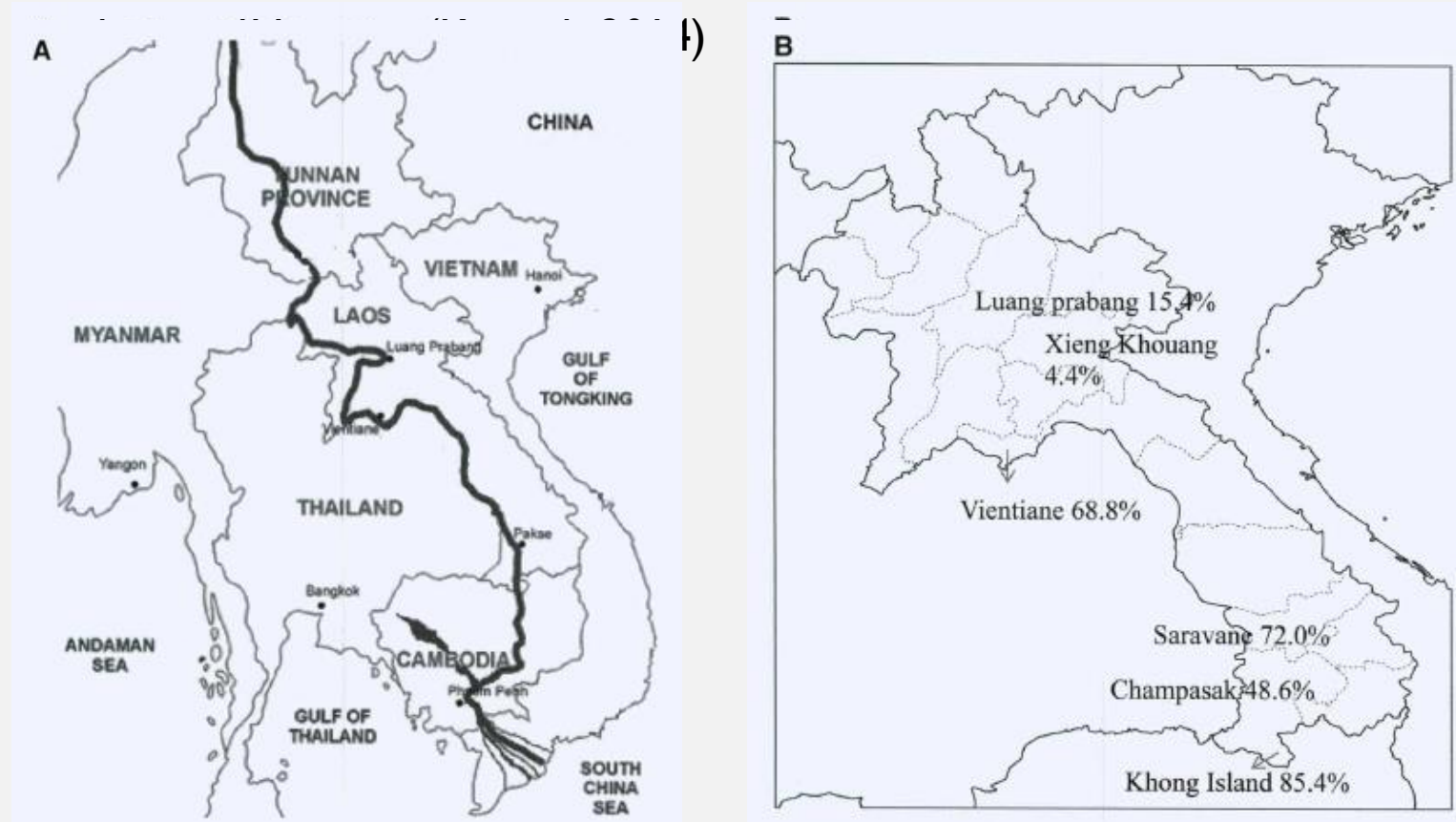


Country areas in the Mekong river basin

Basin	Area		Countries included	Area of country in basin (km ²)	As % of total area of the basin	As % of total are of the country
	km ²	% of Southeast Asia				
Mekong	795 000	3.8	China	165 000	21	2
			Myanmar	24 000	3	4
			Lao PDR	202 000	25	85
			Thailand	184 000	23	36
			Cambodia	155 000	20	86
			Viet Nam	65 000	8	20

PARASITIC INFECTION IN LAOS

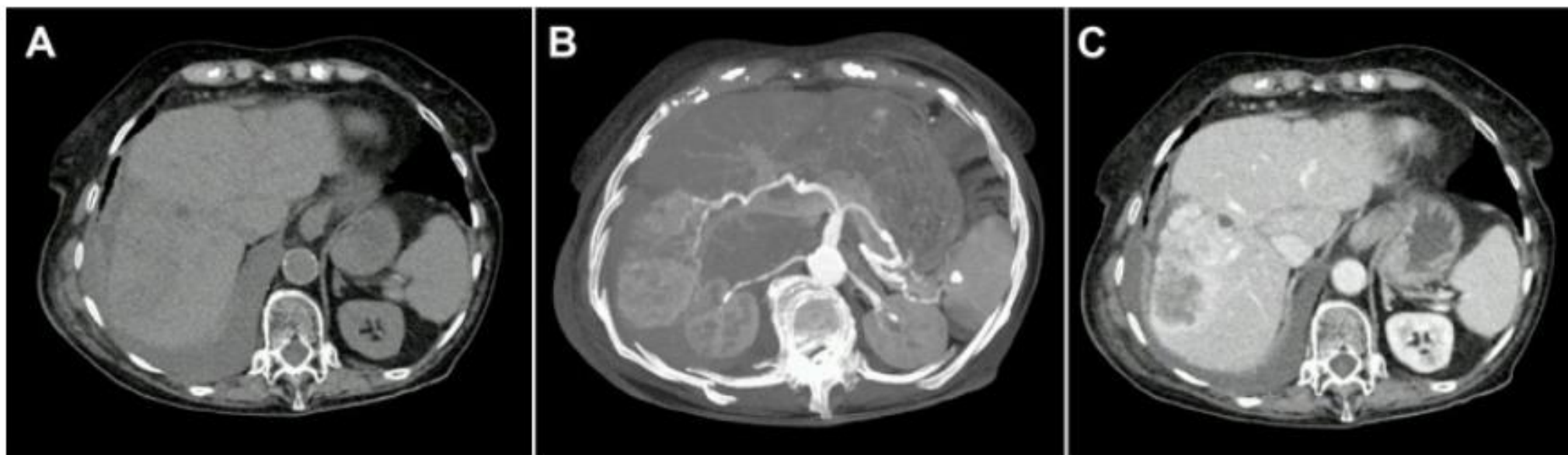
- *O. viverrini* is endemic in the Lower Mekong Basin, including Thailand, Lao PDR, Cambodia



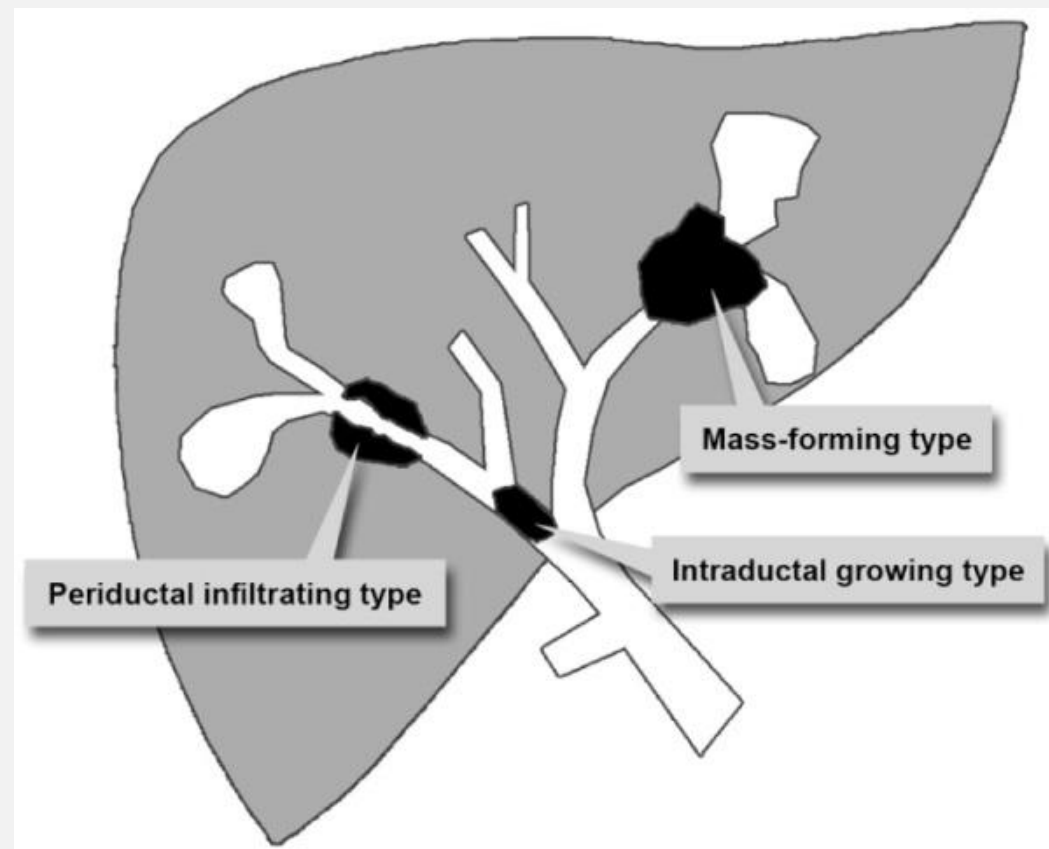
(B) Prevalence of *O. viverrini*/MIF by area in Lao PDR from 2009 to 2011

Fig. 2

CT images of an iCC. **A** In non-contrast enhanced images, a hypodense mass is visible in liver segment V-VI/VII-VIII. **B** Tumour vascularity can be visualized in major intensity projections of arterial-phase images. **C** The exact tumour size with peripheral enhancement and typical hypodense areas in the lesion centre are shown in portal-venous phase CT images.



TYPES OF CHOLANGIOCARCINOMA



CANCER PREVENTION

1. Most of the cancers in Laos are still under diagnosis, high burden
2. High risk factors are Viral Hepatitis Infection, Liver fluke infection, Opisthorchis Viverrini (OV), HPV infections, H. Pylori infections, Tobacco, Alcohol consumption
3. Cancer awareness on risk factors is low
4. Cancer Screening only episodic / mass screening once or twice a year
5. Access to definitive diagnosis very limited
6. Most of HCC / CCA patients are under diagnosis and presented in late stages

DIAGNOSIS CANCER IN LAOS

1. Most of the cancers by Biopsy confirmation (Cervix, GI Tract, NPC, Breast), but some are very difficult HCC/CCA, Lung
2. Help diagnosis and staging by imaging study (Echography, CT scan, MRI)
3. Immunohistochemical staining IHC not available
4. Clinical manifestation, tumor markers

**WORKSHOP FOR INNOVATION OF PHOTONIC AND
ELECTROCHEMICAL BIOSENSORS FOR
CHOLANGIOCARCINOMA DIAGNOSIS, MISSION IN LAOS
(NOV 13-14) ON NOV 13-16, 2023.**



**WORKSHOP FOR INNOVATION OF PHOTONIC AND
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BUDGET FOR WORKSHOP MISSION IN LAOS (NOV 13-14) ON NOV 13-16, 2023.

VI. Budget Plan:

No	Items	Descriptions	Quantity	Price per unit	Total
1	Van service for projects' member on days 12, 13, 14, 15 and 17 Nov 2023* Since Nov 17 is added, Please provide the new van quotations (two companies)	Rental fee for one round <u>pick</u> up for two teams form Khon Kaen, Thailand to Vientiane, Lao	1	975USD	975USD
2	Hotel Please give the accommodation quotation of Crown Plaza for price comparison purpose.	Room for three nights will preserve for 4 persons from CMU and KKU teams	4 x 3	960 USD	960 USD
3	Place	Place for workshop	15	1,450 USD	1,990 USD
Total Amount					3,925USD

PLAN FOR COMING YEAR

Refrigerator & Freezer Freezers, -150 °C ~ -25 °C

Freezer, -40 °C, Vertical Type

LF40-270E LF40-280E LF40-330E



LF40-330E

Key Features

High density CFC-free urethane foam insulation.



Microprocessor control, digital display, adjustable temperature range: -20 °C ~ -40 °C.

Digital display for easy observation.



Independent inner door or drawers to avoid more cooling leakage, and provide more stable inside temperature performance.



Permanently lubricated cooling fan for safety and longevity.



Lockable caster design for customer to move as needed.

Reliability

Chemically stable, CFC-free, commercially available and environmentally safe refrigerant.



Multiple malfunction alarms to detect high and low temperature, sensor error, power off, temperature controller malfunction, door ajar.

Application

It is suitable for low temperature test of special materials and preservation of plasma, biological materials, vaccines, reagents, biological products, chemical reagents, strains, biological samples, etc.

Optional

USB and temperature recorder.



Specifications

Model		LF40-270E	LF40-280E	LF40-330E
Capacity (L)		268	278	328
Dimension (W*D*H)	Internal (mm)	508*455*1137	480*415*1460	508*455*1393
	External (mm)	673*676*1630	659*600*1694	673*676*1886
Temperature	Range (°C) at RT. 10 ~ 32°C	-20 ~ -40	-20 ~ -40	-20 ~ -40
	Sensor	NTC	NTC	NTC
	Controller	Microprocessor	Microprocessor	Microprocessor
Cooling System	Refrigerant	R290 (CFC Free)	R290 (CFC Free)	R290 (CFC Free)
	Defrost	Manual	Manual	Manual
	Compressor (Qty)	CUBIGEL / 1	CUBIGEL / 1	CUBIGEL / 1
Display		Digital display	Digital display	Digital display
Audible & Visible Alarm	High / Low temperature	Standard	Standard	Standard
	High ambient temperature	/	/	/
	Sensor error	Standard	Standard	Standard
	Low battery	/	/	/
	Power failure backup		.	

BUDGET PLAN FOR PURCHASING EQUIPMENT



ICT Virtual Organization of ASEAN Institutes and NICT
(ASEAN IVO)

VII. Budget estimate

No	Items	Descriptions	Quantity	Price per unit	Total
1	Refrigerator and Freezer -40	Suitable for low temperature test of special materials and preservation of plasma, biological materials, vaccines, reagents, biological products, chemical reagents, strains, biological samples, etc	01	4,370 USD	4,370 USD
2	UPS Power management	Line interactive UPS with stabilizer pure sine wave	01	1,670 USD	1,670 USD
		Total Amount			6,040 USD

*Please select the item with lower cost.

VIII. Quotations from two local companies

1. DDP Chaleunxup Co., Ltd
2. LAO KBN Medical Product

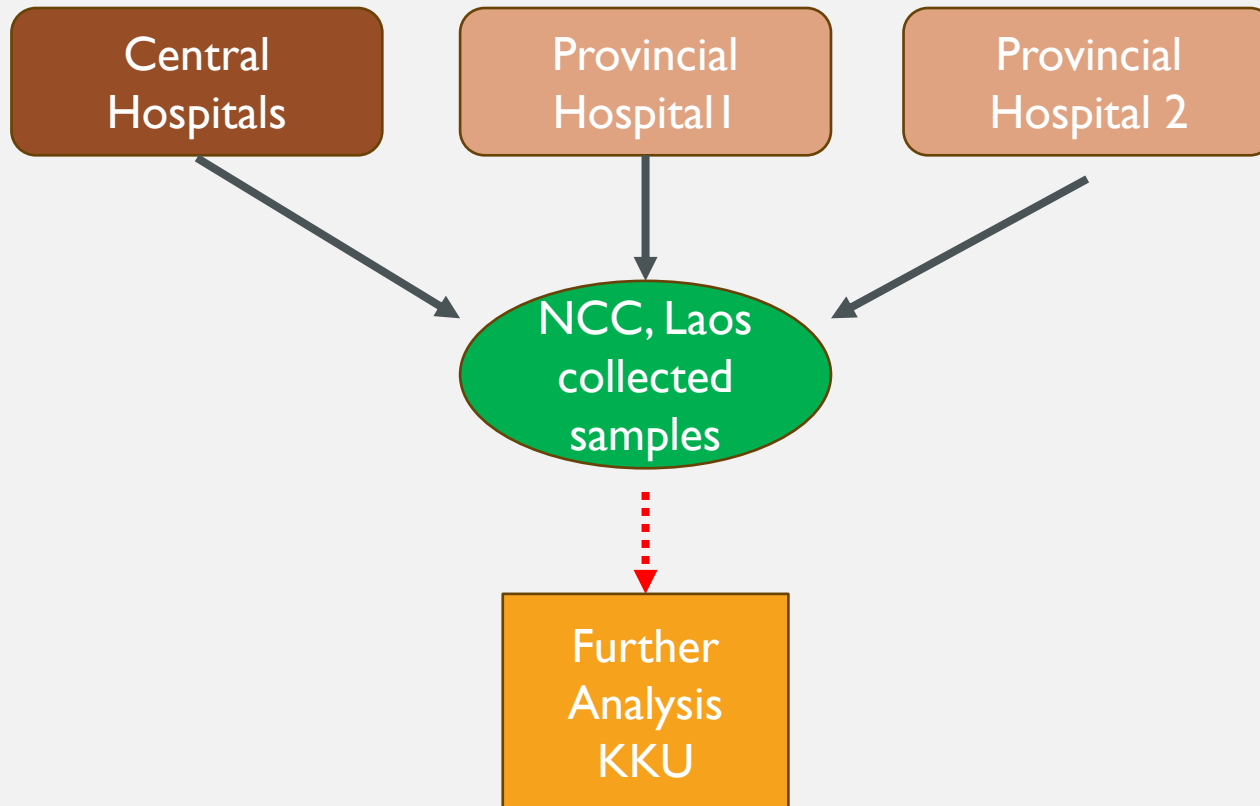
REASONS FOR NEEDING THE EQUIPMENT

Lao PDR team has high incidence of CCA patients and who are high risk for CCA in community and hospital based. For sample collection for project research.

The success of biosensors platform development will be also transferred and implemented in Lao PDR for point-of-care of CCA diagnosis.

MISSION COLLECTING SAMPLES

The total numbers could be from 100 up to 1,000 cases



Once the Ethic approved, the team will collect various samples of patient group in central and provincial hospital. (Mittaphab, Cancer Center, Khammuan, Savanakhet, Champasack hospital)

All samples will be stored at -40°C and then will be waiting for further investigated using biosensing developments platform and store in Cancer Center Laos for certain period

The sample will be further send to KKU Thailand for long-term stored.

S

Strength

- Socialist Nation of a One-party state
 - Political Stability
- **Government Efforts to attract Foreign Research and studies**
- Low Personnel Expenses

W

Weakness

- Lack of Infrastructure
 - Inactive Cancer Registry
 - Poor Availability of data
 - Lack of Health Professionals
- **Lack of Health Awareness**
- **High risk behavior**
 - Traditional dietary habit (raw fish)
 - High amount of alcohol consumption
 - High prevalence of tobacco
- High Prevalence of Infectious Disease

S.W.O.T analysis

- Financial support from International Organization
 - Collaborative International Funding Opportunities

ASEAN IVO, NICT, KCU

O

Opportunity

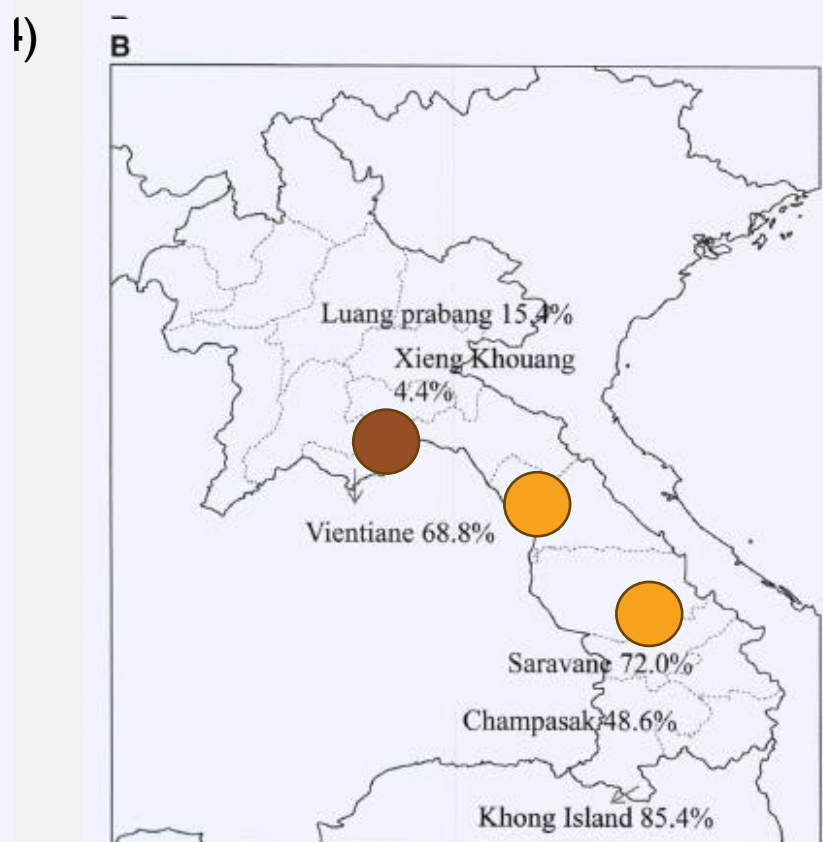
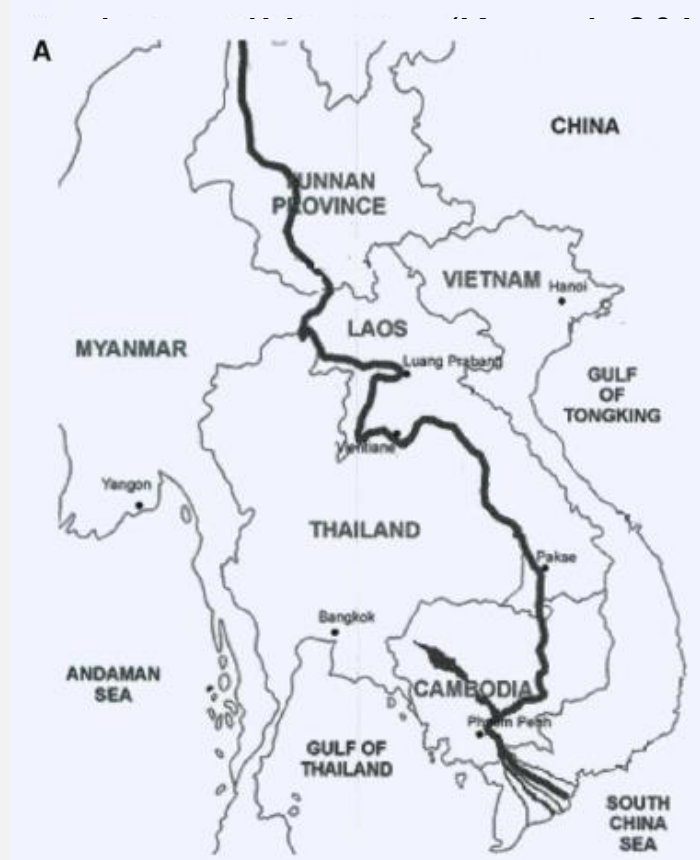
- Lack of coordinated and harmonized budget, **Inflation**
- Geography (Land-locked country surrounded by five other countries)
- **Timing, season**
- **Maintenance facilities and environments**
- Taboo

T

Threat

COLLECTING MISSION PLAN

- *O. viverrini* is endemic in the Lower Mekong Basin, including Thailand, Lao PDR, Cambodia



(B) Prevalence of *O. viverrini*/MIF by area in Lao PDR from 2009 to 2011

INTERNATIONAL COLLABORATION

1. IAEA & IARC (International Atomic Energy Agency & International Agency for Research on Cancer)
2. UICC (Union for International Cancer Control)
3. WHO country & WPRO, GCSP-NCI Korea
4. ANCCA (Asians National Cancer Center Alliances) Japan
5. NCI and KKU, Thailand



IAEA
International Atomic Energy Agency

**International Agency
Research on Cancer**



**World Health
Organization**



A MEMBERSHIP ORGANISATION
FIGHTING CANCER TOGETHER



THANK YOU