Presentation # 1

EXPLORING CANCER DATA AND RESEARCH DIRECTIONS IN HEALTHCARE AI

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ROLL #:002

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COURSE: AIHC

LEVEL: MSCS (SEM I)

Introduction:

- Cancer is one of the top causes of death worldwide.
- abnormal cells grow uncontrollably and can spread to other parts of the body.
- It can begin in almost any organ or tissue — such as the lung, breast, colon, skin, or mouth.
- **Common causes:** tobacco, infections, unhealthy diet, pollution, and genetics.
- **Types:** solid tumors (e.g., breast, oral, lung) and blood cancers (e.g., leukemia, lymphoma).
- Early detection helps improve treatment and survival.
- Focus on **breast cancer in Pakistan**.
- **AI** is being used to detect and diagnose cancer using **open datasets**

Part A – Cancer Landscape Exploration

- **Source:** WHO & GLOBOCAN 2022
- Over **36 major cancer types** recognized globally.
- **Top 10 most common cancers worldwide:**
- Breast, Lung, Colorectal, Prostate, Stomach
- Liver, Cervical, Thyroid, Bladder, Non-Hodgkin Lymphoma
- **Breast cancer**: → **most diagnosed worldwide** ~12.5% of all new cancer cases

1.Global Cancer Overview

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- **Breast cancer**: ~12.5% of all new cancer cases → **most diagnosed worldwide**

Global Cancer Classification (ICD-10 & Body Region)

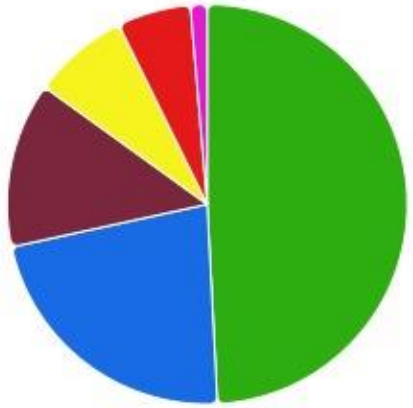
- Total recognized cancer sites: **39**
- **ICD-10 codes**: Standard labels for diseases

➢ **Grouped by body region:**

A. Head & Neck (Lip, Oral Cavity, Throat, Nasopharynx, etc.)
B. Digestive System (Stomach, Colon, Rectum, Liver, Pancreas)
C. Respiratory (Lung, Larynx, Mesothelioma)
D. Reproductive (Breast, Cervix, Ovary, Prostate, Testis)
E. Blood & Lymph (Leukaemia, Lymphomas, Multiple Myeloma)
F. Others: Skin cancers, Brain & CNS, Kaposi Sarcoma

Prevalent Cases Continent Vise:

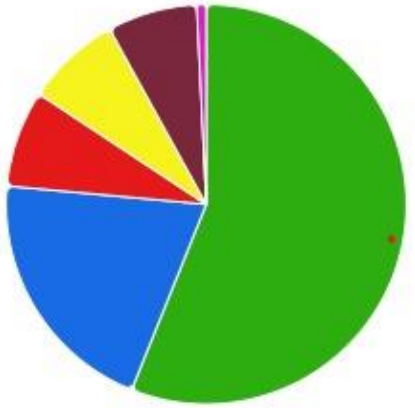
Incidence



Continent	Cases	Percent
Asia	9 826 539	49.2%
Europe	4 471 422	22.4%
Northern America	2 673 174	13.4%
Latin America and the Caribbean	1 551 060	7.8%
Africa	1 185 216	5.9%
Oceania	269 088	1.3%

Incidence, both sexes

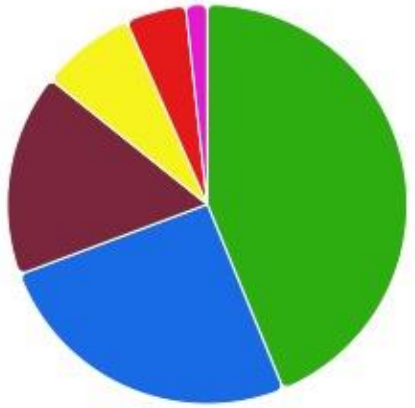
Mortality



Continent	Deaths	Percent
Asia	5 464 451	56.1%
Europe	1 986 093	20.4%
Africa	763 843	7.8%
Latin America and the Caribbean	749 242	7.7%
Northern America	706 427	7.2%
Oceania	73 776	0.76%

Mortality, both sexes

Prevalence



Continent	Prev. cases	Percent
Asia	23 429 909	43.8%
Europe	13 646 087	25.5%
Northern America	8 799 565	16.4%
Latin America and the Caribbean	4 096 032	7.7%
Africa	2 611 478	4.9%
Oceania	921 116	1.7%

5-year prevalence, both sexes

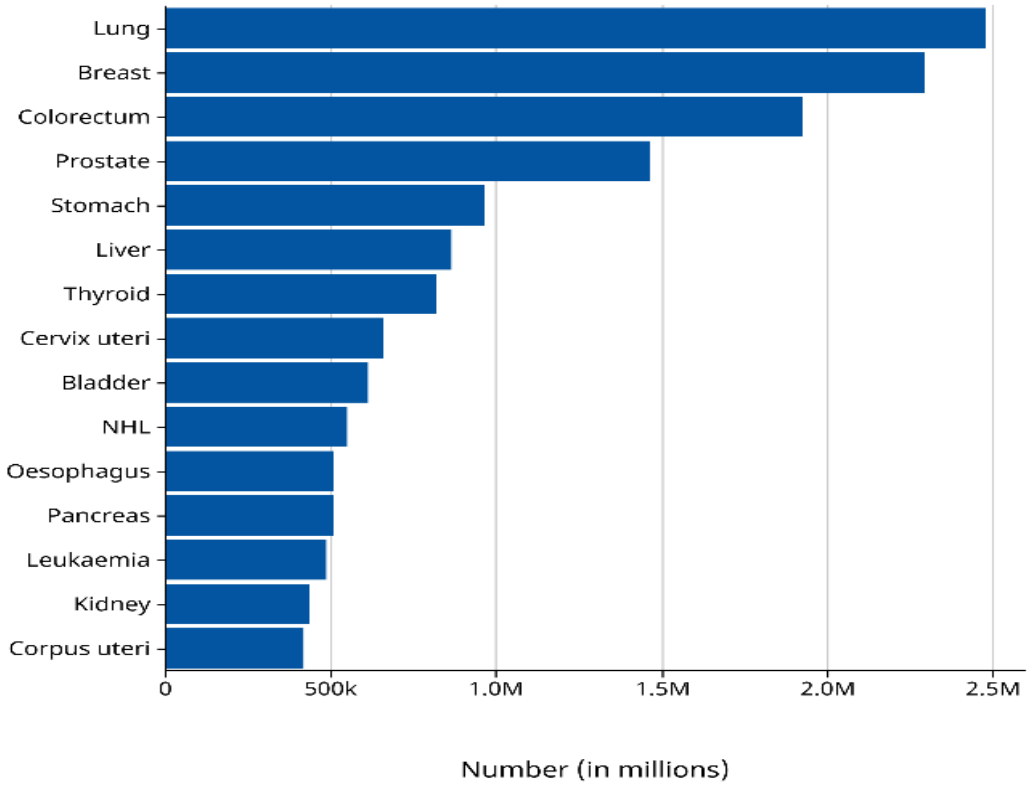
Notes & Special Cases:

- Bladder cancer may include uncertain or in-situ tumors.
- Non-melanoma skin cancer excludes basal cell carcinoma.
- Kaposi sarcoma considered in HIV-related mortality data.
- **All cancers combined (C00–C97)** include all sites globally.

Top 10 Global Cancers (WHO / GLOBOCAN 2022)

Rank	Cancer Type	Brief Description
1	Breast	Most common cancer in women worldwide
2	Lung	Cancer of lungs and windpipe
3	Colorectal	Cancer of colon and rectum
4	Prostate	Male reproductive gland cancer
5	Stomach	Cancer of the stomach
6	Liver	Liver and bile ducts cancer
7	Cervical	Lower part of uterus cancer
8	Thyroid	Cancer of thyroid gland
9	Bladder	Urinary bladder cancer
10	Non-Hodgkin Lymphoma	Lymph node cancer

Absolute numbers, Incidence, Both sexes, in 2022
World
(Top 15 cancer sites)

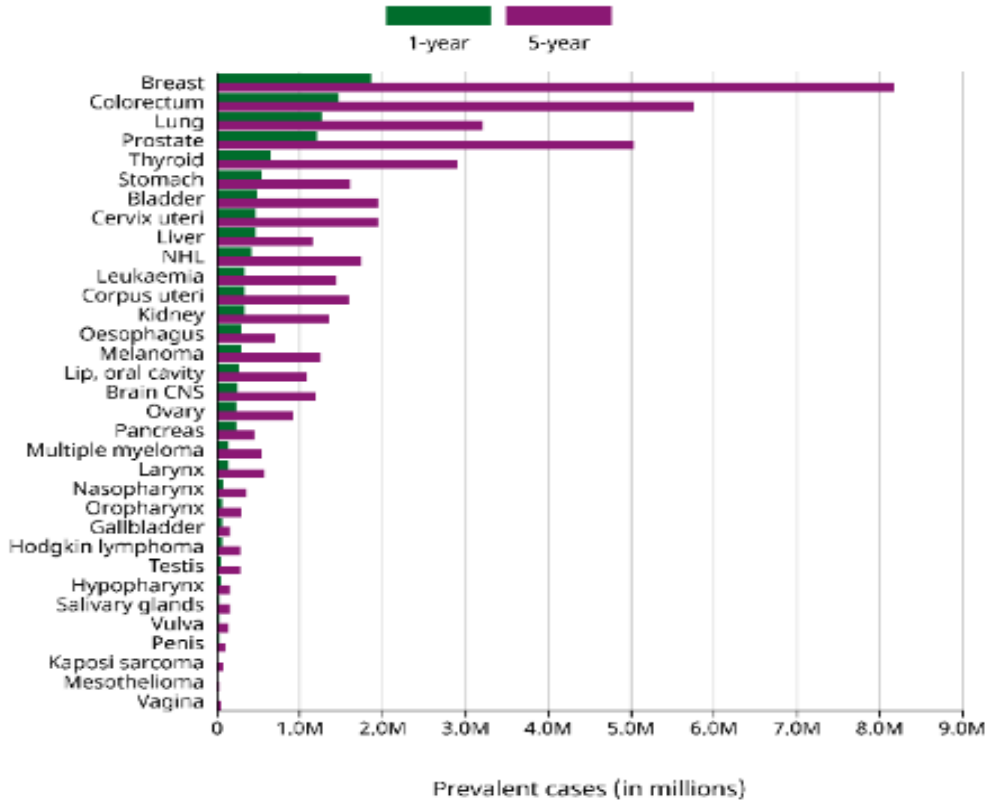


Cancer TODAY | IARC - https://gco.iarc.who.int/today
Data version : Globocan 2022 (version 1.1)

International Agency for Research on Cancer
World Health Organization

Recent 1 and 5 years:

Estimated number of prevalent cases, Both sexes, in 2022
World
All cancers



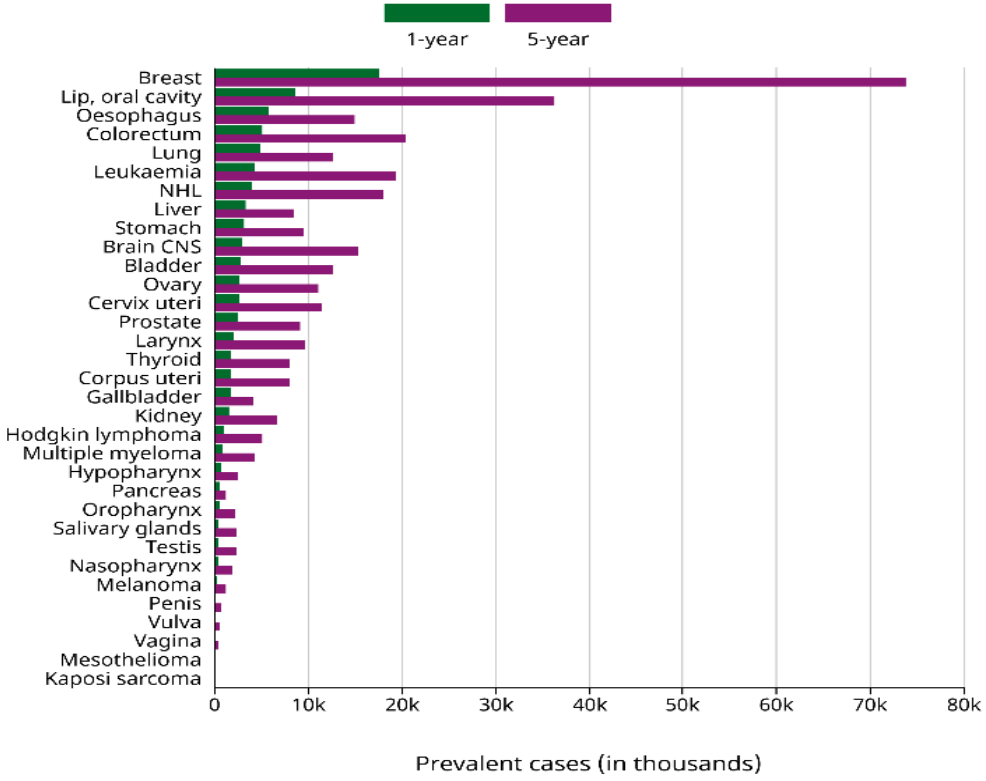
International Agency for Research on Cancer
World Health Organization

2.National View (Pakistan)

- In Pakistan, **Shaukat Khanum Cancer Registry** and **GLOBOCAN 2022** report the following:
- Most prevalent cancers: **breast, oral cavity, lung, colorectal, lymphoma**
- **Gender trends:** Breast cancer dominates in females, oral and lung cancers dominate in males
- **Region trends:** Punjab has the highest incidence, followed by Sindh and Khyber Pakhtunkhwa

Recent 1 and 5 years:

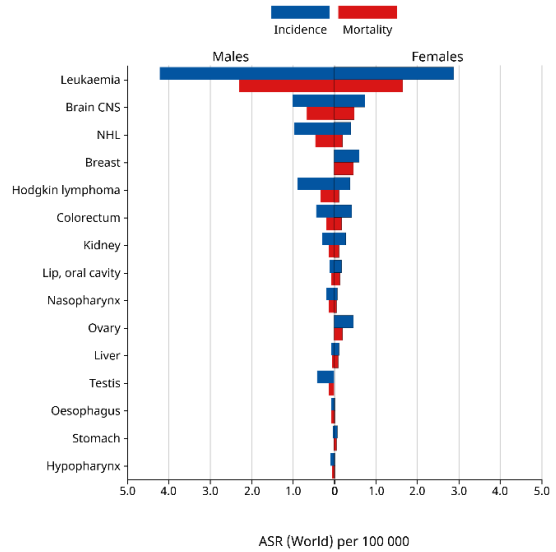
Estimated number of prevalent cases, Both sexes, in 2022
Pakistan
All cancers



International Agency for Research on Cancer
World Health Organization

According to incident ,mortality and Age

Age-Standardized Rate (World) per 100 000, Incidence and Mortality, Males and Females, age [0-24], in 2022
Pakistan
(Top 15 cancer sites)



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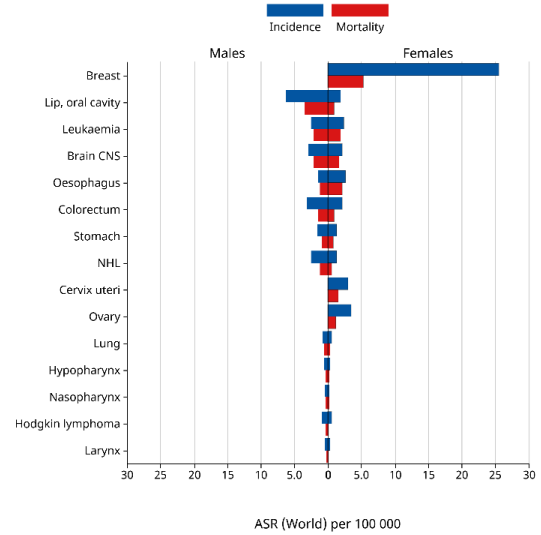
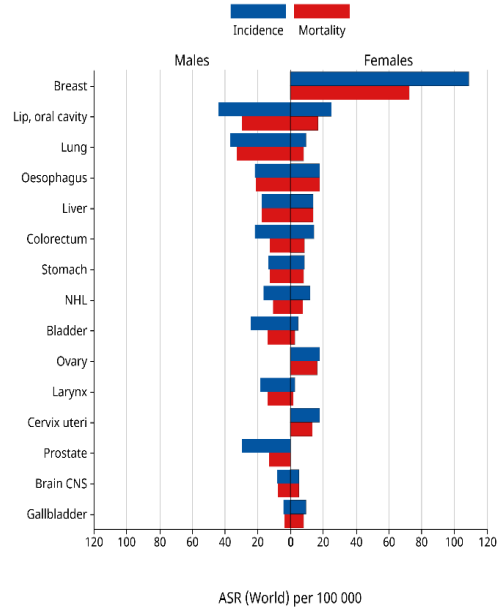
World Health Organization

Age-Standardized Rate (World) per 100 000, Incidence and Mortality, Males and Females, age [25-39], in 2022
Pakistan
(Top 15 cancer sites)



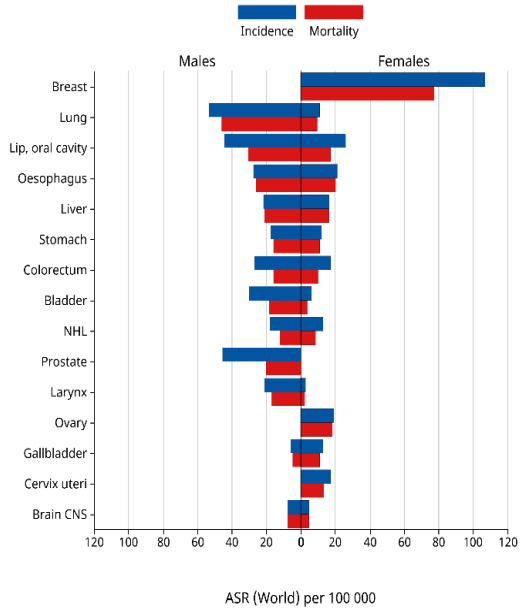
International Agency for Research on Cancer
World Health Organization

Age-Standardized Rate (World) per 100 000, Incidence and Mortality, Males and Females, age [55-69], in 2022
Pakistan
(Top 15 cancer sites)



International Agency for Research on Cancer
World Health Organization

Age-Standardized Rate (World) per 100 000, Incidence and Mortality, Males and Females, age [60-84], in 2022
Pakistan
(Top 15 cancer sites)



International Agency for Research on Cancer
World Health Organization

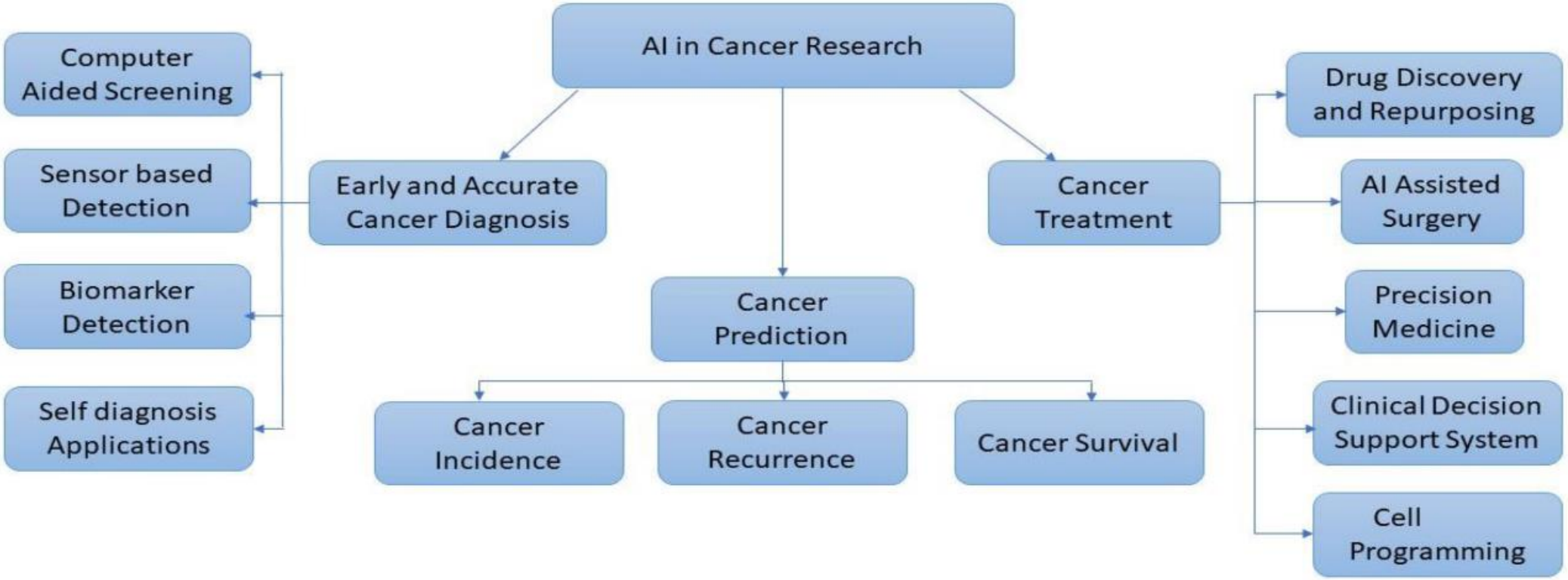
Cancer Statistics Summary

Cancer Type	Global Rank	Pakistan Rank	Incidence Rate	Gender (M/F)	Most Affected Region	Source
Breast Cancer	1	1	12.5% (Global)	F	Punjab	WHO, GLOBOCAN, SKMCH
Lung Cancer	2	3	12.2% (Global)	M	Sindh	WHO, GLOBOCAN
Colorectal Cancer	3	4	10.7% (Global)	M/F	Punjab	WHO, GLOBOCAN
Prostate Cancer	4	-	7.3% (Global)	M	-	WHO
Oral Cancer	9	2	3.9% (Global)	M	Sindh	Shaukat Khanum Registry

Part B – Research Direction Identification

- **Selected Cancer: Oral Cancer Diagnosis**
- **Why Oral Cancer?**
- High cases in **Pakistan**, especially among males
- Can be detected **early** using non-invasive imaging
- **Open datasets** available for AI training
- Supports **mobile / computer-aided** screening tool development

AI In Cancer Research



AI Research Directions in Early Detection

Research Area	Description	AI Approach / Tools
Early lesion detection	Identify oral lesions before cancer develops	CNN, Vision Transformers, Mobile AI apps
Histopathology analysis	Classify tissue as normal, precancerous, or malignant	ResNet, DenseNet, U-Net
Multi-modal modeling	Combine image + patient data	Ensemble learning, multi-input neural nets
Explainable AI	Help doctors understand AI predictions	Grad-CAM, LIME, SHAP
Risk prediction	Predict cancer recurrence or progression	Random Forest, SVM, Gradient Boosting

Challenges & Opportunities

Challenges:

- Limited datasets
- Poor image quality
- Ethical and privacy concerns
- Low-resource deployment issues

Opportunities:

- Early screening **AI apps**
- Use of **multi-modal models**
- Integration of **explainable AI** for doctors

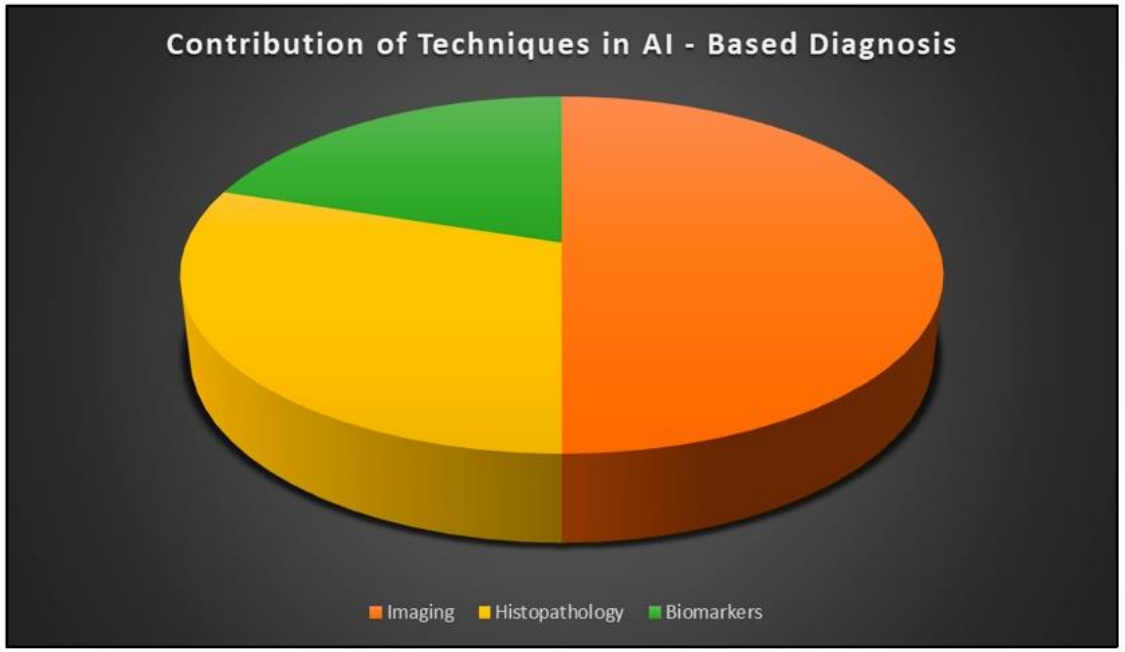
Cancer Detection Modalities

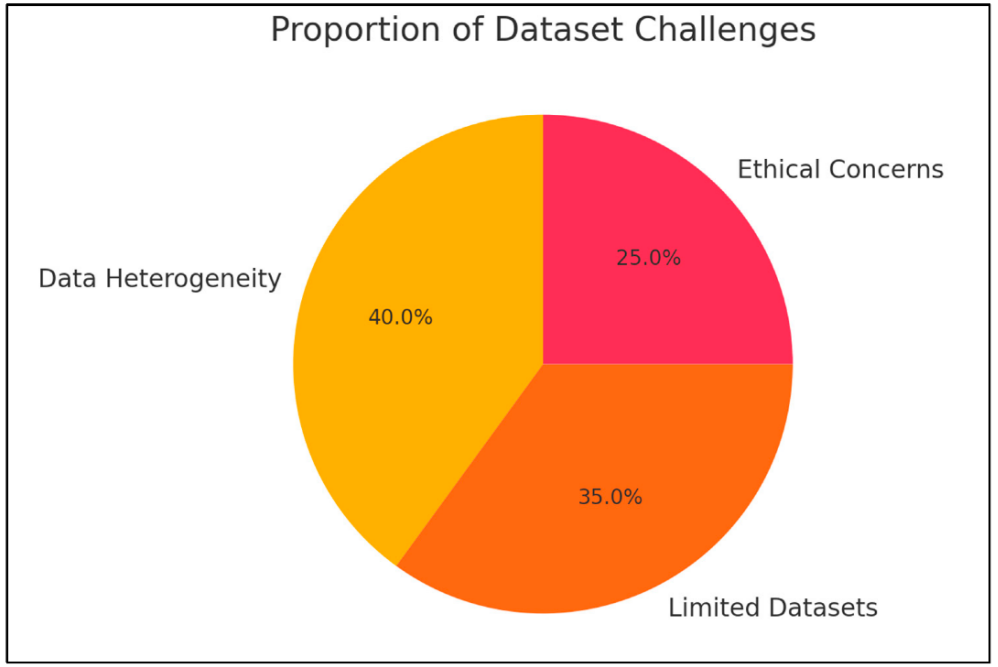
Modality means the method or technology used to detect or diagnose cancer.

Modality	Description	Use in Oral Cancer
Clinical Examination	Visual check by doctor	First-level screening
Imaging	Captures images of tissues	X-rays, CT, MRI, Intraoral cameras
Histopathology	Microscopic study of tissue biopsy	Confirming cancer type
Molecular Tests	Detect genetic or protein markers	Identify cancer mutations
AI / Computer Vision	Analyze images automatically	Detect early lesions from photos

Part C – Dataset Exploration

Dataset	Type	Size	Access
Oral Cancer (Kaggle)	Clinical photos (benign/malignant)	~1,200 images	Kaggle – Oral Cancer
ISBI Oral Lesion (NIH)	Annotated oral mucosal images	2,000+	NIH ISBI Challenge
AIIMS Oral Cancer (India)	Hospital-based clinical images	~4,000	Institutional Access
Augmented Oral Cancer (GitHub)	Data for CNN model training	Variable	GitHub search: Oral Cancer Classification Dataset


Contribution of Techniques in AI - Based Diagnosis
Imaging
Histopathology
Biomarkers


Proportion of Dataset Challenges
Ethical Concerns
25.0%
Data Heterogeneity
40.0%
35.0%
Limited Datasets

Recent Review Papers on Oral Cancer & AI

- **1. *"Insights Into AI-Enabled Early Diagnosis of Oral Cancer"* (2025)**
- Explores AI's role in **early diagnosis**, especially in **low-resource settings**.
- Highlights **AI techniques** and their applications in oral cancer detection.
  Read the full article here

- **2. *"Assessing Artificial Intelligence in Oral Cancer Diagnosis"* (2025)**
- Reviews **12 major studies** on AI applications in oral cancer diagnosis.
- Focus on **lesion identification** and **prognostic prediction** using ML & DL.
  Access the study on PubMed

- **3. *"Revisiting Early Detection of Oral Cancer: A Review on Methods, Impact on Survival Rates, and Recurrence Prevention"* (2025)**
- Discusses **early detection**, **impact on survival**, and **recurrence prevention**.
- Compares various **diagnostic methods** and their effectiveness.
  Read the article here

Conclusion

- **Oral cancer** is a major health concern in Pakistan.
- **AI** offers great potential for:
  - Early **detection** and **lesion classification**
  - **Risk prediction** and patient monitoring
  - **Mobile-based screening tools** for low-resource areas
- AI can help **bridge healthcare gaps** and **improve survival outcomes** through faster and more accurate diagnosis.
- 💡 *AI-driven early detection can save lives and make screening more accessible.*

References

- World Health Organization – Cancer Fact Sheet
- GLOBOCAN 2022 – Global Cancer Observatory
- Shaukat Khanum Cancer Registry Reports (2022) – shaukatkhanum.org.pk
- National Cancer Registry of Pakistan (NCRP), *JCPSP 2015–2019*
- Kaggle – Oral Cancer Image Dataset
- ISBI Dataset – Oral Lesion Histopathology Dataset
- *"Artificial Intelligence in Oral Cancer,"* MDPI Diagnostics, 2023

Thank You for Your Attention!

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TOPIC: EXPLORING CANCER DATA AND RESEARCH DIRECTIONS IN HEALTHCARE AI

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