

Translational Research; Presents A Significant Challenge in Cancer in The Personalized Medicine Era

Prof. Dr. Aisyah Elliyanti, MD

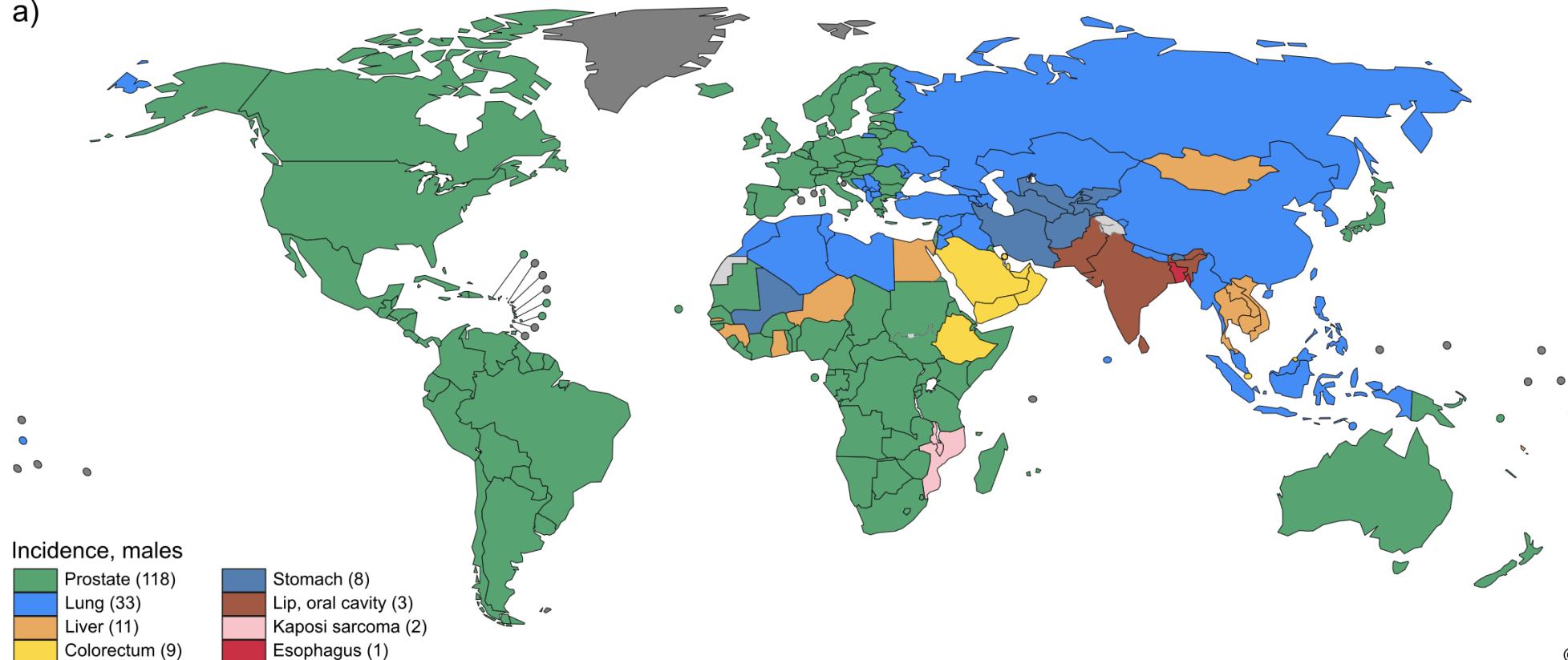
Faculty of Medicine, Universitas Andalas

19 December 2025

Cancer Incidence

(in Males) 10th to rank

a)



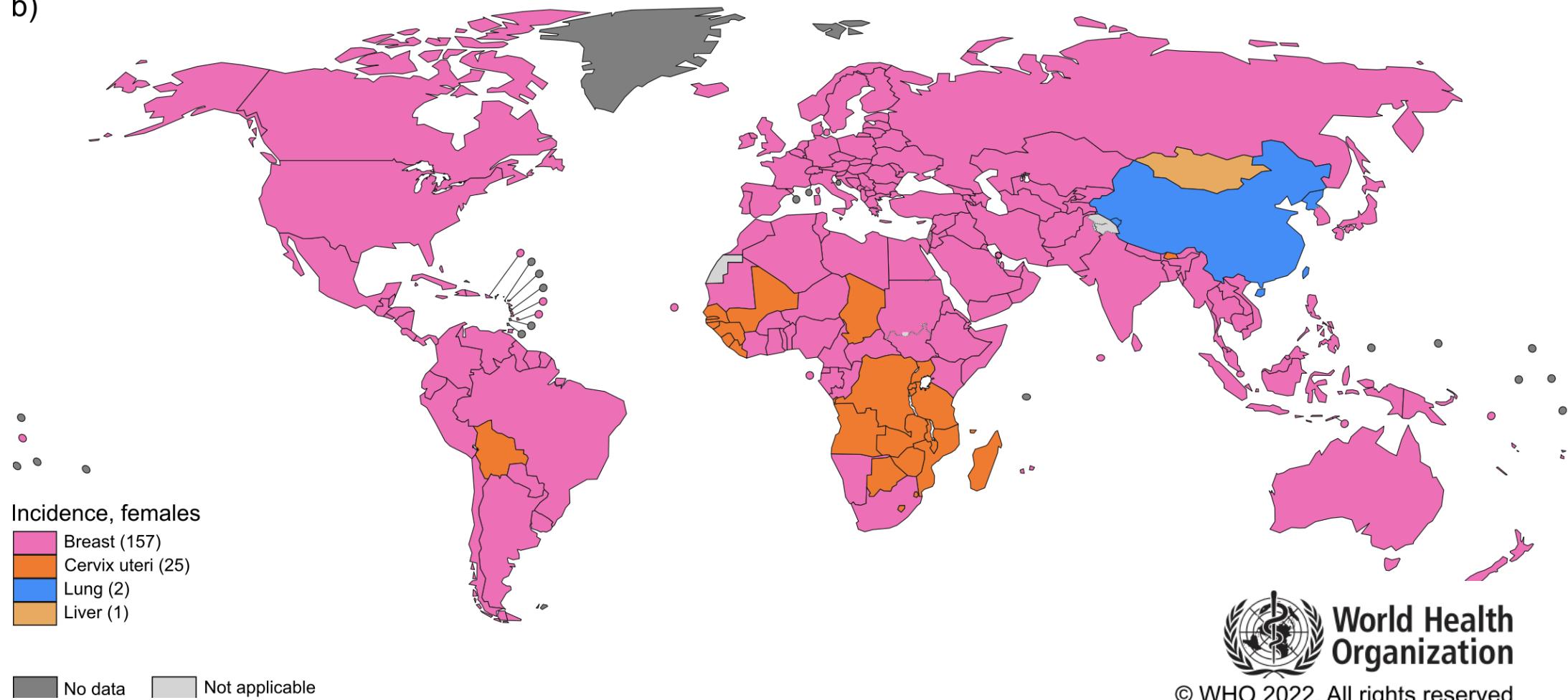
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Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries

Cancer Incidence

(in Females, 5th top rank)

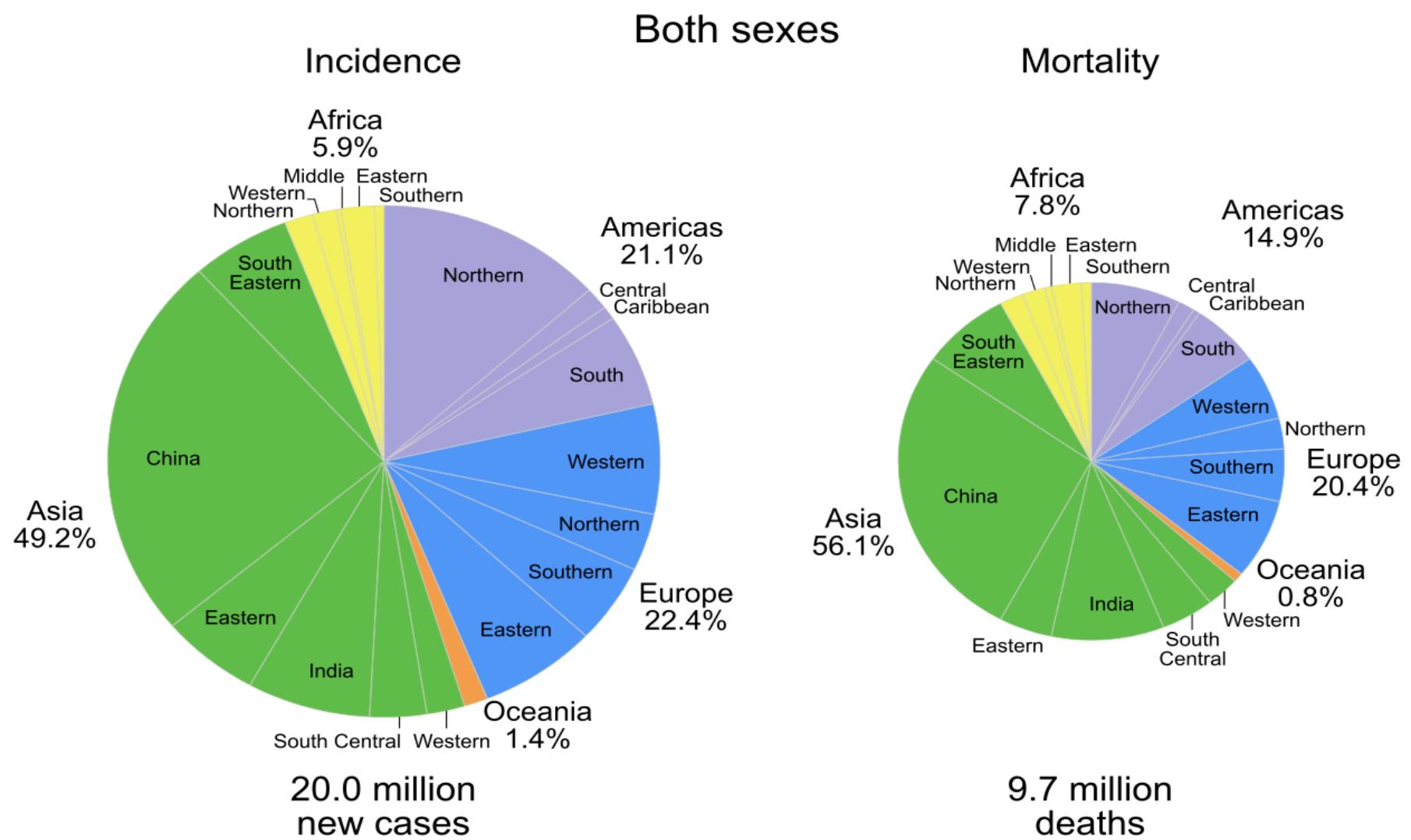
b)



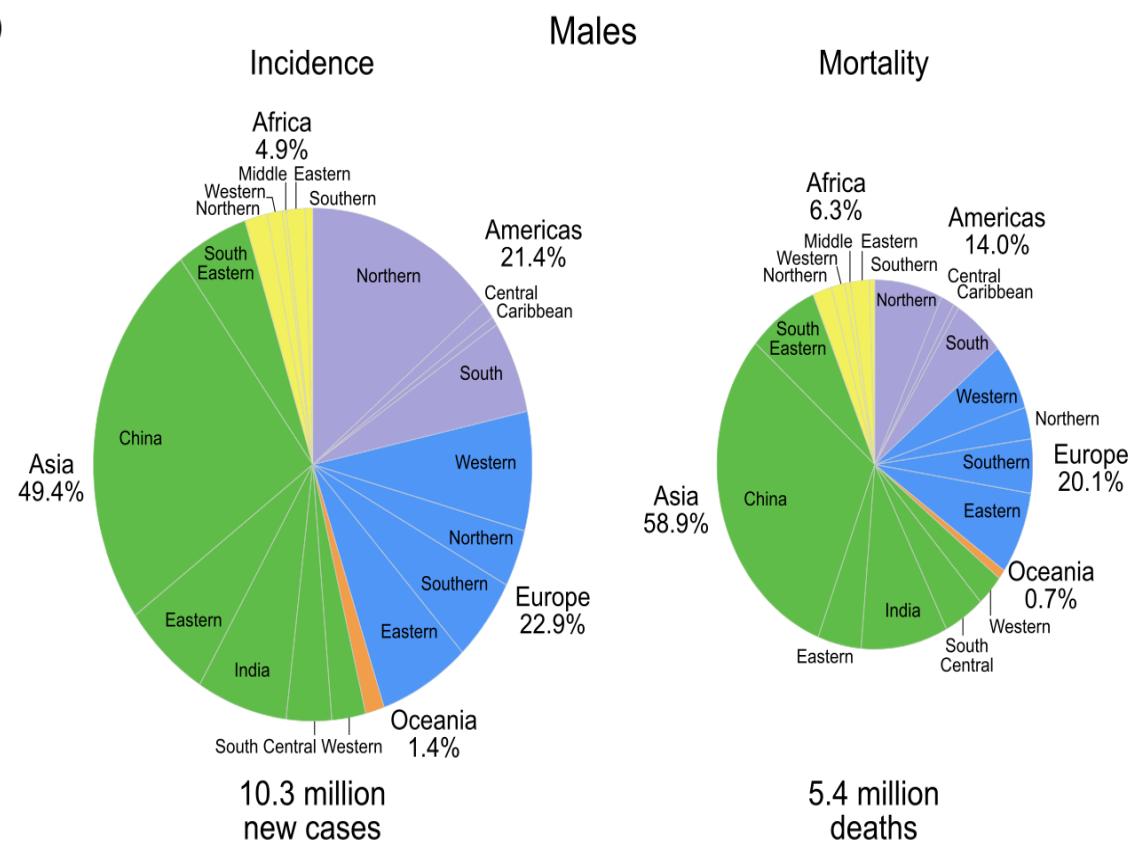
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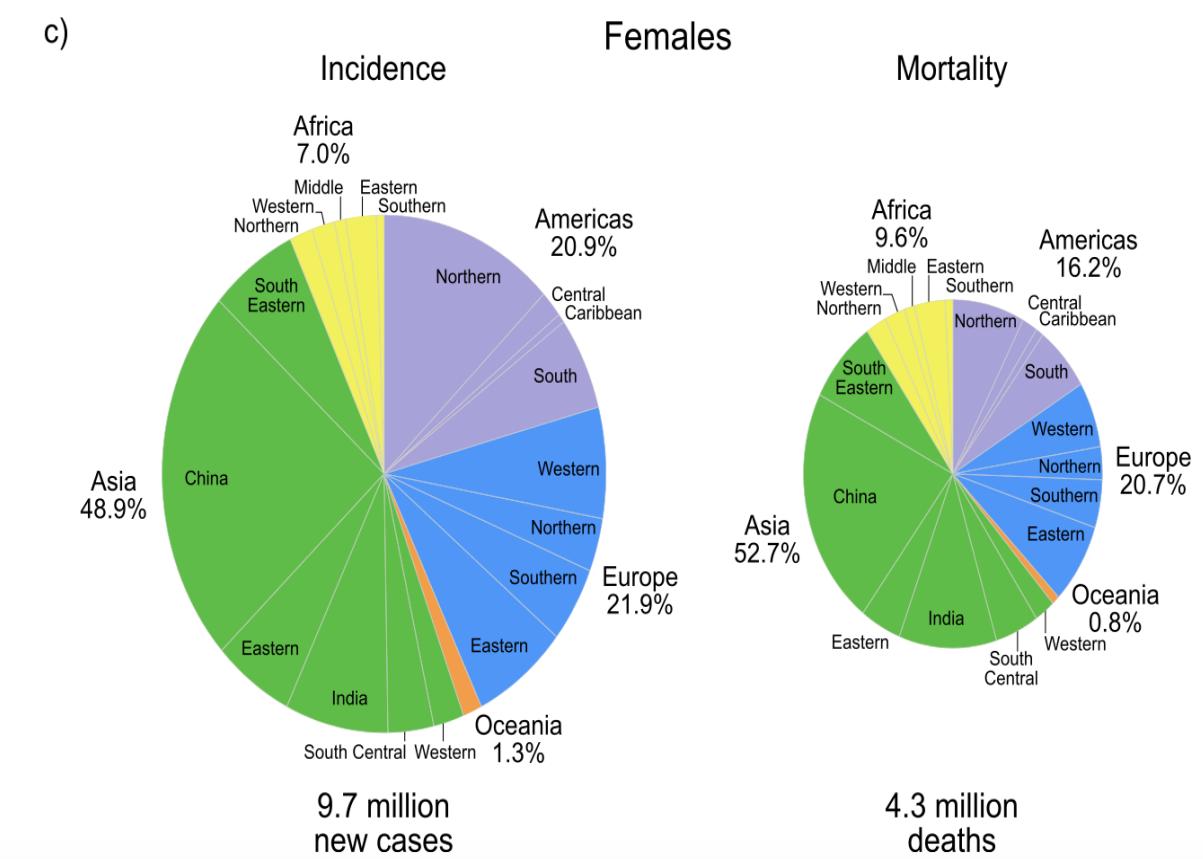
a)



b)



c)



Original Investigation | Health Policy

Financial Toxicity Among Patients With Breast Cancer Worldwide A Systematic Review and Meta-analysis

Anam N. Ehsan, MBBS; Catherine A. Wu, MD; Alexandra Minasian, MS; Tavneet Singh, MS; Michelle Bass, PhD; Lydia Pace, MD; Geoffrey C. Ibbotson, MD, MSc; Nefti Bemppong-Ahun, MMedSci; Andrea Pusic, MD; John W. Scott, MD, MPH; Rania A. Mekary, PhD, MSc, MSc; Kavitha Ranganathan, MD

FT rate was 35.3% (95% CI, 27.3%-44.4%) in high-income countries
78.8% (95% CI, 60.4%-90.0%) in low- and middle-income countries.

A high global burden of FT due to
multidisciplinary treatment at specialized facilities;
Prolonged treatment and follow-up;
Transportation costs;
time off work.



This burden has often been
associated with adverse clinical
outcomes
mortality



Palliative care

Challenges

CANCER : >20 million/year new cancer patients worldwide

1. There are multiple causes, manifesting differently over time, varying from one patient to another, which makes *treating cancer very challenging*.
2. Conventional cancer therapy is a non-targeting therapy and damages healthy cells



**Need to treat
Cancer as
Personalized**

Opportunities

A. Early Diagnosis

Screening

1. Biomarker
2. Molecular imaging

B. Targeted therapy

Deliver the therapeutic agent to the target tumor to reduce adverse effects and improve efficacy.

C. Palliative treatment

To improve the quality of life for both the patient and the family.

Personalized Medicine



- Personalized medicine aims:
 - Enhances diagnostic precision
 - Reduce therapeutic failures.
- Molecular modalities
 - Screening
 - Diagnosis
 - Treatment
 - Assessment of disease heterogeneity
 - Progression planning
 - Molecular characteristics
 - Long-term follow-up for various diseases.

Review

The Role of Molecular Imaging in Personalized Medicine

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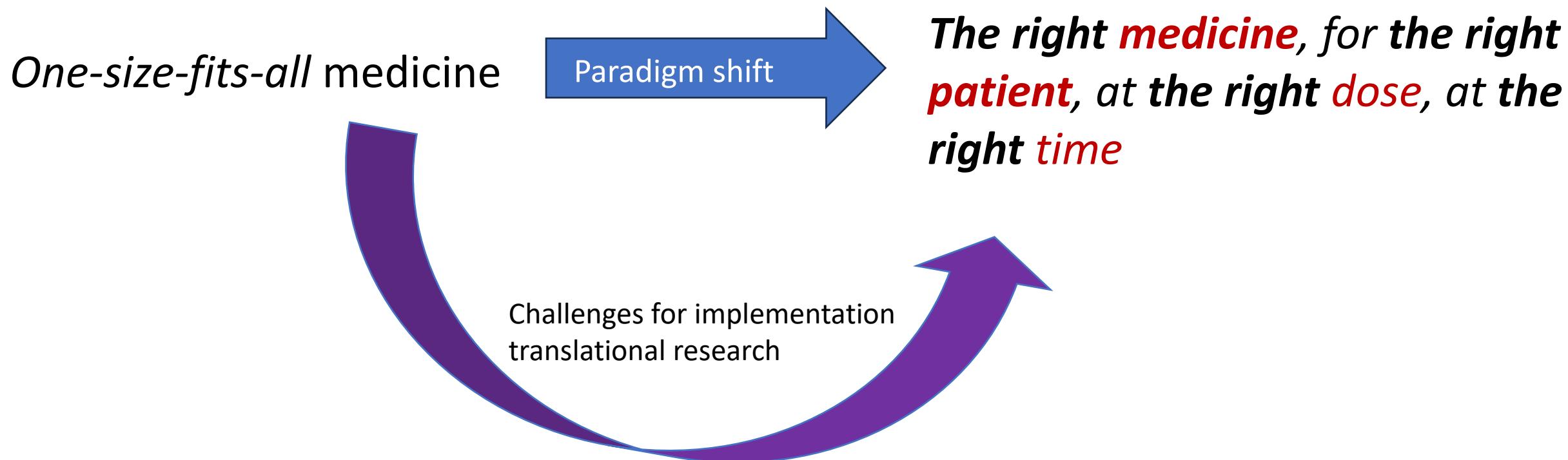
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Personal Medicine

Precision medicine



Translational research

Translation research

Translational science

Basic research



Humans benefit

1. Science

Biology

Medical Sciences

2. Technology

Components of *Translational research in Personalized Medicine*

1. Multi-omics profiling
2. Model-based data integration
3. Artificial Intelligence (AI)
4. Digital biomarkers
5. Patient engagement

REVIEW

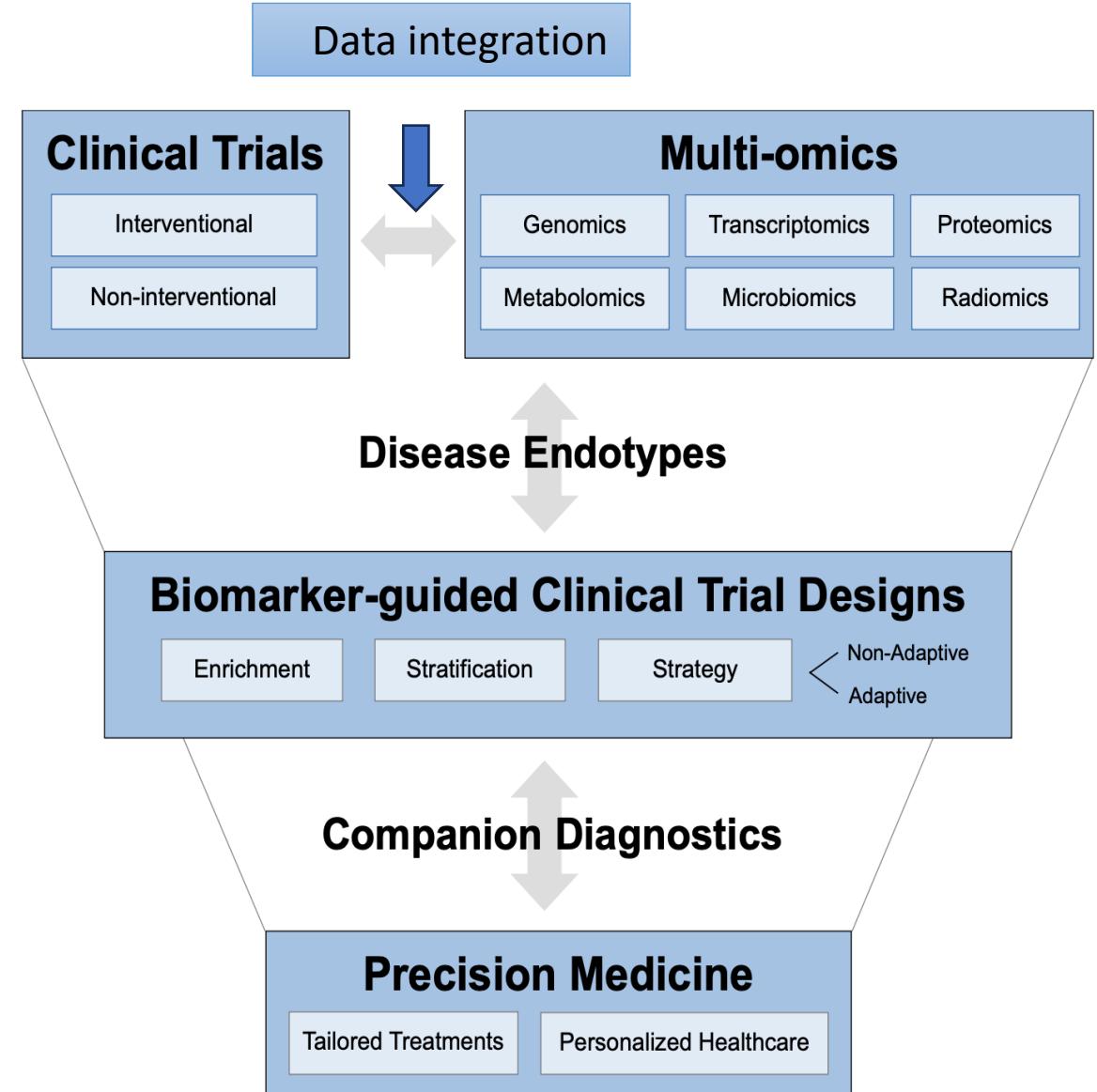
Open Access



Translational precision medicine: an industry perspective

Dominik Hartl^{1,2*}, Valeria de Luca¹, Anna Kostikova¹, Jason Laramie³, Scott Kennedy³, Enrico Ferrero¹, Richard Siegel¹, Martin Fink¹, Sohail Ahmed⁴, John Millholland⁵, Alexander Schuhmacher⁶, Markus Hinder¹, Luca Piali⁷ and Adrian Roth⁷

- *Multi-omics Profiling*
 - *Genomics, epigenomics, transcriptomics, proteomics, lipidomics, metabolomics, microbiomics, radiomics and others.*
 - Allowing the interplay between genetics, gene regulation and proteins, and to obtain a more complete picture of the molecular patterns



1. Multi-omics limitation to clinical drug development (challenge)

1. Omics technologies assess large number of genes/protein → batch effects
2. Integrating multi-omics data set (data transfer, format, analyzing) → increase the chance for false interpretation
3. Link multi-omics data to disease characteristic and clinical trial outcomes
4. Collaboration network, samples, Standard operating procedures, etc.

2. Model-Based Data Integration (Challenge)

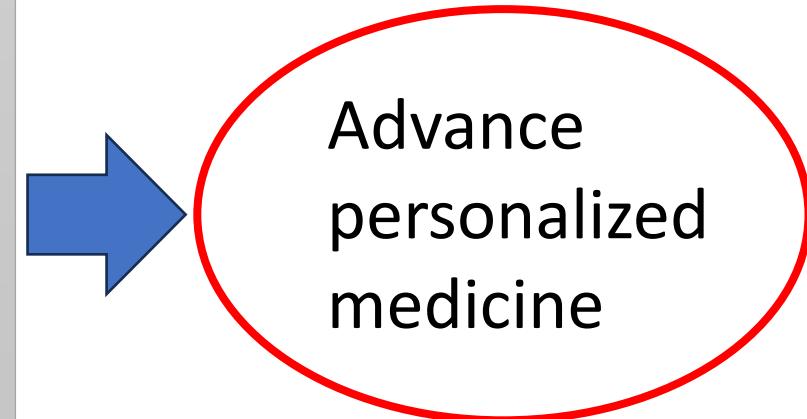
- Analyzing and leveraging biomarker data in translational research
- Mathematical models are used to predict future experimental outcomes
- The small size and low number of samples
 - Pre-clinical experiments
 - Early clinical trials remain challenging.
- Small therapeutic window (individual dose is needed)
- Drug compounds (delay between exposure and response).

3. Artificial Intelligence (AI)

- The amount of data generated and collected increase
- Combined with powerful hardware
 - Machine learning
 - Deep learning
- Connected complex raw data from sensors and connected digital devices endpoints and clinically measures
- Near future AI algorithms;
 - identify novel targets or new indications for existing drugs,
 - uncover : disease pathogenesis or drug response,
 - discover predictive biomarkers enabling patient stratification strategies that can optimize clinical trial designs,
 - impact the drug development value chain.

4. Digital Biomarker

- Physiological and behavioral measures collected through digital devices can influence or predict health-related outcomes.
- Advantages
 - Objective data can be gathered in real-life settings.
 - Data is quantitative and unbiased.
 - Frequent or continuous data collection increases statistical power.
 - There is enhanced sensitivity and specificity.
 - In clinical trials, this approach allows for
 - Smaller sample sizes
 - Fewer study visits
 - Shorter study durations
 - Real-time feedback for early decision-making.



5. Patients engagement

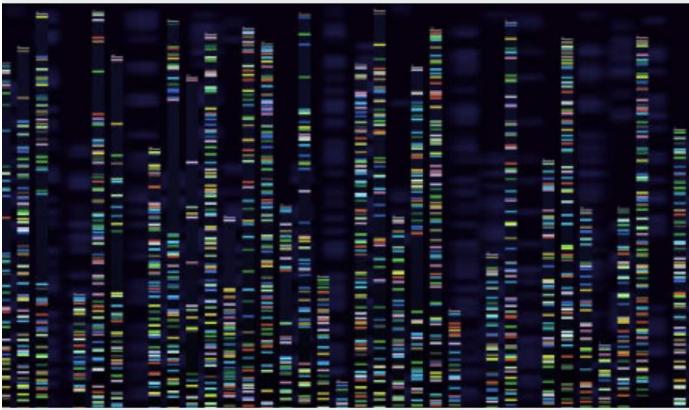
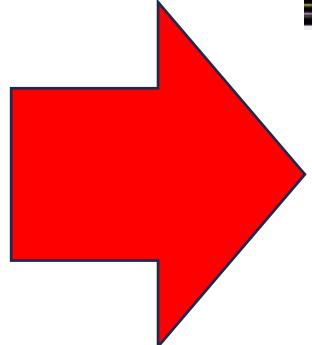
- Personalised healthcare (PHC), precision medicine and stratified medicine
 - describe the concept of tailoring treatment to patients based on their individual pathology.
- With the rise of new diagnostic and data-driven approaches
 - deepen our understanding of the molecular basis of disease.
- The awareness of the potential of PHC is also emerging in the patient community and its meaning goes far beyond precision medicine.

The Future of Healthcare with Industry 5.0: Preliminary Interview-Based Qualitative Analysis

by Juliana Basulo-Ribeiro  and Leonor Teixeira * 

Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT), Institute of Electronics and Informatics Engineering of Aveiro (IEETA), Intelligent Systems Associate Laboratory (LASI), University of Aveiro, 3810-193 Aveiro, Portugal

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Take Home Messages

- Challenges
 - Paradigm shift from a *one-size-fits-all* to a biomarker-guided patient-centric medicine.
 - The classification of disease conditions as multi-omics-defined endotypes.
 - The implementation of digital biomarkers as clinical endpoints and the development of companion diagnostics.
 - Near future : Emerging AI-based digital tool
 - new targets to overall impact drug development
 - Healthcare with Industry 5.0

Thank You

