LUCIA

LUng Cancer-related risk factors and their Impact Assessment

LUCIA: Understanding Lung Cancer Related Risk Factor and their Impact

HORIZON-MISS-2021-CANCER-02

San-Sebastian; 05.09.2023

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TECHNION Israel Institute of Technology

European Commission

Quick Facts

- Lung cancer (LC) is the biggest cancer killer worldwide.
- Every 30 seconds, someone, somewhere in the world dies of LC.
- The current five-year survival rate following diagnosis of all types of LC is 21% (17% for men and 24% for women).
- Five-year survival rate for some of the LC types varies between 5% (small cell LC) to 25% for non-small cell Lung Cancer (NSCLC).

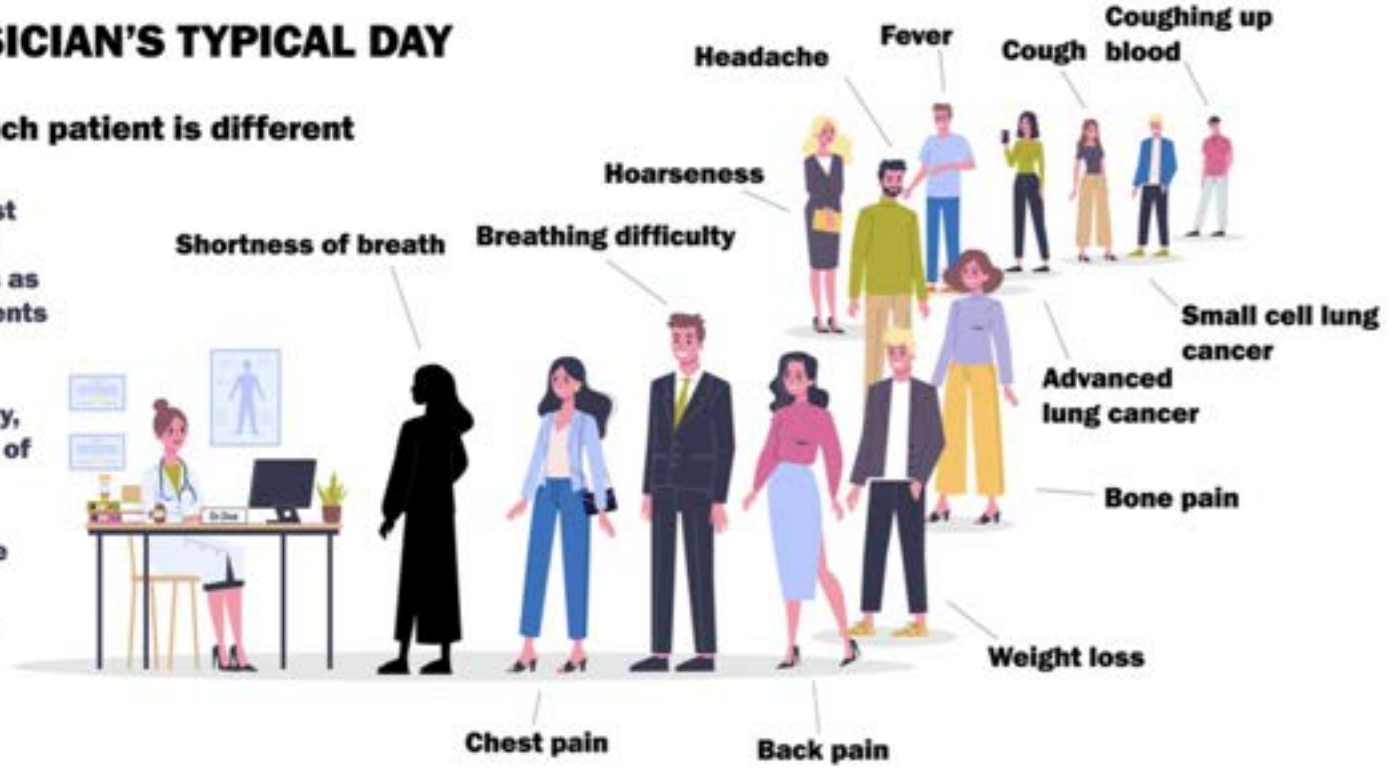
The Challenge

Poor knowledge of risk factors and cellular processes associated with LC.

A PHYSICIAN'S TYPICAL DAY

Each patient is different

Physicians can memorize the most serious and most common diseases as they care for patients and look for emergencies. Complexity, variety, and sheer volume of patients make it impossible to correctly diagnose each and every patient situation, based solely on physicians' experience and memory.



20
Average number of patient visits per day

34%
Percentage of visits involving a diagnostic question

"The Findings: A new study by the Institute of Medicine cites that more than 5% of diagnoses are in error, translating to 70,000 to 80,000 deaths directly from misdiagnosis."

"Nearly every person will experience a diagnostic error in their lifetime"

PATIENTS

- Clinical benefit (patient safety)
- Patient empowerment
- Satisfaction
- Value of knowing and deciding

CITIZENS

SOCIETY

CARERS

HEALTHCARE SYSTEMS

ECONOMIC EFFICIENCIES

- Patient triage
- Avoided cost of disease progression
- Waiting time
- Avoided advers events
- (Re-)hospitalisation
- Shift to community care

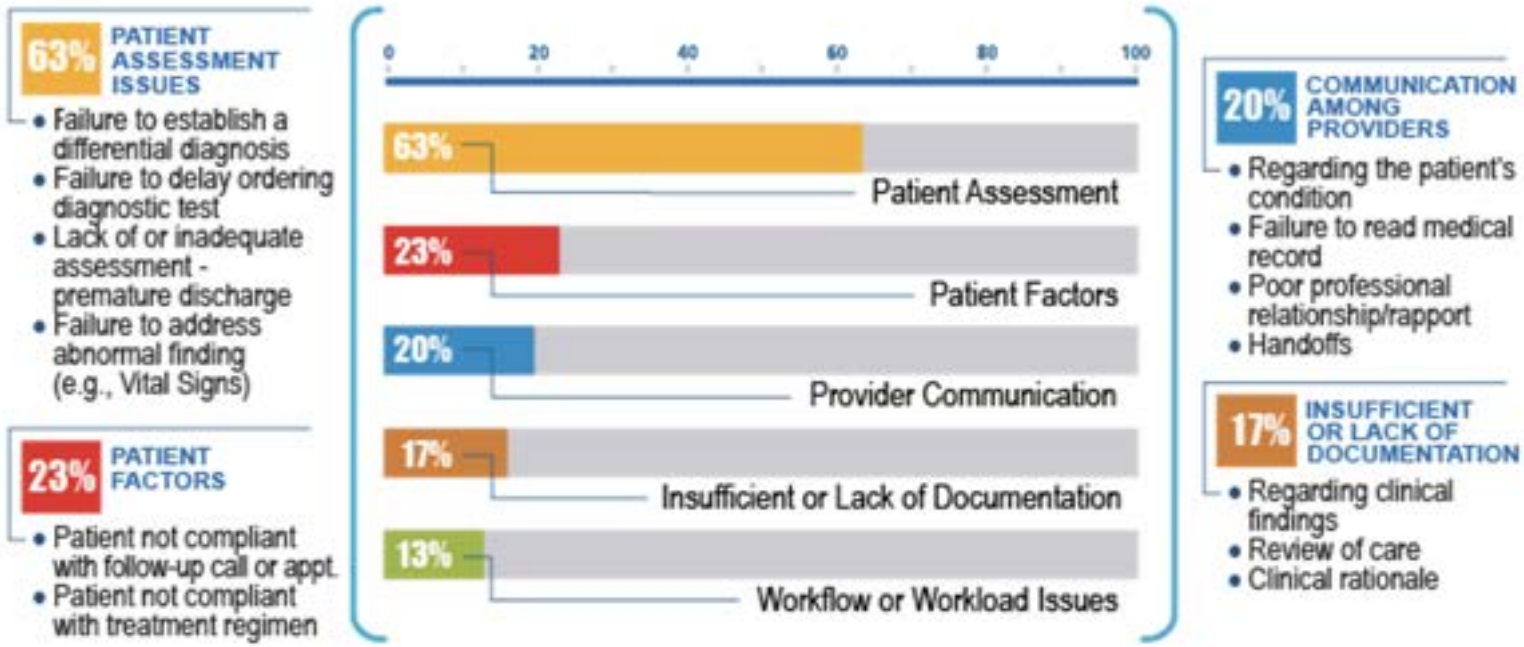
HEALTHCARE PROVIDERS

- Turn around time
- Operational costs
- Quality (reliability, reproducibility)

HEALTHCARE PROFESSIONALS

PATIENT MANAGEMENT

Failures in the Diagnostic Process



Source: The Sullivan Group

Factors Involved in Failure to Diagnose Cases

85% of claims in ED diagnosis-related malpractice claims cite an inadequate assessment.

DIAGNOSIS-RELATED CLAIMS STEM FROM ERRORS THROUGHOUT THE PROCESS OF CARE

		Percent of Cases	Average Indemnity
1	Patient notes problem and seeks care	6%	$529k
2	History and physical exam	11%	$816k
3	Ongoing monitoring of clinical status	30%	$653k
4	Ordering diagnostic tests	65%	$525k
5	Performance of diagnostic tests	5%	$670k
6	Interpretation of diagnostic tests	22%	$463k
7	Transmittal of test resultsto (ED) provider	7%	$576k
8	Consultation management	26%	$566k
9	Development of discharge plan	43%	$499k
10	Post-discharge follow-up (includes pending test results)	9%	$488k
11	Patient adherence with follow-up	5%	$220k

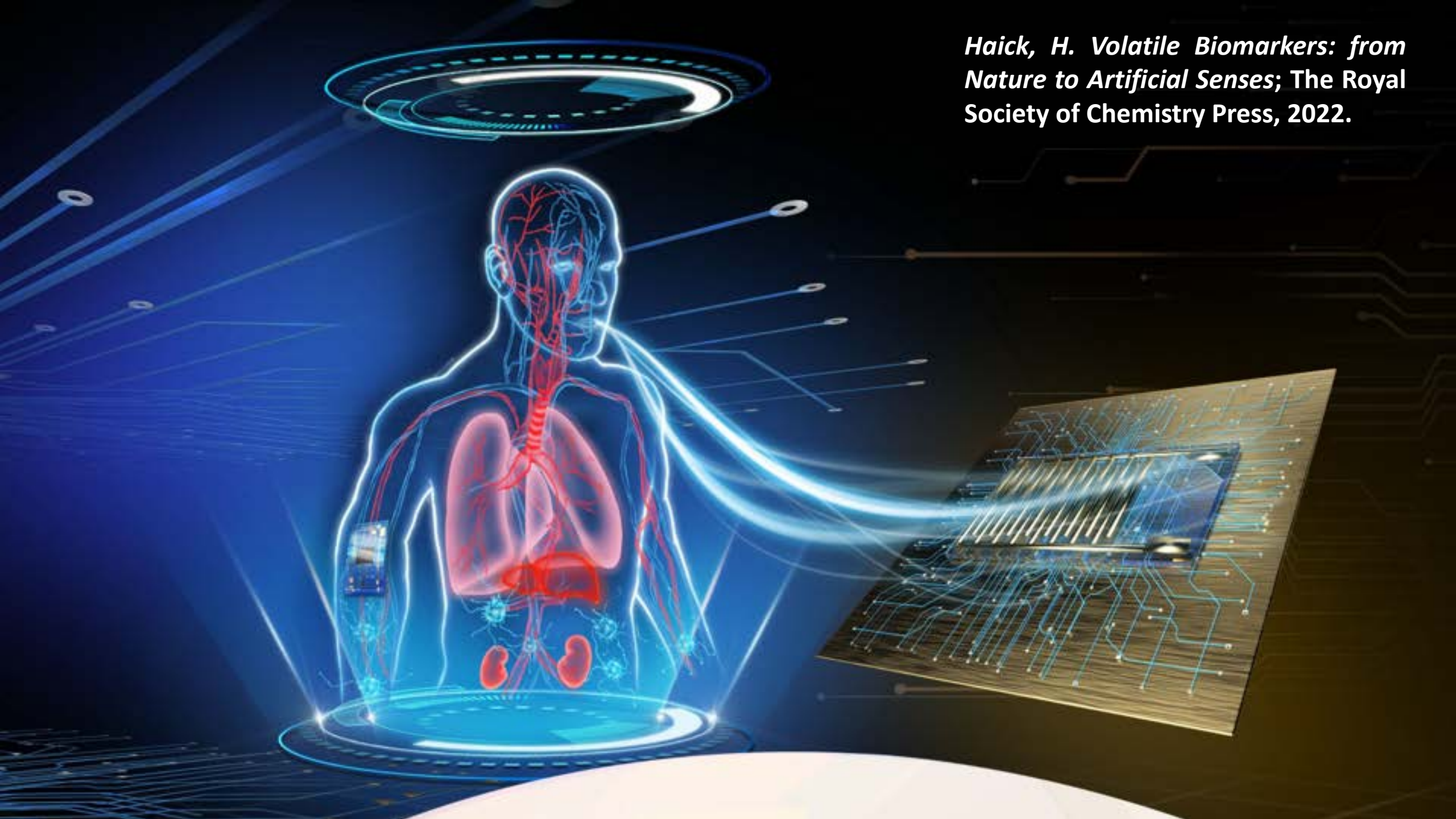
Source:
The Sullivan Group

The Need

- To establish risk factor assessment tools for LC and its sub categories, including less frequent forms of LC, to gain a better understanding of LC as a disease.

Why it's important?

- Allow to better orient public health policies towards more effective LC screening and diagnosis pathways.
- Understanding the molecular basis through which risk factors act to foster the genesis and progression of LC will identify new avenues for therapeutic intervention, particularly for less common and rare types of LC.



Haick, H. Volatile Biomarkers: from Nature to Artificial Senses; The Royal Society of Chemistry Press, 2022.

No.	Participant organization name	Short	Type	Country
1 (Coordinator)	Technion – Israel Institute of Technology	TECH	ACA	Israel
2	German Cancer Research Centre	DKFZ	RTD	Germany
3	Fundació Institut de Recerca Biomédica (IRB Barcelona)	IRB	ACA	Spain
4	Fundació Centre de Regulació Genómica	CNAG	ACA	Spain
5	Fundación Centro de Tecnología de Interacción Visual y Comunicaciones Vicomtech	VICOM	RES	Spain
6	Ruprecht Karls Universitaet Heidelberg	UHEI	ACA	Germany
7	Emoda Yazilim Ve Danismanlik Sanayiticaret Lmited Sirketi	EMO	SME	Turkey
8	University of Ulster	ULSTER	ACA	UK
9	Universidad Politécnica de Madrid	UPM	ACA	Spain
10	Bilbomatica S.A.	BILB	IND	Spain
11	Latvijas Universitate	LU	HOS	Latvia
12	Centre Hospitalier Universitaire de Liège	CHUL	HOS	Belgium
13	Servicio Andaluz de Salud	SAS	HOS	Spain
14 (Affiliated)	Fundación Pública Andaluza para la Investigación en Salud en Sevilla	FISEVI	NGO	Spain
15	YAGHMA	YAG	SME	Netherlands
16	Time.lex	TLX	SME	Belgium
17	Fédération européenne des hôpitaux et des soins de santé	HOPE	NGO	Belgium
18	Dexai – Etica Artificiale	DEX	SME	Italy
19	Nanose Medical	NAN	SME	Israel
20	PRONAT Industries	PRON	SME	Israel
21	Biocruces Bizkaia	BCB	RTD	Spain
22 (Affiliated)	Servicio Vasco de Salud Osakidetza	OSA	HOS	Spain

Quick Facts:

Partners: 22

Countries: 9

Clinical centers: 6

Academy: 6

SMEs: 6

Industry: 1

RTD: 2

RES: 1

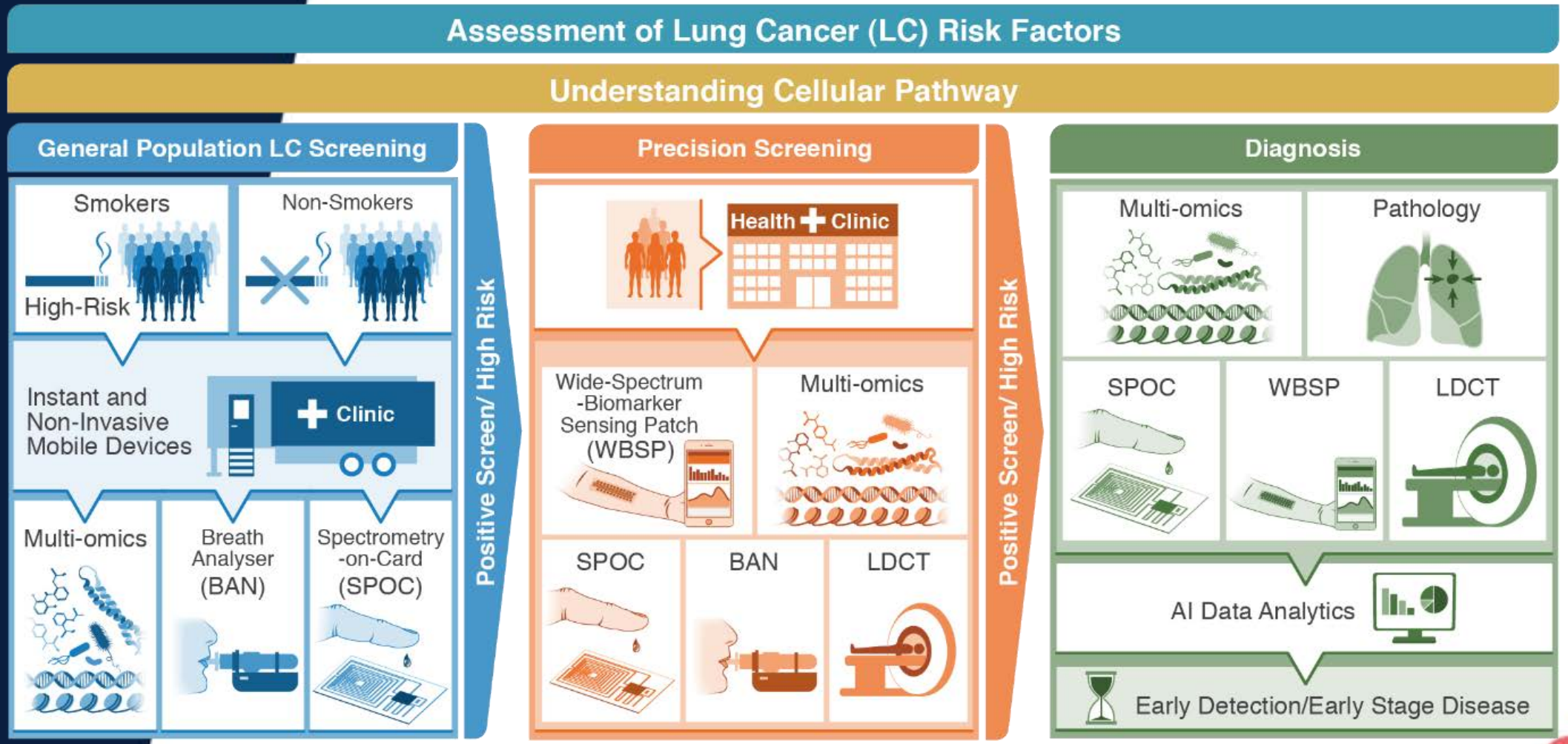
Objectives and Ambitions

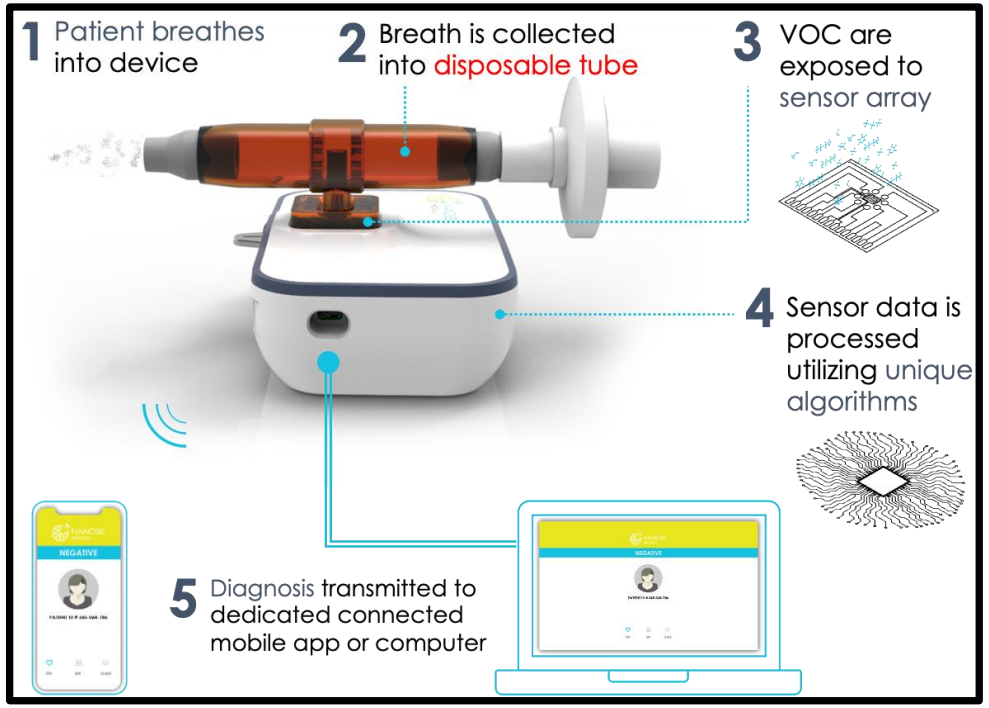
LUCIA aims to develop a toolbox for studying and understanding risk factors and causes of LC via three complementary domains that feed into each other: (i) the **personal risk factors**; (ii) the **external risk factors;** and (iii) the **cellular processes**.

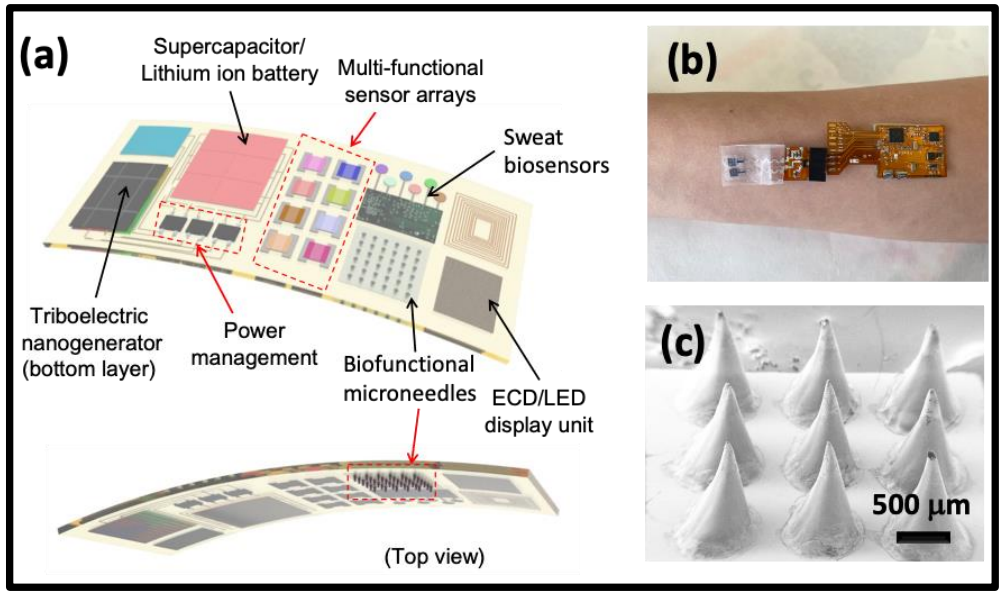
SO1	**To identify and use relevant comprehensive databases comprising clinical LC studies, biobanks and registries, demographics, lifestyle, and exposure, and others to support LC risk factor assessment tools.**
SO2	To work with patients, healthcare providers and policy makers to define the specifications and requirements of AI tools for the identification and modelling of risk factors and health determinants relevant to LCs and their progression.

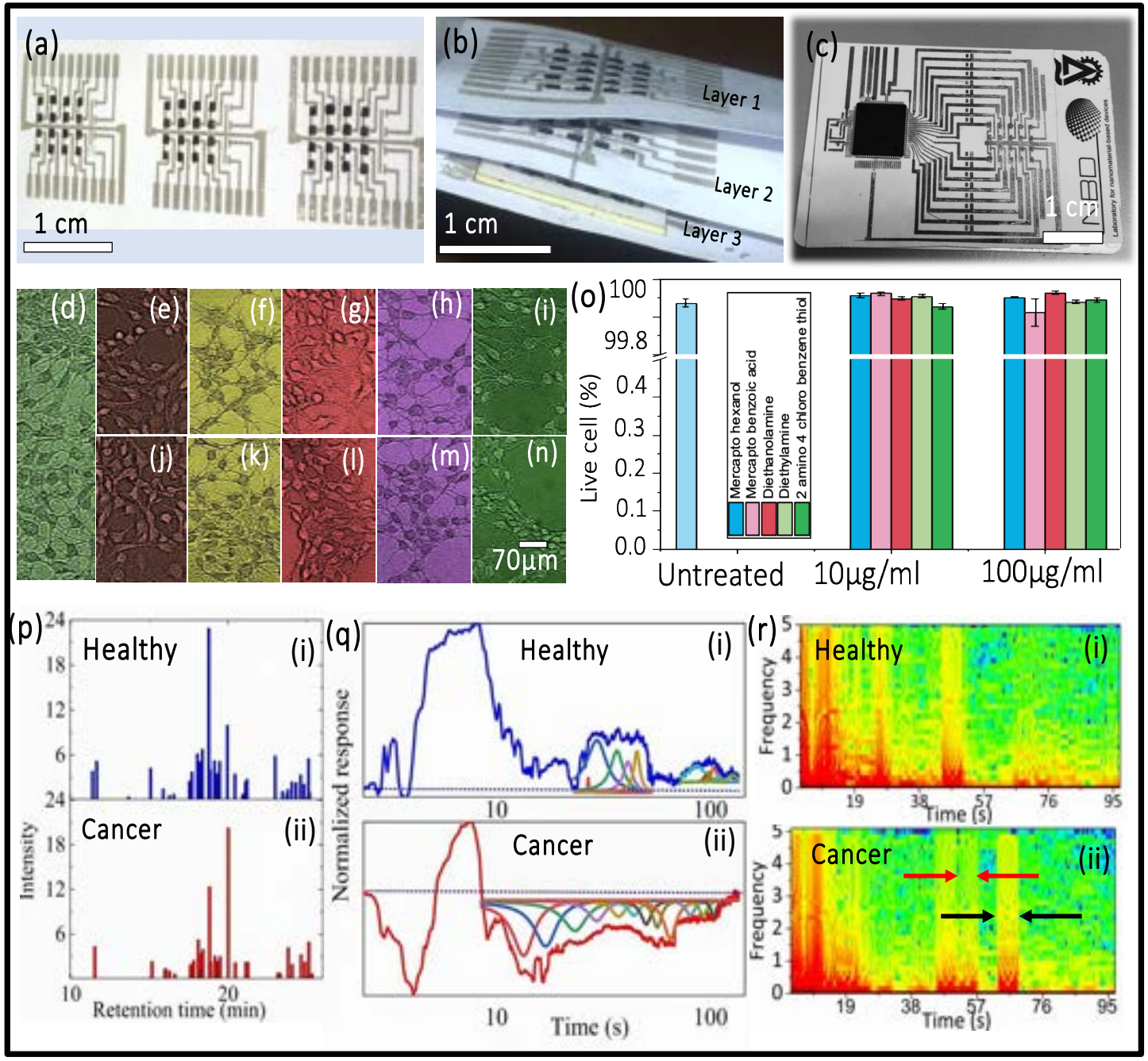
Objectives and Ambitions (*Cont.*)

SO3	Implement sensor technology for LC screening and accurate LC detection; and omics analysis, poly-genetic risk scores, pathology, and image processing will also be carried out for a comprehensive insight of the risk factors impact on cellular pathways.
SO4	Integrate the retrospective and prospective information with LC-related polygenic scoring, epidemiological analysis for mapping risk factors and their effect on LC.
SO5	Use the risk factor mapping from SO4 to develop a systematic understanding of cellular processes that lead to subtypes of LC and their progression, and to define mechanistically how novel risk factors promote transformation.
SO6	To validate the integration of the risk factor assessment tools within the LCS process in prospective observational cohort studies.
SO7	To effectively disseminate and communicate project results, and to develop synergies with EU-funded initiatives.


Assessment of Lung Cancer (LC) Risk Factors
Understanding Cellular Pathway
General Population LC Screening
Smokers
High-Risk
Non-Smokers
Instant and Non-Invasive Mobile Devices
Clinic
Multi-omics
Breath Analyser (BAN)
Spectrometry -on-Card (SPOC)
Positive Screen/ High Risk
Precision Screening
Health
Clinic
Wide-Spectrum -Biomarker Sensing Patch (WBSP)
Multi-omics
SPOC
BAN
LDCT
Positive Screen/ High Risk
Diagnosis
Multi-omics
Pathology
SPOC
WBSP
LDCT
AI Data Analytics
Early Detection/Early Stage Disease


1 Patient breathes into device
2 Breath is collected into disposable tube
3 VOC are exposed to sensor array
4 Sensor data is processed utilizing unique algorithms
5 Diagnosis transmitted to dedicated connected mobile app or computer


(a)
Supercapacitor/ Lithium ion battery
Multi-functional sensor arrays
Sweat biosensors
Triboelectric nanogenerator (bottom layer)
Power management
Biofunctional microneedles
ECD/LED display unit
(Top view)
(b)
(c)
500 µm


(a)
1 cm
(b)
Layer 1
Layer 2
Layer 3
1 cm
(c)
1 cm
(d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n)
70µm
(o)
Live cell (%)
100
99.8
0.4
0.3
0.2
0.1
0.0
Mercapto hexanol
Mercapto benzoic acid
Diethanolamine
Diethylamine
2 amino 4 chloro benzene thiol
Untreated
10µg/ml
100µg/ml
(p)
Healthy
(i)
Cancer
(ii)
Intensity
Retention time (min)
(q)
Healthy
(i)
Cancer
(ii)
Normalized response
Time (s)
(r)
Healthy
(i)
Cancer
(ii)
Frequency
Time (s)

Objectives and Ambitions (*Cont.*)

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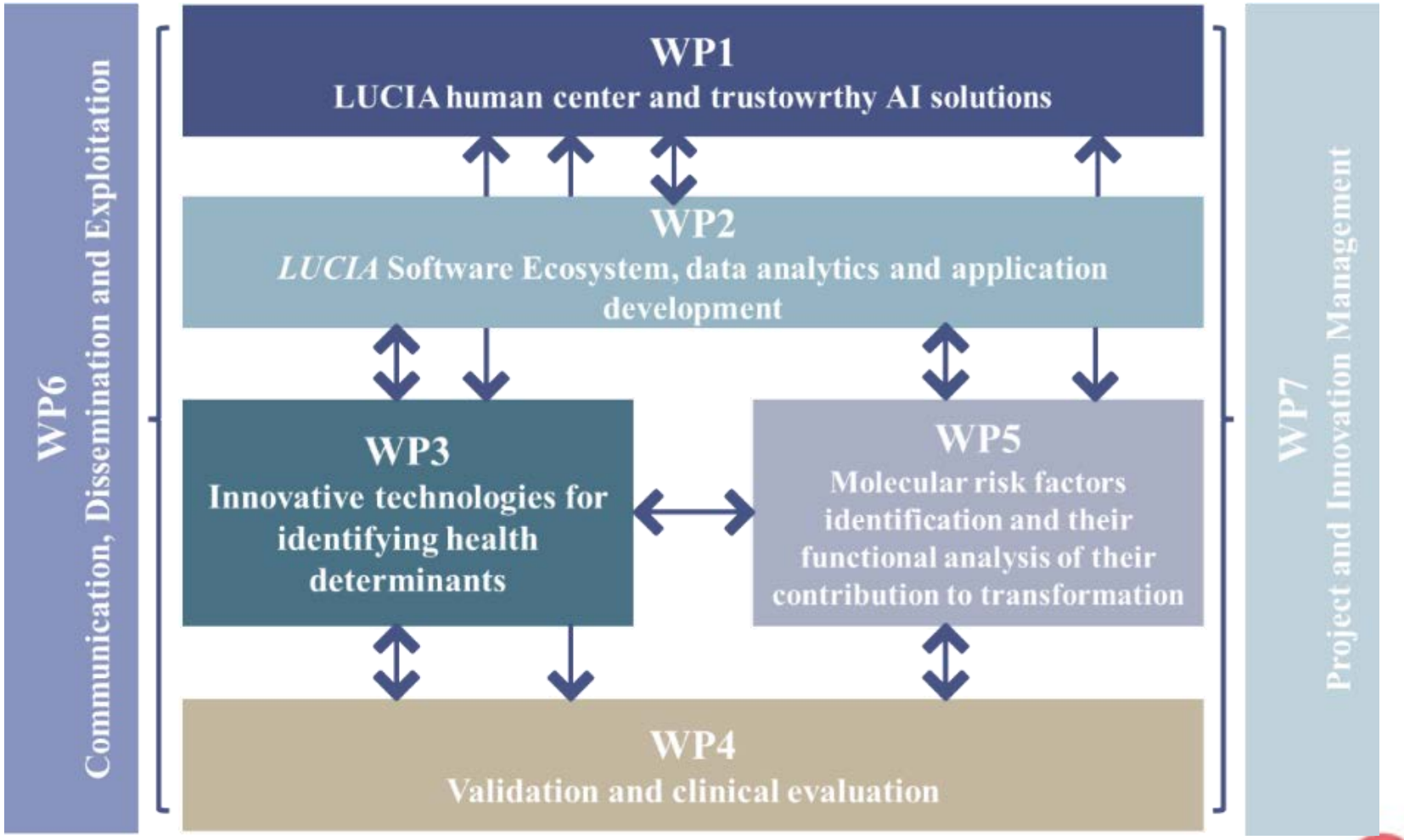
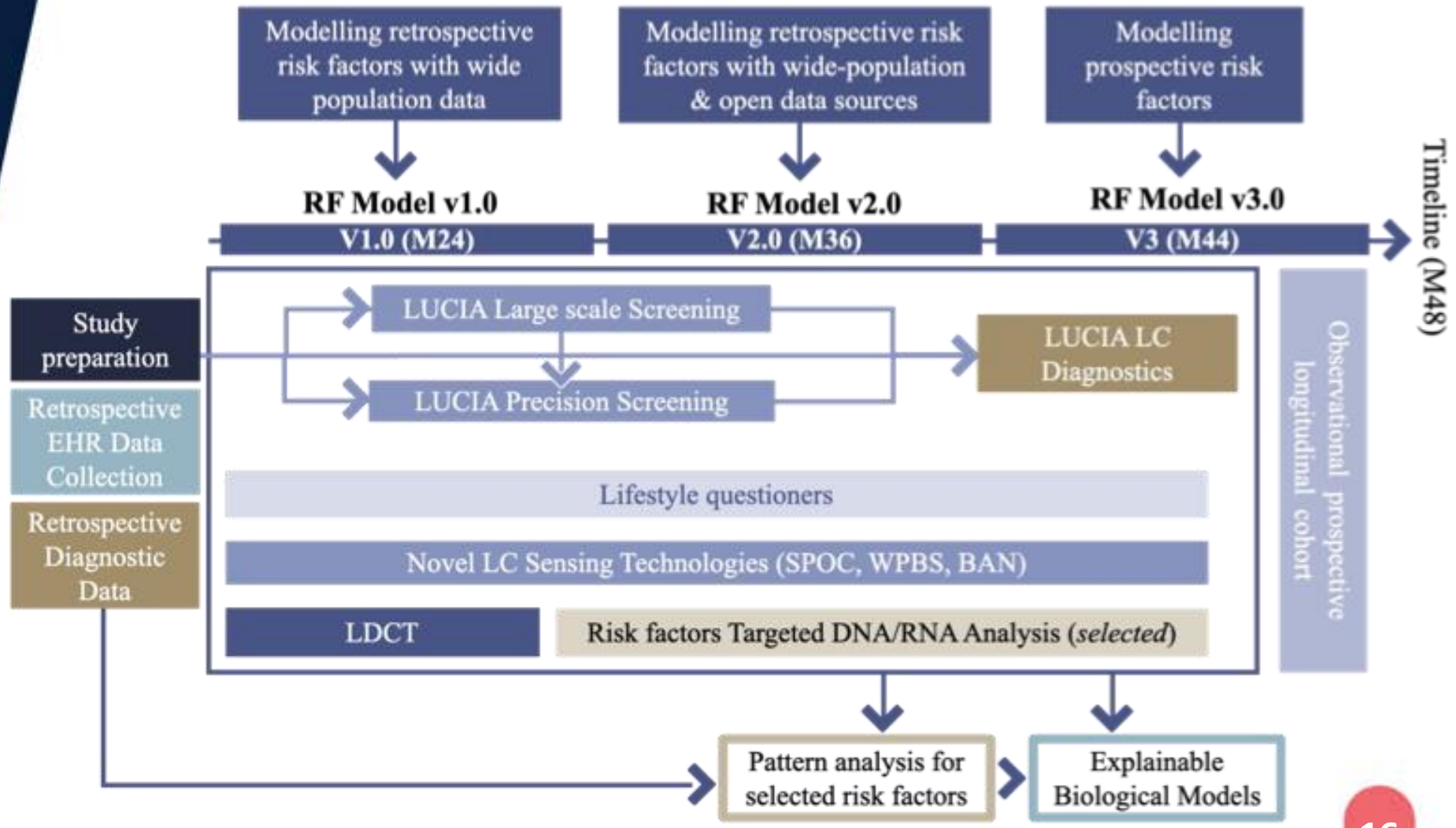
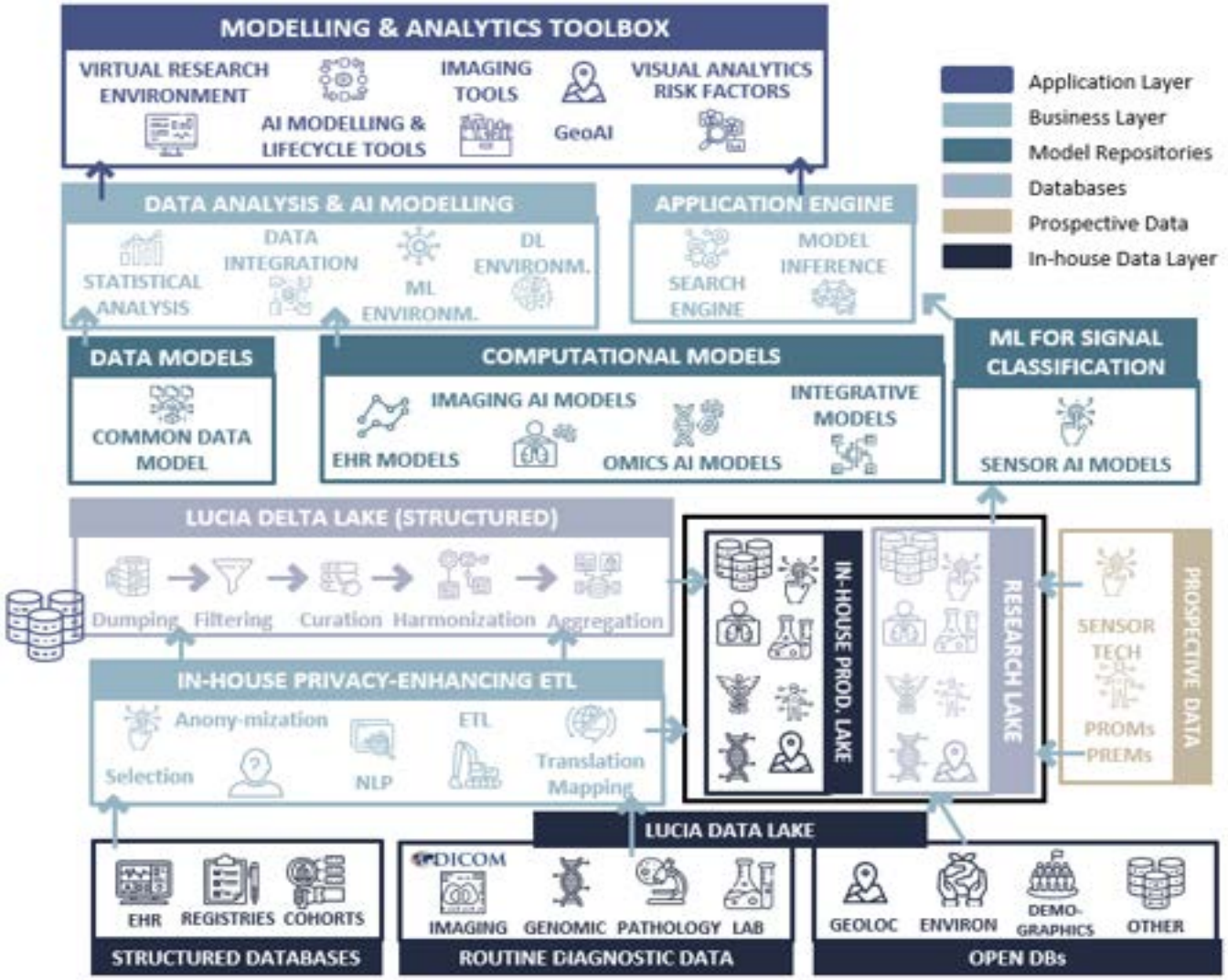
Implementation Strategy



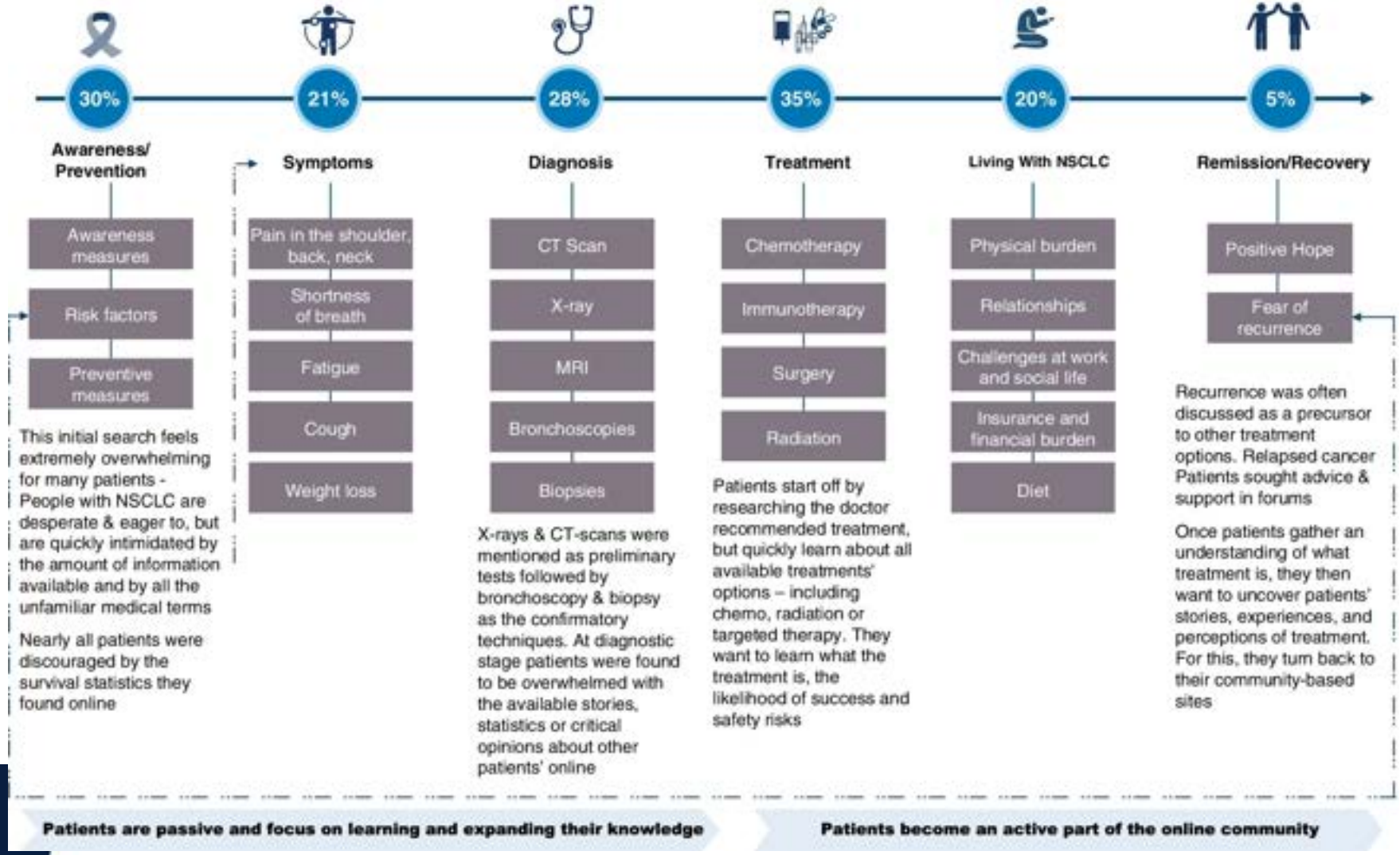
Data Collection and Integration



Data Management



Nature Medicine **28,** 620–626 (2022)



BMC Cancer
22, 475 (2022)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Thank you for listening

Questions? & Answers

LUCIA (Horizon Europe) KICK-OFF MEETING 1-2.02.2023

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