

DEMOCRACY AND PANDEMIC



13 — 15.11.25

Fondazione Giorgio Cini, Venezia



浙江大學
ZHEJIANG UNIVERSITY

Public Health and Pandemic Preparedness: Example Practices from China

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November, 2025



CONTENTS



01 | **China's Infectious Disease Surveillance and Early Warning System**

02 | **101 Plan for Public Health and Preventive Medicine Majors**

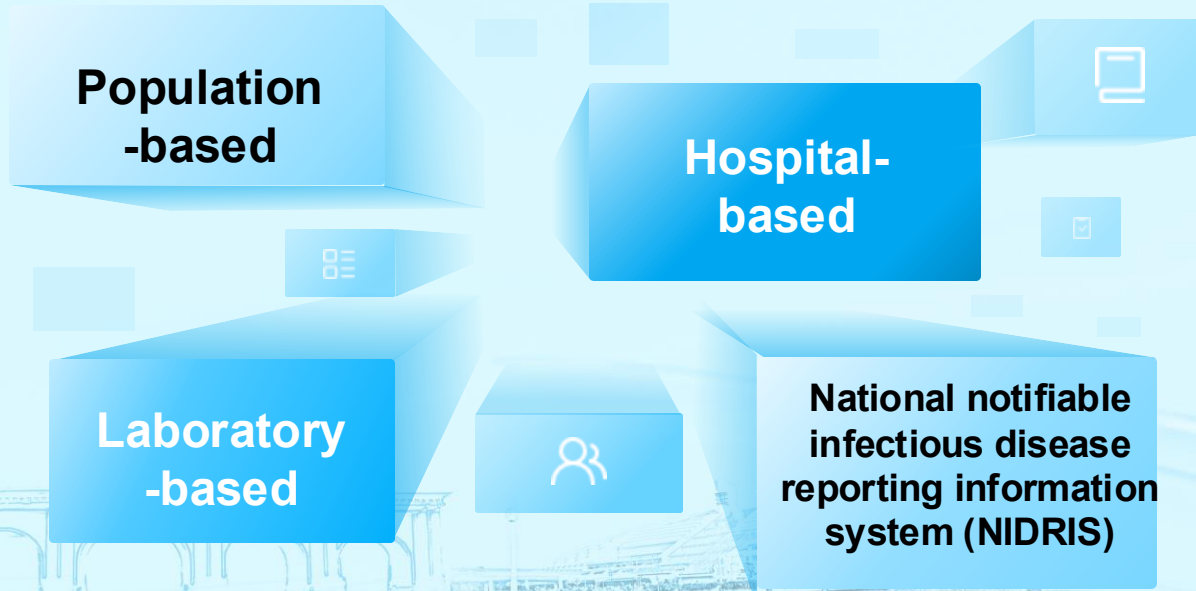
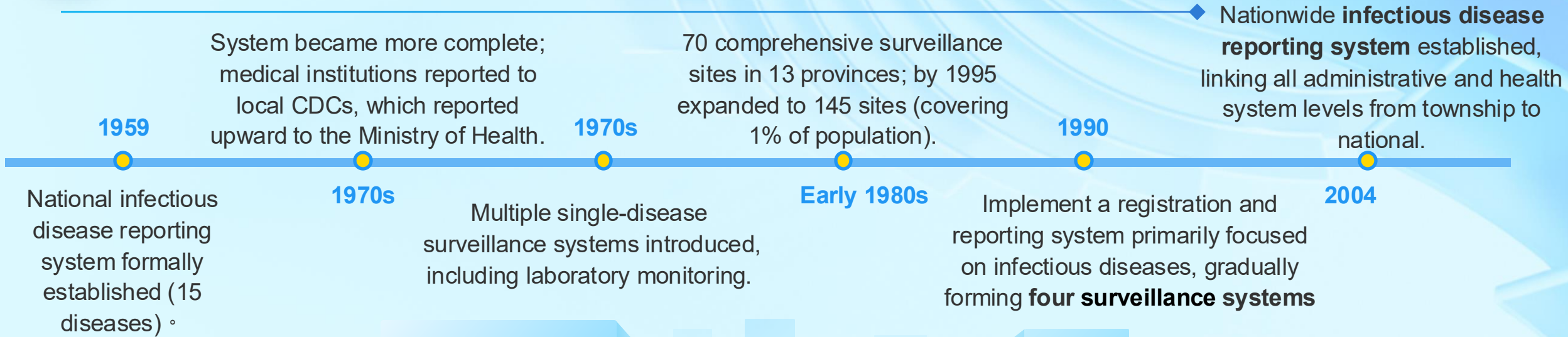
03 | **Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries**

04 | **Big Data and AI Driven Public Health Initiative**





China's Infectious Disease Surveillance and Early Warning System



Four surveillance systems



Phase 1 (1950–1985)

Manual reporting; data aggregated and mailed upward; only monthly/annual summaries.

1

Phase 2 (1986-1995)

Initial computerization; reports sent via paper, floppy disk, or email through CNDR network.

2

Phase 3 (1996–2003)

Electronic management; case-based reporting from 1998; some provinces began ten-day reports (2002).

3

Phase 4 (2004—Present)

Online direct reporting since Jan 1 2004; five-level linkage (township–county–city–province–national); real-time data entry, review, and analysis.

4



Reportable Infectious Disease Categories

The first Infectious Disease Prevention and Treatment Law was **enacted in 1989 and revised in 2004**, established mandatory reporting for all notifiable diseases

At present, China monitors **41 notifiable diseases** in total, forming a comprehensive and real-time national surveillance system

Class	Definition	Infectious Diseases	Reporting requirement
Class A (2)	Highly infectious, severe public health threat	Plague, Cholera	Must be reported immediately; emergency isolation, containment, and medical treatment required.
Class B (28)	Key infectious diseases, require enhanced monitoring and reporting	AIDS, Tuberculosis, Viral Hepatitis, Poliomyelitis, Highly Pathogenic Avian Influenza, Measles, Hemorrhagic Fever, Rabies, Japanese Encephalitis (B), Dengue Fever, Anthrax, Bacterial and Amoebic Dysentery, Typhoid and Paratyphoid Fever, Meningococcal Meningitis, Pertussis, Diphtheria, Neonatal Tetanus, Scarlet Fever, Brucellosis, Gonorrhoea, Syphilis, Leptospirosis, Schistosomiasis, Malaria, SARS, COVID-19	Must be reported within statutory time (usually within 24 hours).
Class C (11)	Generally managed infectious diseases, lower risk but still reportable	Influenza, Mumps, Rubella, Acute Hemorrhagic Conjunctivitis, Leprosy, Spotted Fever, Kala-azar, Echinococcosis, Filariasis, Hand-Foot-and-Mouth Disease, Infectious Diarrhoeal Diseases (other than A & B)	Reportable, but management and isolation requirements are relatively relaxed.



In August 2024, China CDC and related authorities announced the construction of a **Fully Intelligent, Multi-point Trigger Infectious Disease Surveillance and Early Warning System.**

Optimize Case Reporting System

- Full network reporting by 2030 (primary & private care).
- Monitor outpatient, fever clinic, severe/death, cluster events.

Clinical Syndrome Surveillance Network

- National/provincial sentinel hospitals by 2025.
- Multi-pathogen, multi-test per sample; prioritize respiratory & diarrheal syndromes.

Pathogen Laboratory Surveillance Network

- CDCs, hospitals, research labs with biosafety credentials.
- Rapid reporting of key, emerging, and variant pathogens; integrated with clinical & outbreak response.

Vector, Host Animal, and Environmental Risk Surveillance Network

- Monitor vector ecology, drug resistance, pathogen carriage.
- Sewage & environmental monitoring for early detection; cross-department collaboration.

Cross-sector Risk Surveillance

- Health, education, civil affairs, customs, agriculture, environment, cyberspace, immigration.
- Monitor school absenteeism, animal-origin diseases, environmental & digital signals.

Social Perception Surveillance

- Internet, media, public hotlines, professional websites.
- Automated early-warning signal detection.

Global Epidemic Information Surveillance

- WHO, international agencies, neighboring countries.
- Trend analysis, cross-border monitoring, emerging pathogen tracking.

Targeted and Integrated Surveillance

- Local high-risk populations, behaviors, vaccine effectiveness, drug resistance.
- Large-scale events monitoring.



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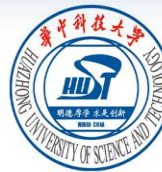


101 Plan for Public Health and Preventive Medicine Majors



- The "101 Plan" is a program that focuses on undergraduate education in fundamental disciplines, initially proposed by John Hopcroft, the Turing Award winner in the field of computer science.
- At the end of 2021, the Ministry of Education initiated a pilot reform plan in the field of computer science at Peking University, with the goal of launching a batch of renowned courses, teachers, and textbooks within two years. **It is called the '101 Plan', because computers use binary 1 and 0.**
- Launch the "101 Plan" for new medical and agricultural science in 2023.

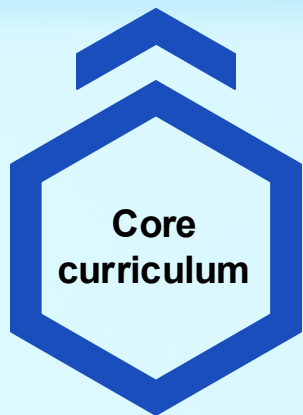
20 high-level public health schools across the country jointly participate in organizing and implementing



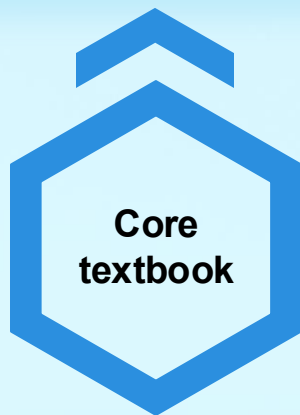


Focus Points

With the goal of **maintaining health throughout the entire life cycle**, we will implement the concept of integrating big health, and medical prevention, combine inheritance and innovation, reconstruct the core curriculum system of public health and preventive medicine, compile high-quality core textbooks, innovate core practice projects, and optimize the construction of core teaching staff.



Build a batch of first-class core courses with "advanced, innovative, and challenging" characteristics



Develop first-class core textbooks that reflect international academic frontiers and have Chinese characteristics



Support students to independently choose topics based on their interests and conduct innovative and exploratory experiments



Leading scholars at home and abroad, using the construction of first-class core courses, textbooks, and practical projects as carriers



Core Courses

Basic Medicine

- » Pathogenic Organisms and Immunology

Clinical Medicine

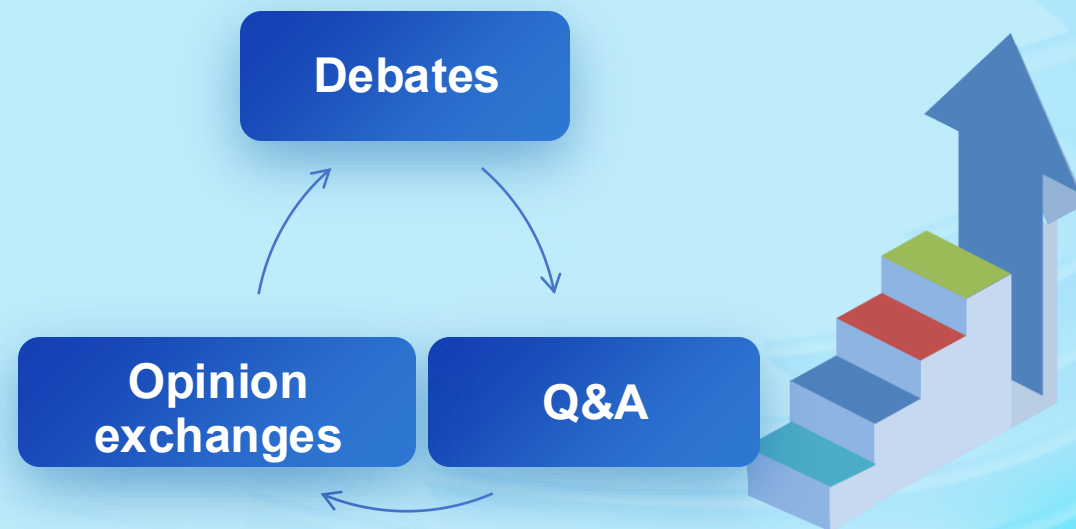
- » Infectious Diseases

Preventive Medicine

- » Epidemiology
- » Medical Statistics
- » Public Health Policy and Management
- » Environment and Health
- » Health Implementation Science
- » Whole Life Cycle Health Care
- » Comprehensive Public Health Skills
- » Medical Big Data and Artificial Intelligence Applications

Methodology

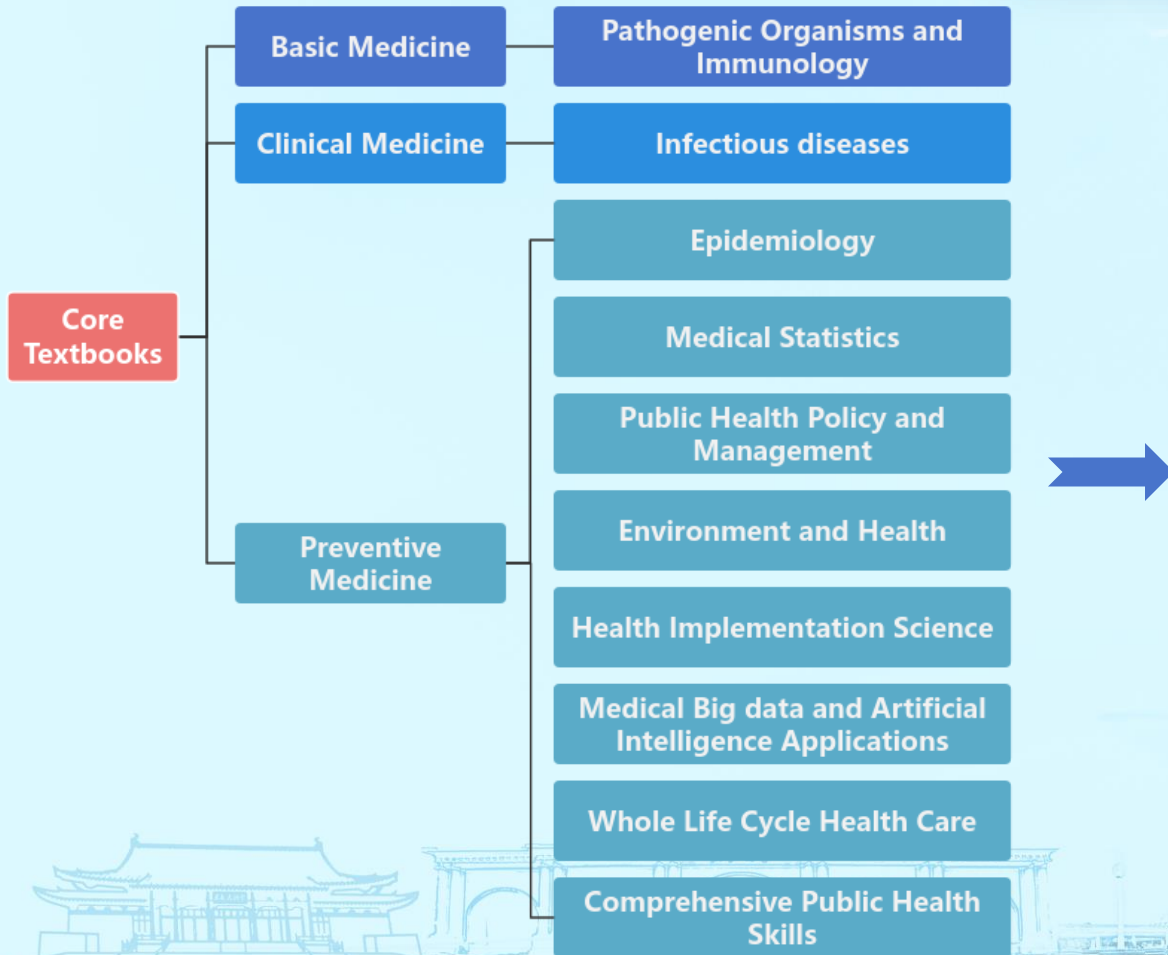
Shift from the **traditional 'quiet lecture'** model to an **interactive approach**



Facilitating deep emotional and intellectual communication between teachers and students



Core Textbooks



The content is up-to-date and closely aligned with the latest domestic and international developments as well as industry practices.

The content is rigorous, with editors devoting sufficient effort to ensure high quality and academic precision.

The textbook features a well-organized structure with enhanced systematicity and integration.

The textbook emphasizes innovation and actively promotes the development and use of digital learning materials.



101 Plan for Public Health and Preventive Medicine Majors



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Key Tasks

Core curriculum/textbook name	Lead agency	
Medical big data and AI applications	Zhejiang University	Xi'an Jiaotong University
Pathogenic organisms and immunology	Xiamen University	Jilin University
Infectiology	Central South University	Peking Union Medical College
Epidemiology	Peking University	Nanjing Medical University
Medical statistics	Sun Yat-sen University	Shanxi Medical University
Public health policy and governance	Fudan University	Tsinghua University
Environment and health	Huazhong University of Science and Technology	Tianjin Medical University
Community Health Communication and Implementation Science	Nanjing Medical University	Shandong University
Whole life cycle health care	Harbin Medical University	Anhui Medical University
Comprehensive public health skills	Nanjing Medical University	Sichuan University



Core Practice Project

Core practice project

Laboratory basic experiment

Laboratory testing and identification experiment

On site investigation and data processing experiment

Practice of preventive medicine

Clinical skills practice

Practice of public health and preventive medicine operational skills

Exploratory public health comprehensive experiment

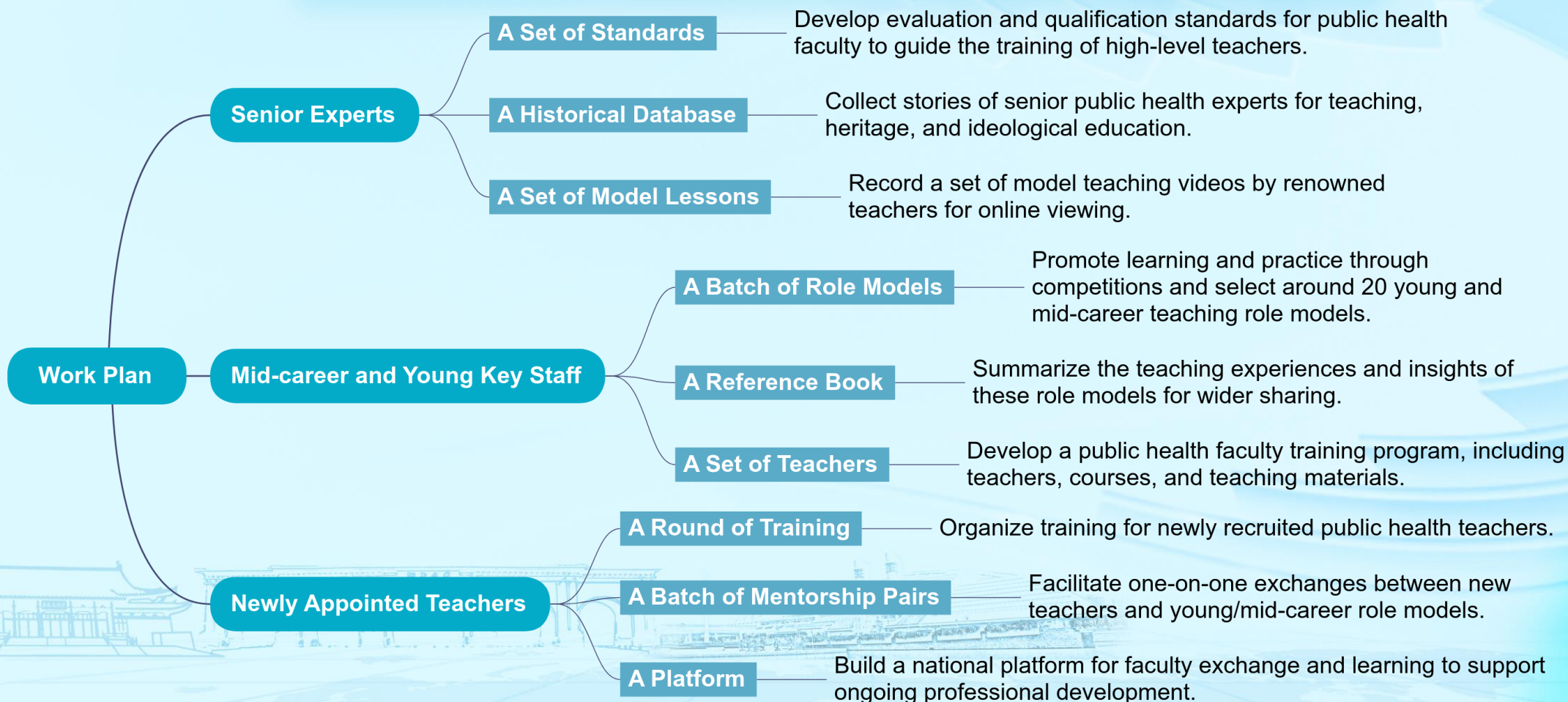
Problem oriented social practice

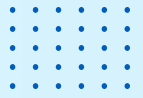
Innovation oriented scientific research practice



Core Faculty Team

Leader: Siyan Zhan, Co-leaders: **Xifeng Wu**, Ying Li





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Three Action Areas in the WHO Roadmap



**Action area 1:
Defining the functions
and services**



**Action area 2:
Competency-based
education**

What are the competencies required by the workforce to deliver the EPHFs? And how should the education and lifelong learning materials be designed and delivered?



**Action area 3:
Mapping and measurement
of occupations**





Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries



Public Health Education

Organize 3 professional Workshops

April 19 – 21, 2024

- » Introduce WHO Public Health and Emergency Workforce Roadmap
- » Present current status in terms of competency-based education
- » Establish the Public Health Interprofessional Leadership Alliance (PHILA)

November 4-5, 2024

- » Share mid-term progress towards competency-based education
- » Explore how to strengthen local competency-oriented education
- » Discuss the plan for the PHILA activities

Held by June 2026

- » Share progress towards competency-based education
- » Share excellent practices from various countries
- » Discuss the challenges and potential solutions in implementing WHO technical solutions



Technical support/assistance

World Health Organization (WHO) and Global Network for Academic Public Health



Funded

By the BILL & MELINDA GATES FOUNDATION

**Design and implement competency-based education programmes
Develop and share educational resources and materials**



Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries



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The First Workshop

International Forum on Public Health and Emergency Workforce: Competency-based Education

April 19 - 21, 2024, Hangzhou, China



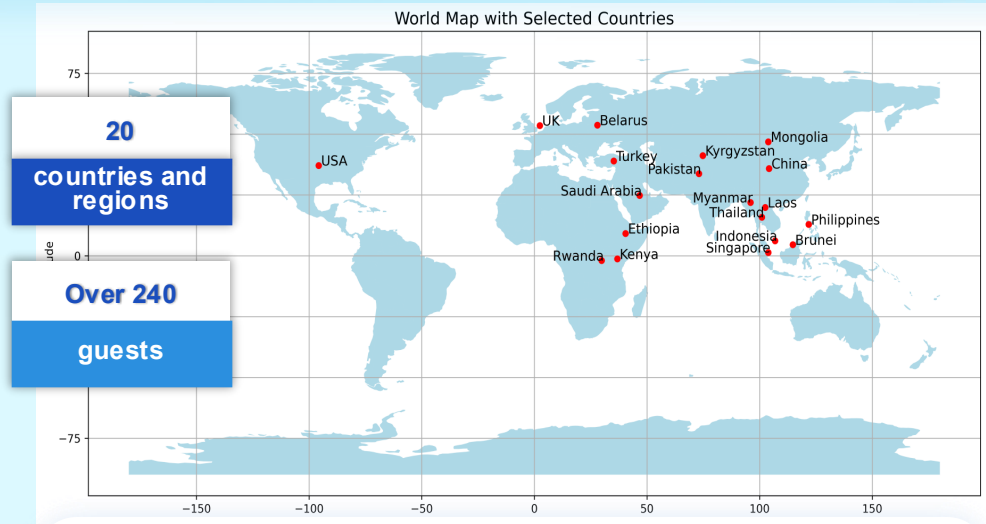
From April 19th to 21st, 2024, the first workshop was hosted by Zhejiang University School of Public Health in Hangzhou, China



Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries



Building a Collaborative Platform International Forum on Public Health and Emergency Workforce: Competency-based Education





Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries



浙江大学
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The Second Workshop

The Second International Forum to Implement WHO Roadmap on Public Health and Emergency Workforce: Competency-based Education

November 4 - 5, 2024, Hangzhou China



From November 4th to 5th, 2024, the second workshop was hosted by Zhejiang University School of Public Health in Hangzhou, China



Implementing the WHO Workforce Development Roadmap Project in China and other Asian Countries



Building a Collaborative Platform The Second International Forum to Implement WHO Roadmap on Public Health and Emergency Workforce: Competency-based Education





Chief Translator: Xifeng Wu

44
Pages

National workforce capacity for essential public health functions

Operational handbook for country-led
contextualization and implementation



World Health
Organization

56
Pages

Essential public health functions

A guide to map and measure
national workforce capacity



World Health
Organization

328
Pages

Global competency and outcomes framework for the essential public health functions



World Health
Organization

60
Pages

Defining essential public health functions and services to strengthen national workforce capacity



World Health
Organization



Current Progress



Translation from July to August 2024

Cross-check by translators from August to September 2024

Revise according to expert opinions in October 2024

Final review, typesetting, and publication: Expected in December 2025





Establishment of PHILA





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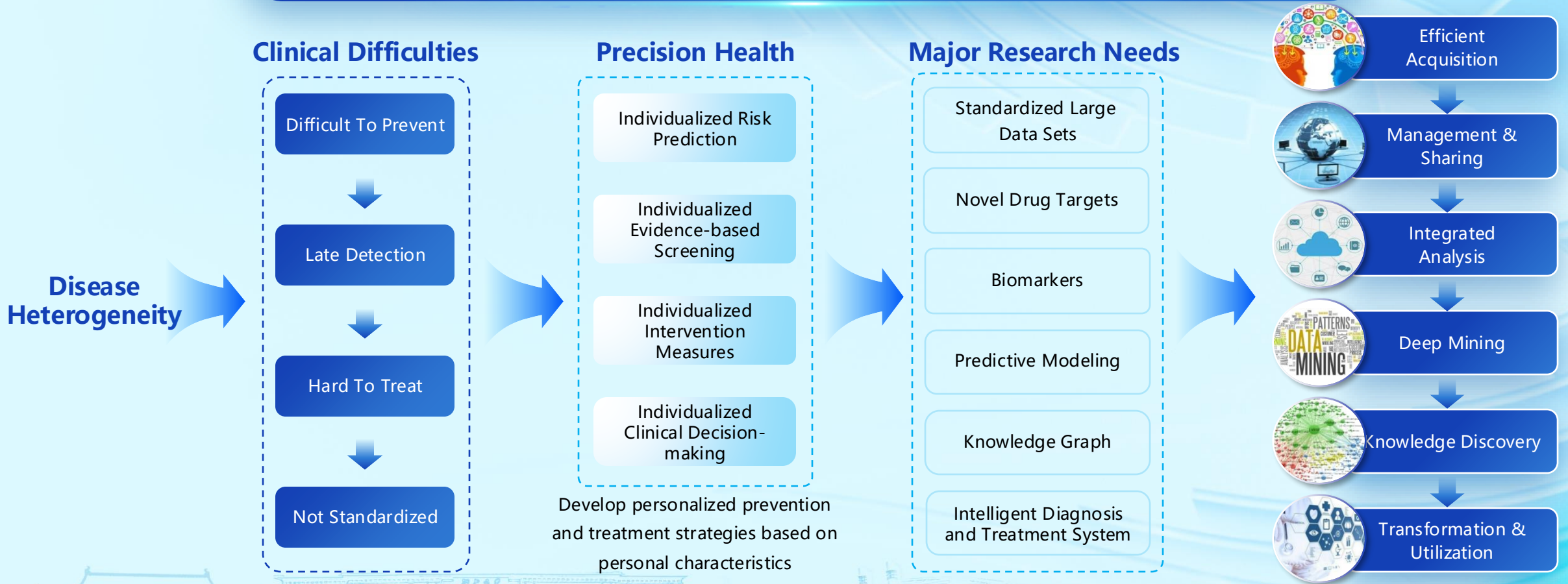


Big data in chronic disease prevention and control



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The burden of major chronic diseases is becoming increasingly heavy, realizing personalized prevention and control are urgent



The major scientific and technological issue involved is how to integrate biotechnology and information technology to break through the efficient collection and utilization of health care big data, so as to promote the development of precision health and digital health

Forging Digital-Intelligent Health New Infrastructure

Dimension

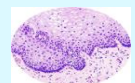
Modal



Molecule



Cell



Tissue



Organ



Body

Genome

Proteome

Metabolome

The TCR Phenotype

Liquid Biopsy

Radiomics

Clinical Phenotypics

Exposomics

Building a Hub for Theoretical and Key Technological Innovation Research

Adaptive fusion theory of cross-scale and multi-modal medical big data

New patterns of drug target cohorts and tuber/chronic disease biomarker discovery

Construction technology of knowledge graph for cancer/chronic disease prevention and treatment

Big data storage architecture and sharing system technology for tumors/chronic diseases

Knowledge embedding techniques in data driven intelligent algorithms

Joint analysis methodology of multi-directional, multi-scale and multi-omics big data

Intelligent algorithm library technology to support graph mining calculation

Technologies such as entity recognition, relationship extraction, and knowledge fusion

A new method for modeling the overall risk prediction of tumors/chronic diseases

.....

Establishing the Technological Innovation for Digital-Intelligent Health Governance and Translation

Precision prevention, diagnosis and treatment of chronic diseases

Healthy aging

Intelligent medical services

Clinical diagnosis and treatment assistance decision-making

Precision management of chronic diseases

Emergency Incident Management



Strongly support the construction of a healthy Zhejiang, a healthy and digital China, and a community with a shared future for mankind



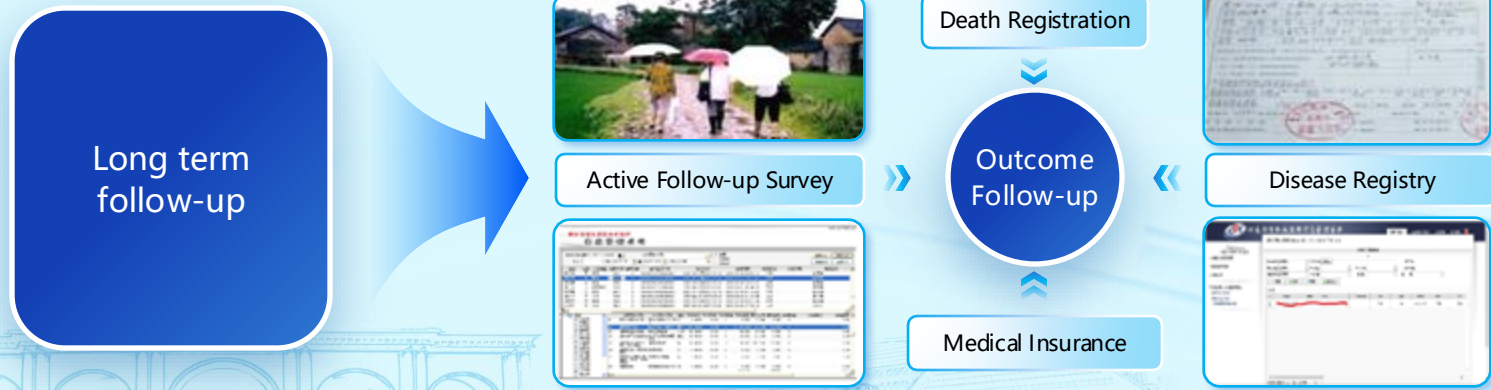
Healthy Zhejiang One Million People Cohort



Hope cohort

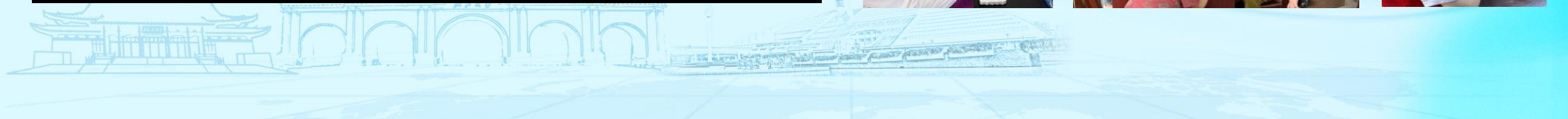
Healthy Zhejiang
One Million People Cohort

From microscopic biomolecular information, to mesoscopic personal information, to macroscopic social factors, effectively obtain multi-dimensional information, and perform long-term follow-up



To establish a world-class public health platform capable of supporting cutting-edge digital public health research and translational works

The HOPE project has been implemented across 228+ enrollment sites in all prefecture-level cities of Zhejiang Province, with over 660,000 participants successfully enrolled





Cutting-edge research platforms

A comprehensive “field – laboratory – data analysis” workflow layout

Biobank



2.88 Million Sample Sizes



Automated Biobanks
(14 Million Sample Sizes / Stations)

Biological Detection Platform

Collection of human origin samples and sample sorting processing platform



Hamilton EasyBlood

Sample nucleic acid extraction and quality control platform



QIAGEN QIAcube HT



Agilent 4150

DNA/RNA library and sequencing platform



MGISP-960



DNBSEQ-T7



Targeted Mass Spectrometry Metabolism Analysis Platform
Sciex7500



Broad-spectrum biochemical index detection platform
cobas501



Multi-factor detection platform
Luminex FlexMAP



High-throughput genetic analysis platform
Fluidigm BioMark HD



Genome-wide microarray detection platform
Illumina iScan system

A one-stop platform for sample processing-nucleic acid extraction- library construction, sequencing-transcription, protein -metabolism detection

High Performance Server Cluster



Server storage is above **8.1PB** and can be extended and upgraded at a later stage depending on usage requirements

Standardized procedures for the entire chain

Data Acquisition

Crowd Investigation And Detection

Registration, Subpackaging, Storage And Transportation Of Biological Samples

Secure Storage, Privacy Protection, Efficient Management And Quality Control Of Data

Unified representation and deep fusion of multi-source data

Data Representation

Convergent Integration Strategy

Feature Representation Learning

Unified Representation Fusion

Construction Of Knowledge Map

Knowledge distillation and modeling of multi-source data

Knowledge Modeling

Prior Knowledge Fusion

Autonomous Noise Mining

Temporal Knowledge Extraction

Modeling Of Dependencies

Intelligent Interpretation

Intelligent interpretation of medical imaging, histopathology and electronic medical record data

Machine Learning

Computer Vision

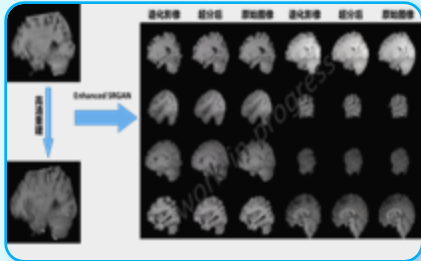
Natural Language Processing

Compression Of Diagnosis And Treatment Model

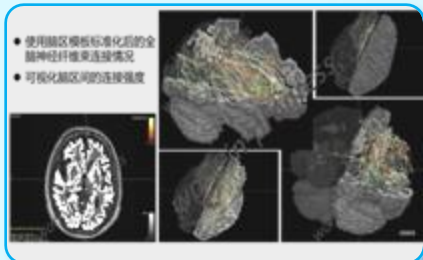
Innovated a series of medical AI technologies

Image Data Processing

MRI super-resolution reconstruction

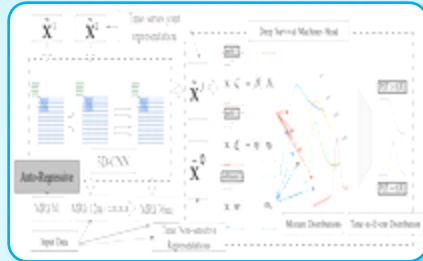


Brain Connectivity Visualization

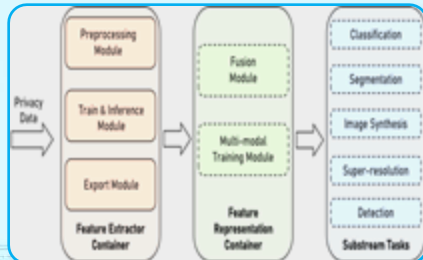


Multi-dimensional Relationship Mining

Survival analysis model based on neural networks



Multimodal Data Interface

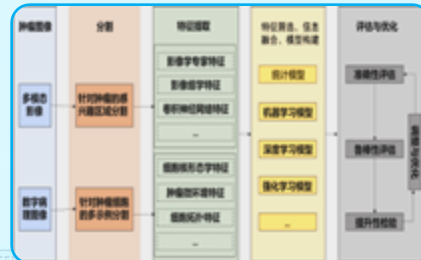


Solution Building

MRI deep learning pipeline

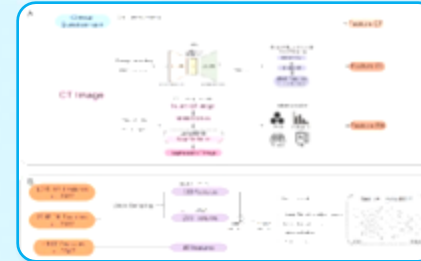


Digital pathology processing process

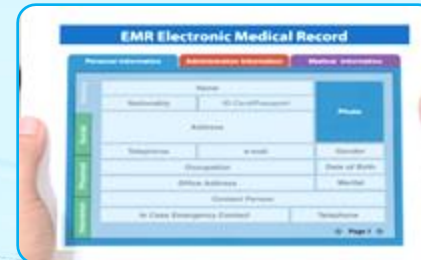


Governance Capability Enhancement

COPD diagnosis model

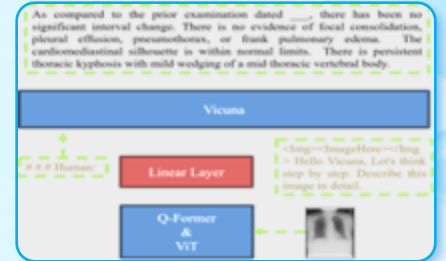


EHR Mining

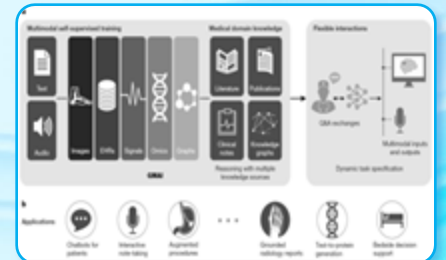


Innovative AI Applications

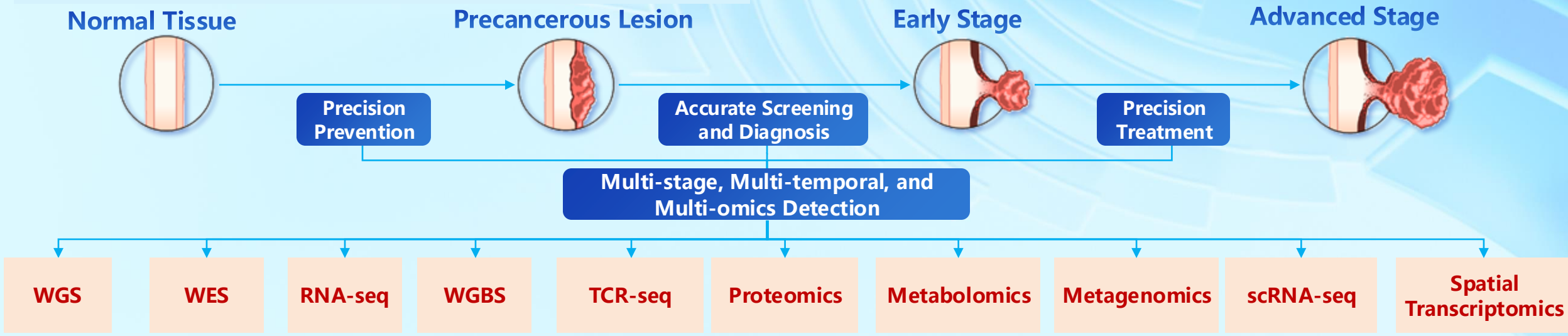
LLM Integration



Foundation Model Development



Big Data Applications (Part 2): Innovative "Dry-Wet integration" Approach for the Discovery of Multi-Omics Biomarker



Single-Omics Data Analysis

Multi-Omics Integrative Analysis

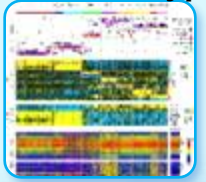
Molecular Characteristic Map



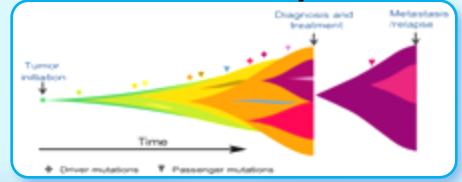
Molecular Interaction Network



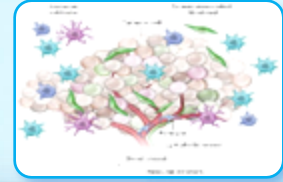
Multidimensional Molecular Typing



Evolution and Key Molecular Event Spectrum



Molecular Characteristics of Immune Microenvironment



Innovation in data fusion analysis theory and methods

Development of interactive intelligent analysis platform

Intelligent analysis of molecular transformation throughout the disease course

Innovation In Multi-source Fusion Theory

Knowledge Graph Iteration

Research And Development Of Intelligent Interpretation Algorithms

Intelligent Prevention

Precision Diagnosis

Clinical Decision Support System

Conducted WGS analysis on 60,000 participants.

Performed genome-wide association studies (GWAS) and transcriptome-wide association studies (TWAS).

Identified and confirmed 6 novel susceptibility loci and genes associated with NSCLC in East Asian populations.

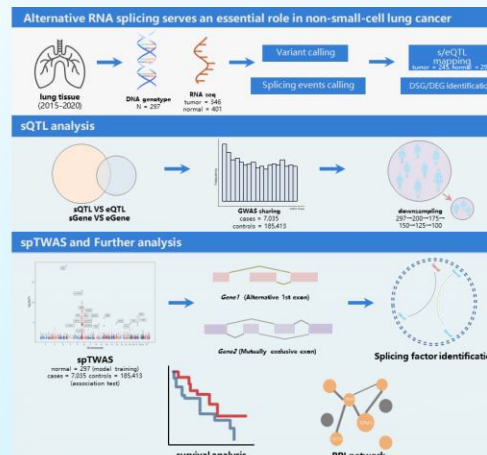
Low-frequency and rare variants analysis

Identified 9 novel genes linked to NSCLC, validated through independent samples

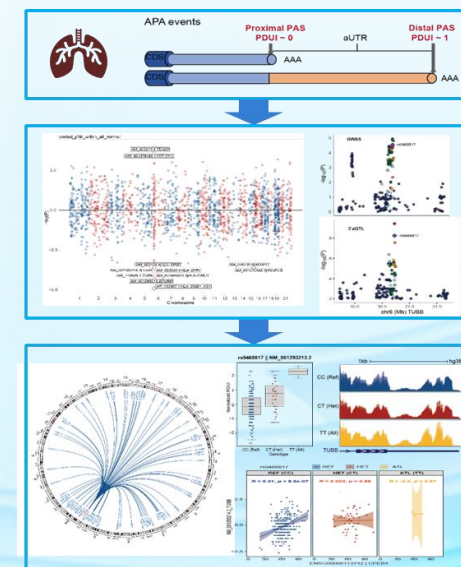
Utilized CNN-based deep learning methods for fine-mapping analysis

Discovered rare mutations potentially affecting transcription factor binding motifs (TF motifs), thereby influencing NSCLC risk

Integrated RNA splicing features to identify new risk loci for NSCLC



Identified novel NSCLC susceptibility genes through TWAS focusing APA sites



Conducting Large-Scale Proteomics Detection

Systematic Analysis of the Association Between Plasma Proteome, Genes, and Phenotypes: Exploring Clinical Applications

Healthy Control

Lung Cancer

Pancreatic Cancer

Liver Cancer

Kidney cancer

...

5100 participants

SOMAscan Proteomic Assay

11,000 Proteins/Sample

Association with the Exposure

Smoking, Drinking, Green Space Area, Dietary, Exercise, Air pollution, Walking environment, Sleep, Tea, ...

Association with the Genome

Protein levels

Exposure-Proteins

MR

Genotype (WGS)

pQTL

Multi-cohort validation

Trans-ethnic analysis

Disease-Protein

MR

Association with Phenotype/Disease

Cancer, Lung nodule, Hypertension, COPD, Diabetes, Hyperlipidemia, Aging, Fatty liver disease, ...

Uncover the impact of the exposome on the proteome and explore its mediating role in exposure-disease associations

Uncover the link between plasma proteomics and genetics, and build a pQTL database for the Chinese population

Uncover the link between proteomics and major chronic diseases/cancer, and identify novel biomarkers.

Proteomics

Epidemiology

Medical Imaging

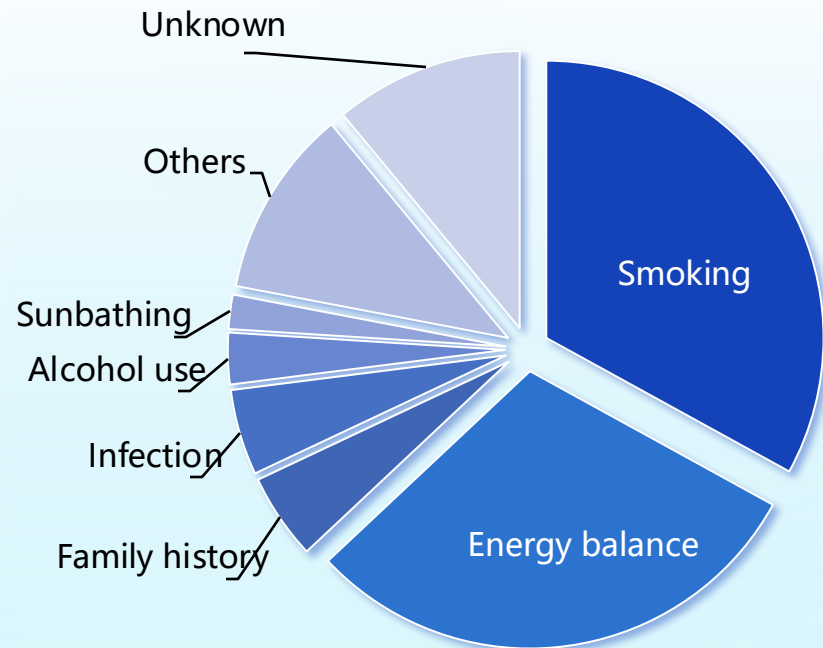
Clinical Information

Machine Learning

Deep Learning

Building a proteomics-based model for precise prediction and management of chronic diseases and cancer

We have conducted thorough research on the association between modifiable risk factors such as exercise, diet, sleep, quality of life, smoking, and the environment, and diseases/health outcomes.



Survival/Death

Cancer
Cardiovascular Disease

Obesity
Insulin Resistance
Inflammation

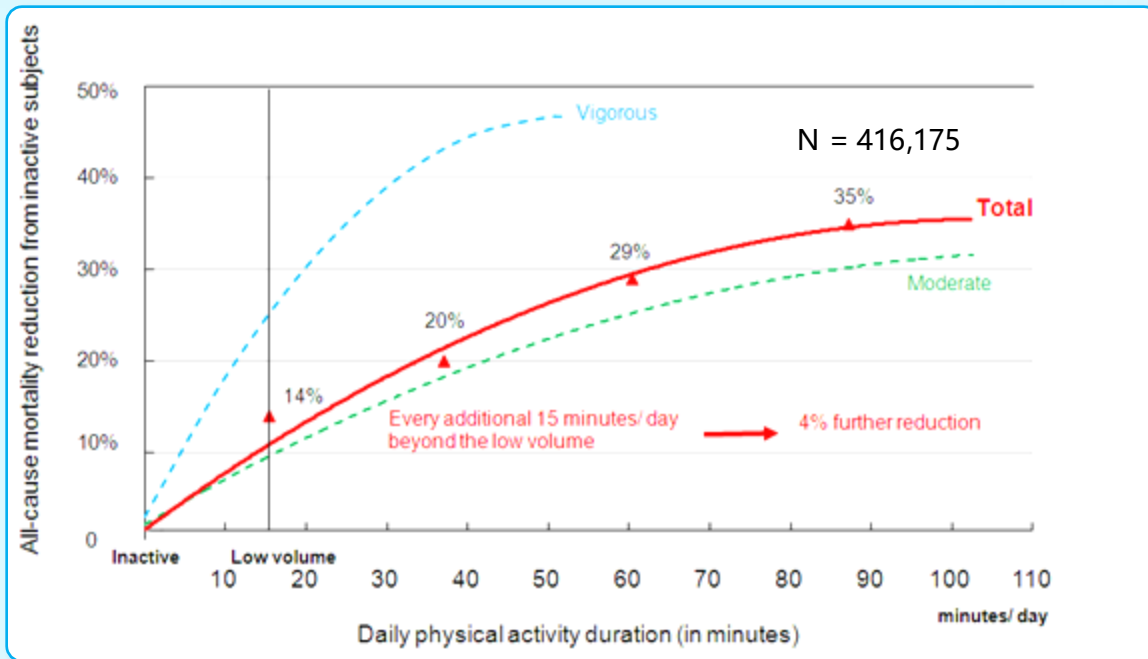
Diet
Exercise
Heredity

Molecular Mechanisms
Gut Microbes
Metabolomics

Achieving translation from observational studies to public health policy implementation and evidence-based interventions

Moderate exercise for just 15 minutes per day can extend lifespan by 3 years and reduce mortality rates by 14%

The Lancet invited experts to comment on the study, stating that the findings are highly feasible. The State Council's Opinion on Implementing the Healthy China Action proposes creating a 15-minute fitness circle.



Opinions on Implementing the Healthy China Action by the State Council

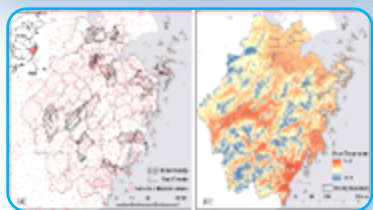
Implementing nationwide fitness campaigns



To establish grassroots fitness organizations and "15-minute fitness circles" accessible to the public.

Explored the health effects of extreme temperatures, air pollution and built environment characteristics

Mortality effects and risk assessment of extreme temperature

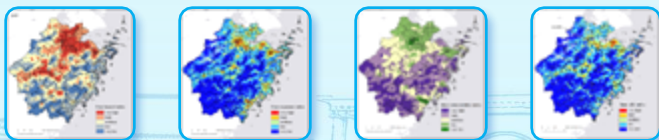


Effects of short-term exposure to extreme temperatures on mortality



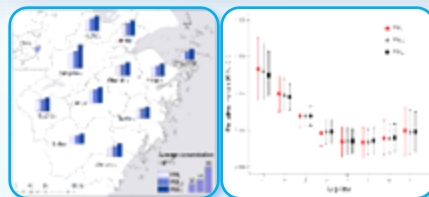
A study on the influence of demographic, socio-economic factors and blue-green space on mortality effects

Modeling of spatial assessment of temperature health risks

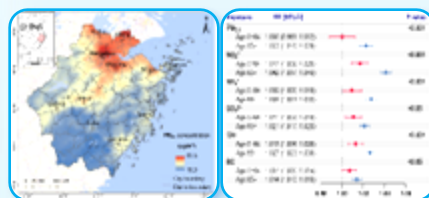


EHP, 2019 STOTEN, 2022 ESE, 2024 EST, 2017

Long- and short-term health effects of air pollution



Short-term mortality effects of different particle sizes of air pollution



Short-term mortality effects of different components of air pollution

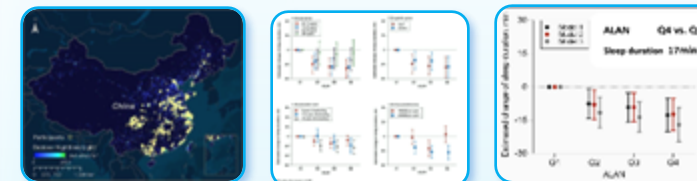
A study of the effects of different components of air pollution on cognitive dysfunction



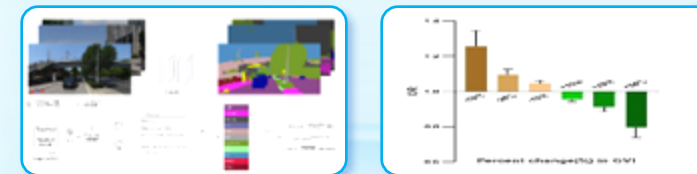
EI, 2018
JHM, 2023

Long-term health effects of the built environment

Artificial lighting at night reduces sleep duration



Green space exposure measurement and health effects study



Higher visible greenness within a 15-minute walk of the workplace was associated with reduced risk of metabolic syndrome

EI, 2024 ER, 2022 LUAP, 2023

Dietary Nutrition Big Data Platform



Digital Dietary Survey System



Intelligent Nutrition Assessment System



Dietary Nutrition Big Data Platform

Methodological Research

Reliability and Validity Studies



FFQ



Biomarker



Screening Dietary Assessment Tools Suitable for Different Populations

PHRI

DNI

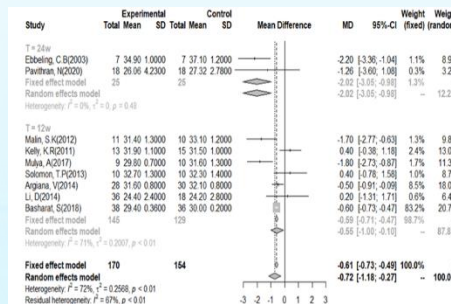
Student Meal Dietary Nutrition Assessment Index

Online Dietary Survey



Empirical Research

Exploring Associations Between Different Dietary Patterns and Health/Disease

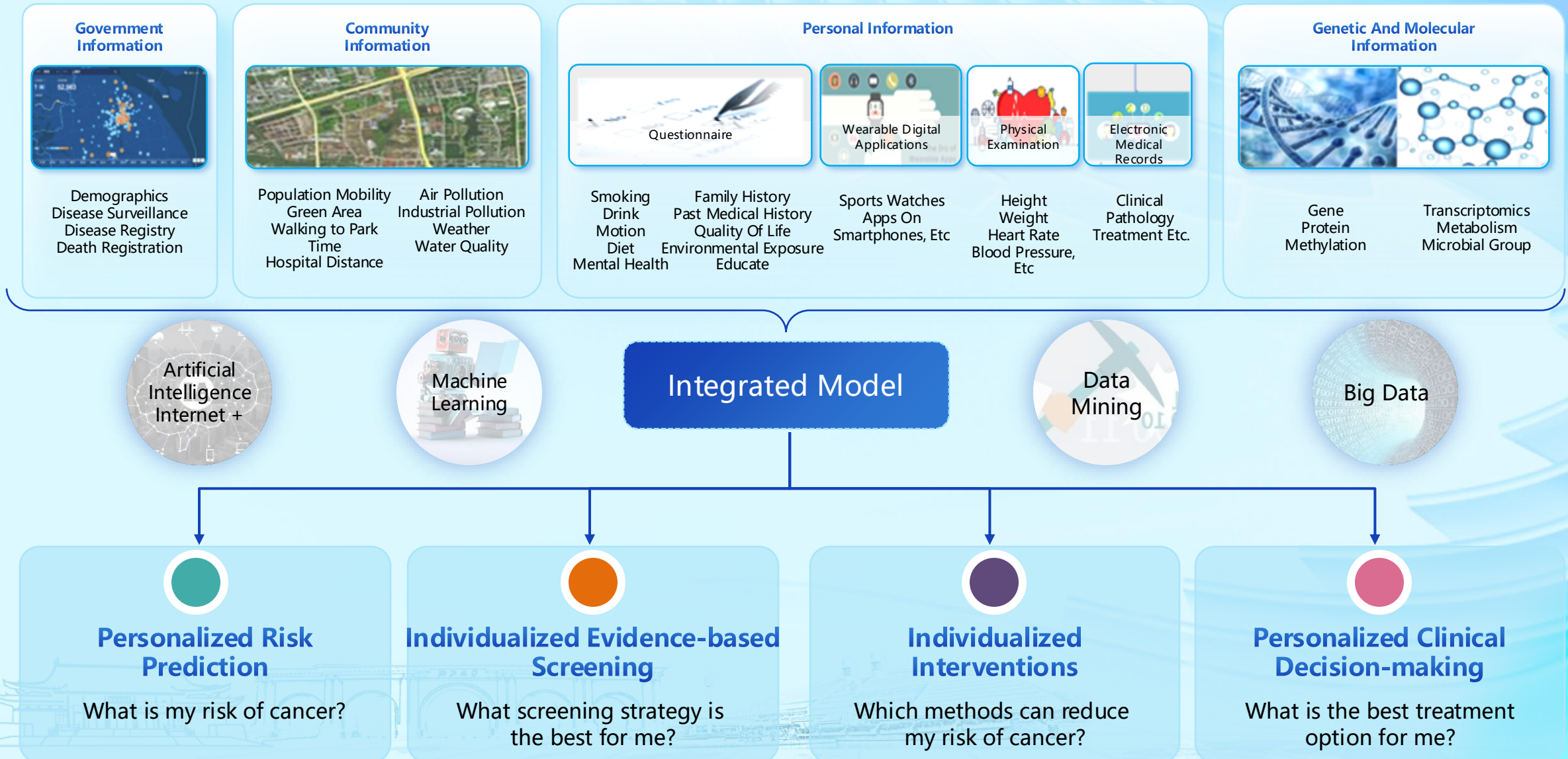


Low glycemic index diets can reduce body mass index and fasting blood glucose
Ni C...Wu X, Yang M. Nutrients. 2022

Translational Research

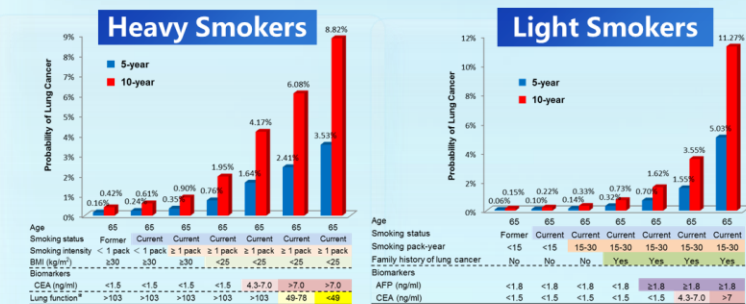


Creating Nutrition-Healthy Canteens



An individualized prediction model covering the whole cancer chain

Risk of lung cancer



Using the standard of >1%, predict the incidence of lung cancer within 5 years:

- 29.9% heavy smokers
- 1.0% light smokers
- 0.7% non-smokers

As a candidate for CT scanning

Radiation toxicity of lung cancer

定制 Illumina iSelect Genotyping BeadChip

>900 个炎症相关基因
~12,000 SNPs

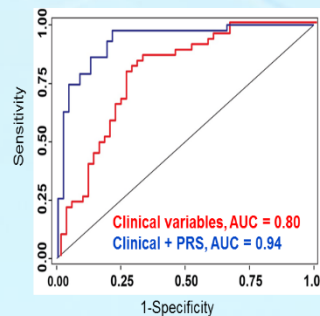
培训队列
244 名非小细胞肺癌患者
多基因风险评分 (PRS)

验证队列
220 名非小细胞肺癌患者

食管炎 (10 SNPs)	多因素 OR (95%CI)	P
培训	3.7 (2.4-5.8)	2.7×10^{-9}
验证	3.0 (2.0-4.5)	6.4×10^{-8}
综合分析	3.3 (2.5-4.5)	1.1×10^{-15}

功能性分析
2 个基因 → 食管炎
1 个基因 → 肺炎

- 做为治疗靶点
- 指引最合适的放疗剂量以降低放疗产生的毒性



Validate the radiation-induced toxicity model for NSCLC:

- RTOG 0617 trial (with Radiation Oncology)

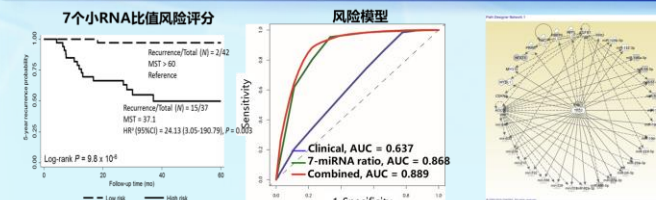
Recurrence of lung cancer

全面小RNA筛选
研究血清内的小RNA

训练

验证

7个小RNA比值



Clinical Benefits

- Approximately 30% of patients with stage I non-small cell lung cancer still die from lung cancer after surgical resection.
- Circulating small RNAs can help stratify the risk of stage I patients who have undergone high-risk surgical resection, guiding which patients require adjuvant chemotherapy or immunotherapy → Design clinical trials to validate the efficacy of the prediction model.
- Research on therapeutic targets and drugs to reduce recurrence → Functional studies to identify small RNA antagonists or analogs in non-small cell lung cancer cell lines and mouse models.

Evidence-based screening

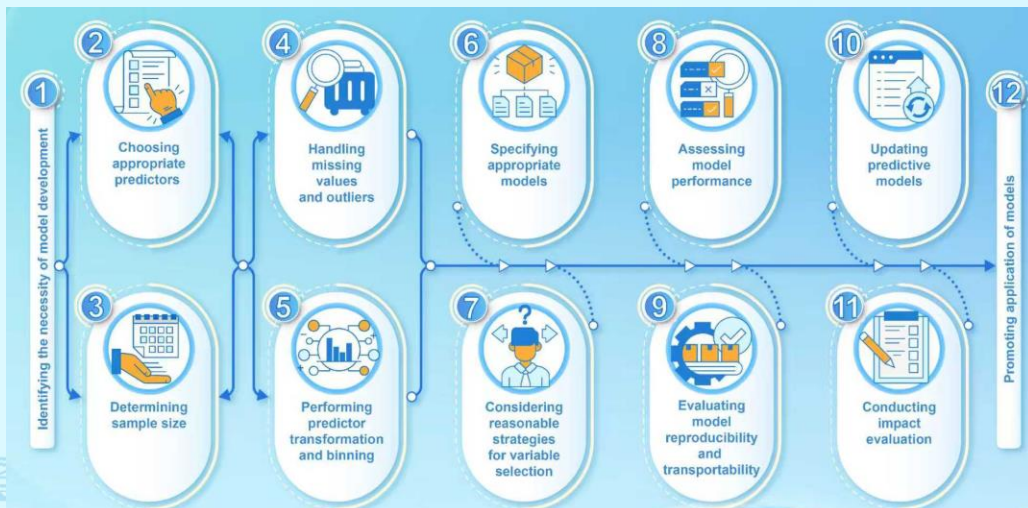
Clinical decision making

Performance of Cancer Risk Prediction Models

Workflow of Risk Prediction Model Construction

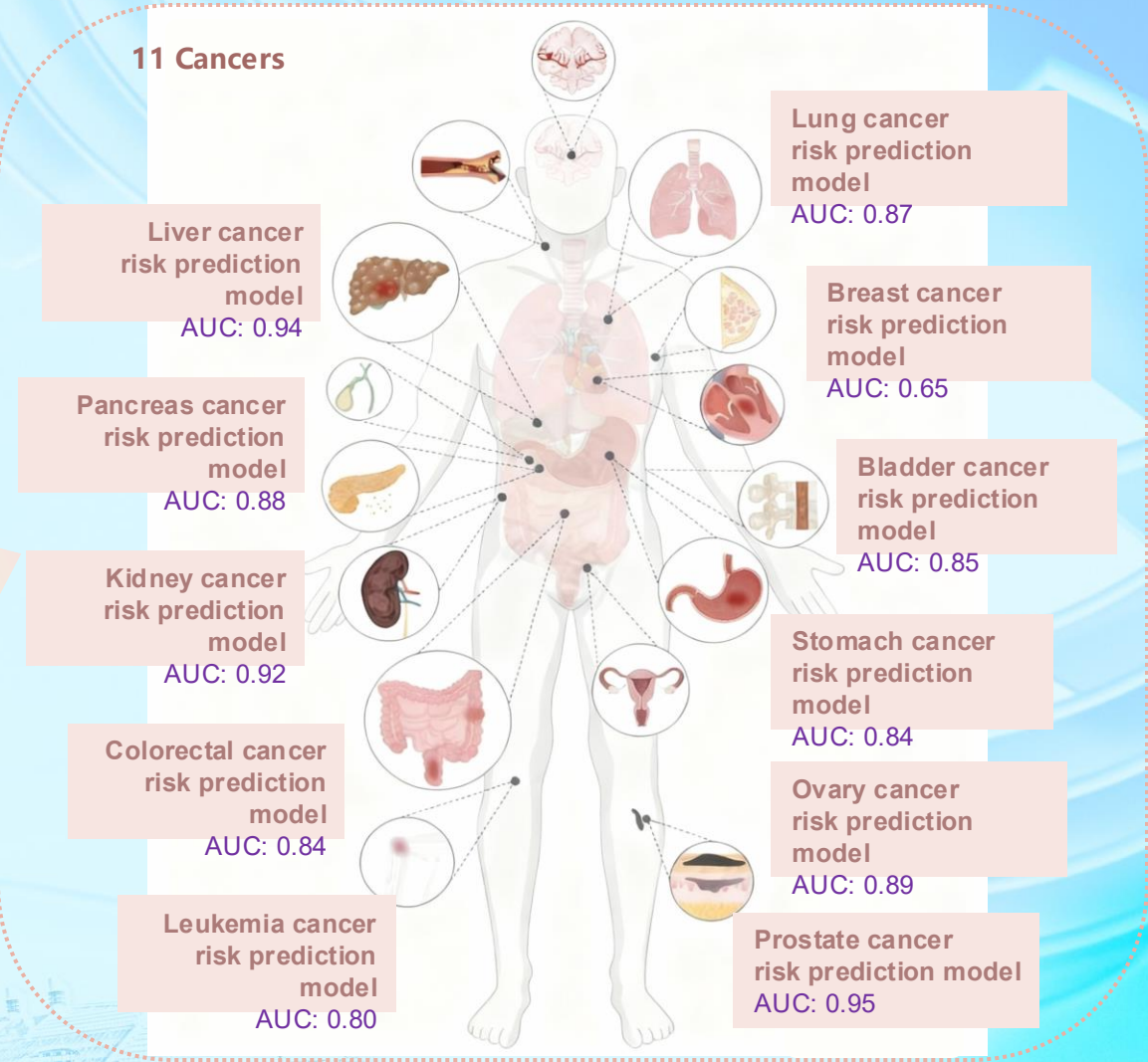


BMJ. 2024



The Innovation Medicine. 2024

11 Cancers



10 prediction models achieved an AUC above 0.80

Large Scale Model-based Predictive Framework for the Entire Disease Lifecycle

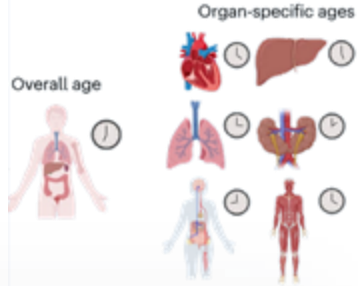
Precision Early Warning

Multi-Organ Biological Age Prediction

LLMs agents

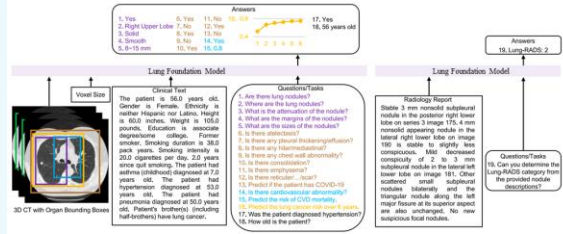


Prompt Tuning

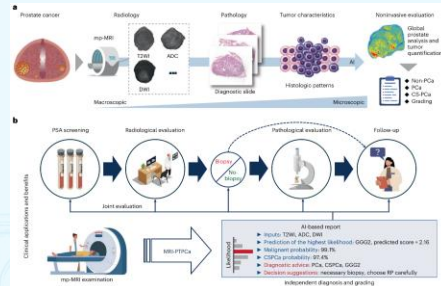


Precision Diagnosis

Accurate Pulmonary Nodule Detection Based on CT Models

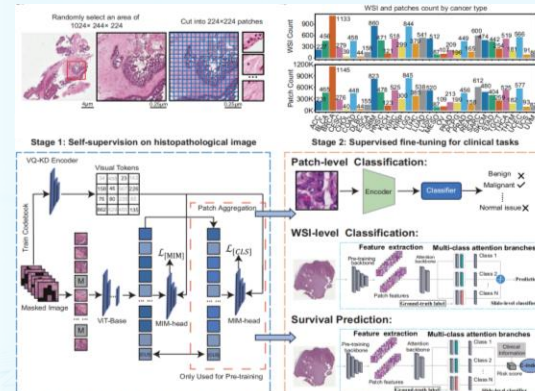


Non-Invasive Diagnosis and Grading of Prostate Cancer Using MRI Models



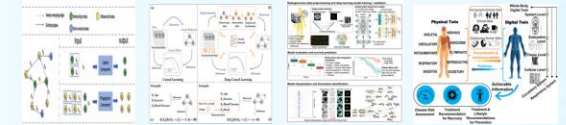
Precision Treatment

- Lung Cancer Genetic Mutation Prediction via Pathology Models
- Patient-Level Adverse Drug Reaction Prediction
- Drug Perturbation Prediction with AI Virtual Cell Technology

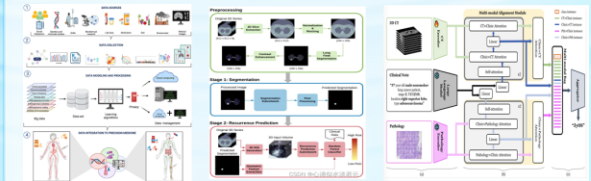


Precision Prognosis

Causal Modeling and Clinical Decision Pathway Optimization Driven by Multimodal Data



Prognostic Prediction and Intelligent Decision-Making Using Multimodal Large-Scale Models



Building precision aging models across molecular, organ, and organism Levels

molecular

- Meta Clock
- Metabolic Clock
- ...

organ

- Brain Age
- Heart Age
- ...

organism

- Phenotypic Age
- MDAge
- ...



Precision intervention for aging

Systematic analysis of influencing factors of aging

Systematically elucidate the significant impacts of genetic, environmental, and behavioral factors on individual aging status from a new perspective of the entire life cycle.



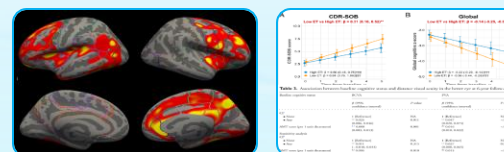
Development and optimization of dementia screening tools and strategies

Development of intelligent screening tools Optimization of community screening strategies



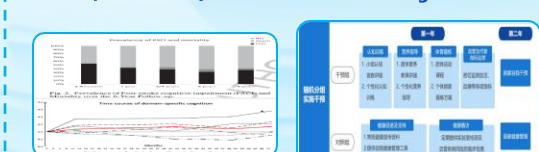
Neuropathological mechanisms of cognitive and behavioral disorders

Brain imaging mechanisms Multidimensional biomarkers



Multidimensional community health management

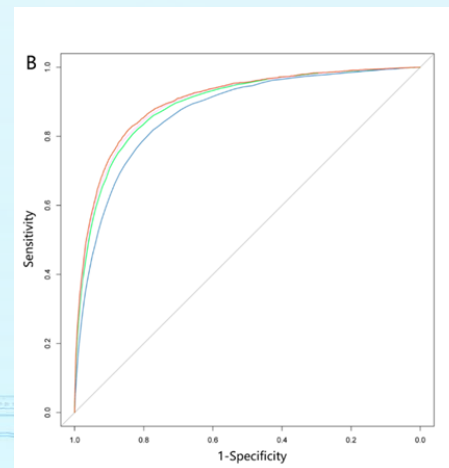
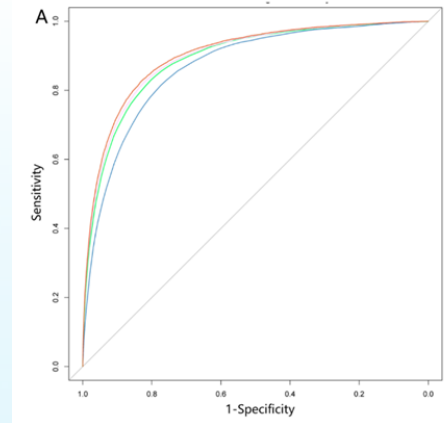
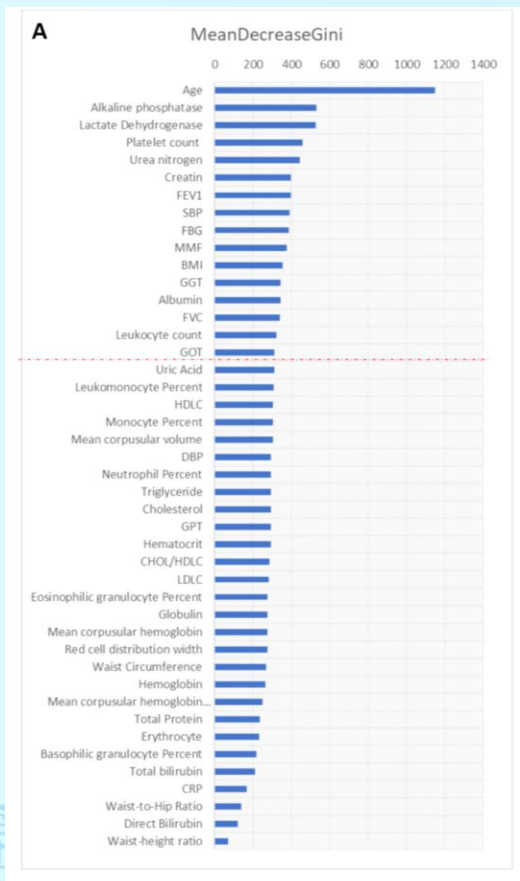
Prediction of long-term cognitive and behavioral developmental trajectories Multidimensional community health management



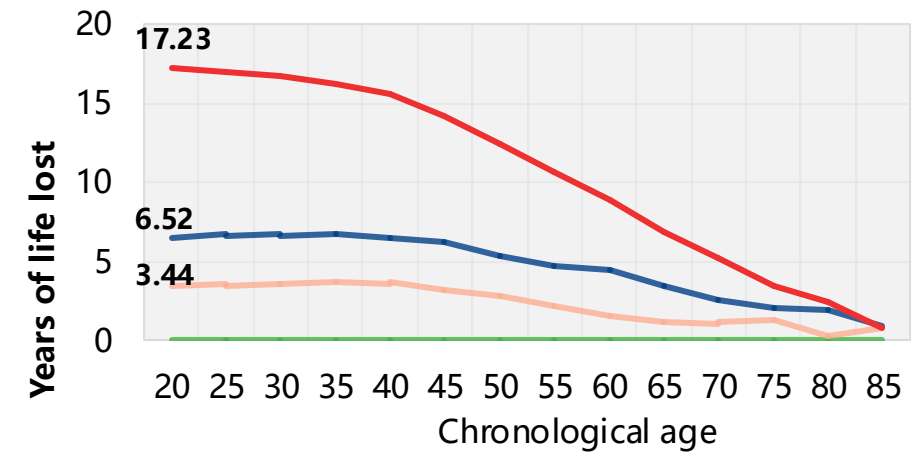
Glob Health Res Policy, 2021; Front Med, 2022; Ann N Y Acad Sci, 2022; Front Psychiatry, 2022; J Gerontol A Biol Sci Med Sci 2023; BMC Med 2023a, 2023b; Arch Gerontol Geriatr 2023; iScience 2024; Alzheimers Dement, 2024; BMJ Evid Based Med, 2024; GPB 2025; Geroscience 2025

Organism Level — MDAge model

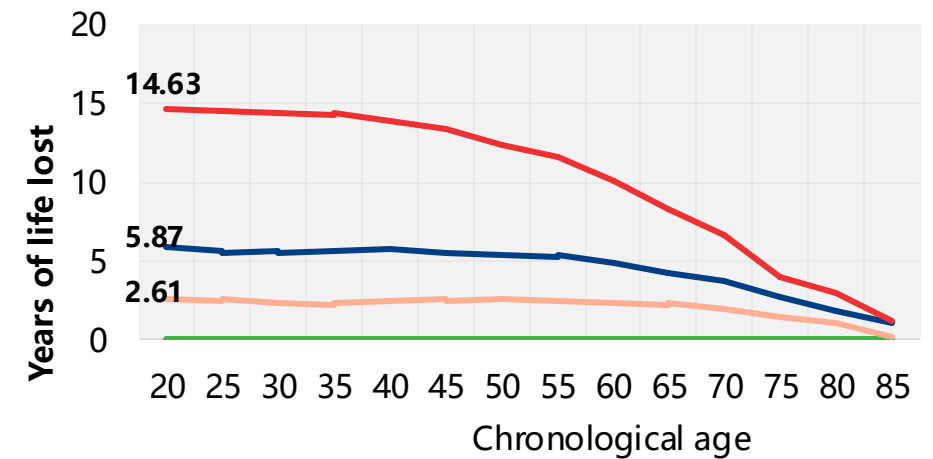
Taiwan MJ cohort N=597,000



Male

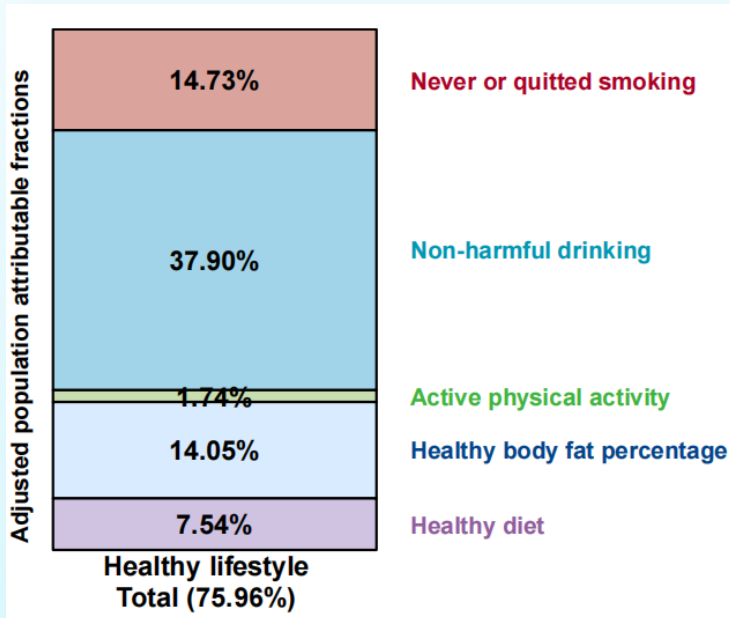


Female

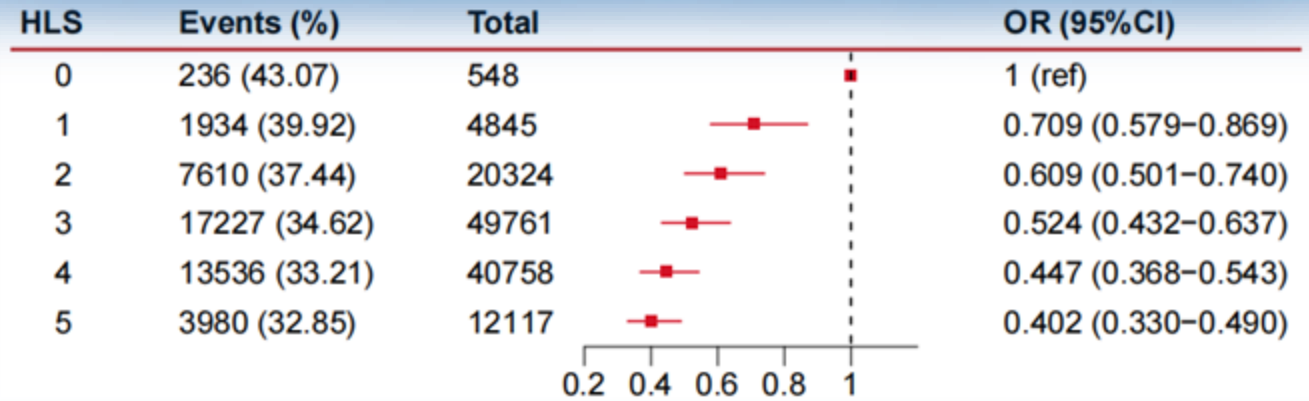


A healthy lifestyle significantly reduces aging acceleration

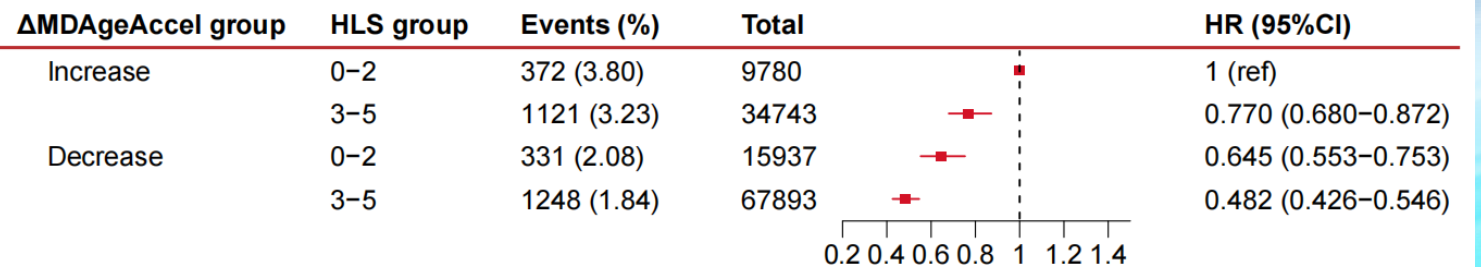
A healthy lifestyle can reduce the likelihood of increased aging acceleration by nearly 76%.



The higher the Healthy Lifestyle Score (HLS), the greater the likelihood of a reduced aging acceleration.

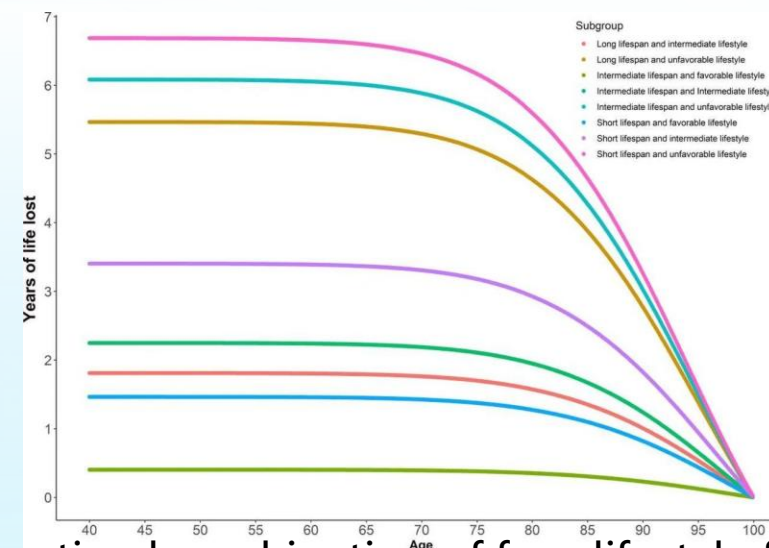
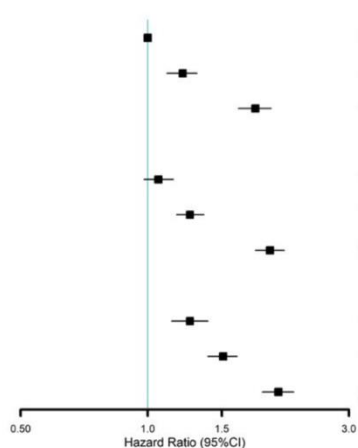


A reduction in aging acceleration, combined with a high HLS, can reduce the risk of death by more than 50%.



A healthy lifestyle can reduce the impact of life-shortening genes by over 60%

Subgroup	Total no.	No. of deaths/PY	HR (95%CI)	P value
Long group				
Favorable lifestyle	16292	734/1140555	1 [Reference]	
Intermediate lifestyle	39151	2284/2732093	1.21 (1.11-1.31)	9.04E-06
Unfavorable lifestyle	15306	1492/1071428	1.80 (1.64-1.96)	3.38E-38
Intermediate group				
Favorable lifestyle	48936	2381/3431436	1.06 (0.98-1.15)	1.47E-01
Intermediate lifestyle	118170	7257/8236031	1.26 (1.17-1.36)	3.59E-09
Unfavorable lifestyle	45138	4695/3153952	1.95 (1.80-2.11)	5.12E-63
Short group				
Favorable lifestyle	16391	924/1146664	1.26 (1.14-1.39)	2.88E-06
Intermediate lifestyle	39481	2829/2748468	1.51 (1.39-1.63)	6.27E-23
Unfavorable lifestyle	14877	1643/1038110	2.04 (1.87-2.22)	3.29E-57



If individuals with high genetic risk for short lifespan choose a healthy lifestyle, they can extend their life expectancy by nearly **5.22 years** at the age of 40.

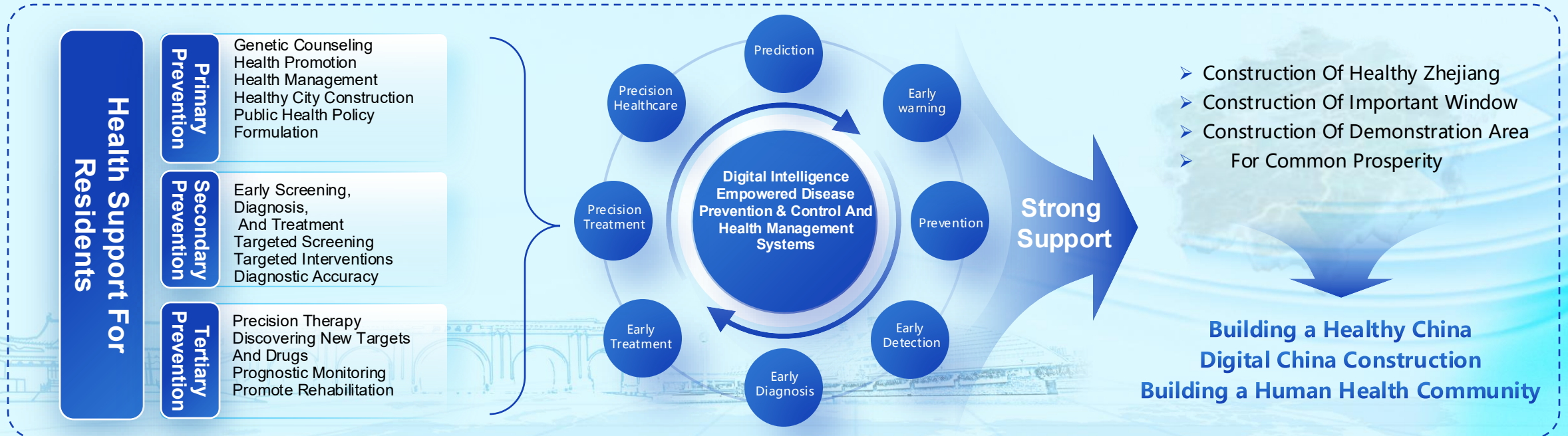
The optimal combination of four lifestyle factors for extending human lifespan: not smoking, regular physical activity, sufficient sleep, and a healthy diet.



Digital public health supports the global community of health



Breakthroughs in Basic Research





浙江大学 公共卫生学院
SCHOOL OF PUBLIC HEALTH
ZHEJIANG UNIVERSITY

Thanks for Your Attention

November, 2025

