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BIG DATA:

from the Moli-sani project to the Neuromed integrated health platform and Biobank

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BIG DATA ?

- A LARGE AMOUNT OF PIECES OF INFORMATION?
- A NEW WAY OF ANALYSING SUCH A LARGE BULK OF DATA?

BIG DATA: A NEW ERA ?

- SUCH A LARGE AND COMPLEX AMOUNT OF DATA NEEDS TO BE ANALYSED BY NEW ADVANCED TECHNOLOGIES, ABLE TO DISCOVER NEW INTERACTIONS AMONG SYSTEMS AND PROVIDE NEW KNOWLEDGE

BIG DATA FOR HEALTH

- TO COLLECT AND STORE THE HIGHEST AMOUNT OF INFORMATION FOR SCIENTIFIC RESEARCH, THROUGH COLLABORATIONS WITH HEALTH OPERATORS (general practitioners, medical specialists, hospitals,…) AND SOCIO-ECONOMICAL LOCAL AND REGIONAL SERVICES

- TO BETTER UNDERSTAND DETERMINANTS OF HEALTH AND DISEASE FOCUSSING ON PREDICTION/PREVENTION APPROACHES, ACCORDING TO THE PRINCIPLES OF PERSONALIZED MEDICINE

- TO CREATE GUIDELINES FOR RISK PROFILE, PREVENTION, DIAGNOSIS AND TREATMENT OF CHRONIC DEGENERATIVE DISORDERS, WITH AN INTEGRATED APPROACH TO PRECISION MEDICINE

Health, Genetics and Lifestyles

An Italian region transformed in a scientific laboratory

to better understand the equilibrium

between genetics and environment

on cardio-cerebro-vascular disease and cancer risk

The Moli-sani study

- ✓ 24,325 residents in the Molise region
- ✓ Aged ≥ 35 years
- ✓ Recruitment phase: 2005-2010
- ✓ Median follow-up: 8 years
- ✓ Second follow-up: December 2015
- ✓ Study duration …∞ years

THE "COMMON SOIL" HYPOTHESIS

Cardiovascular disease, tumors and neurodegenerative disease share some common physiopathological mechanisms and risk factors

Donati, 2003, 2007 and 2010
Iacoviello, 2008

The Moli-sani Project

EPIDEMIOLOGICAL STUDY

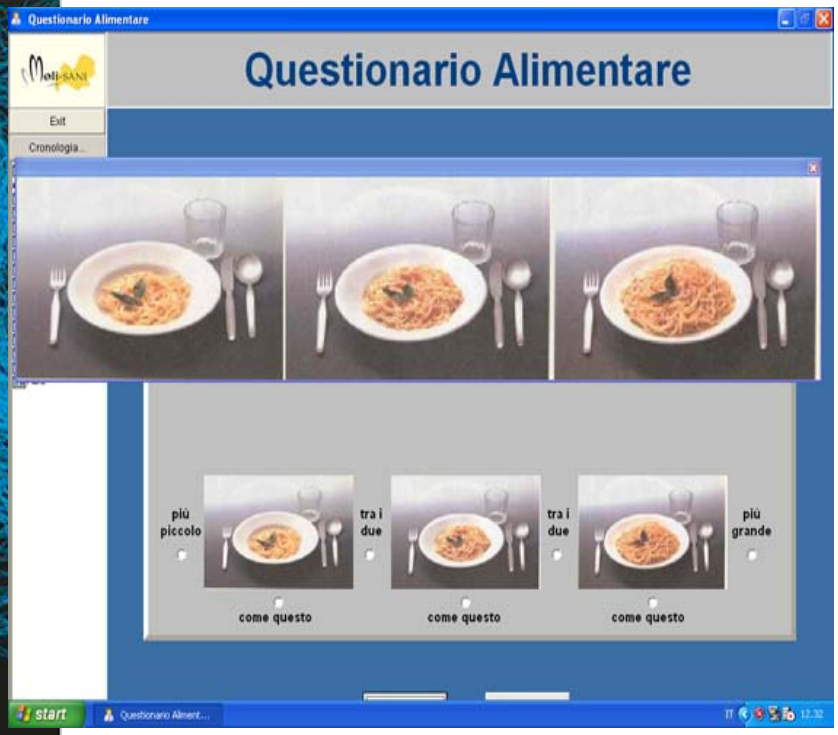
- ✓ *24,325 people living in Molise*
- ✓ *Aged 35 years or more*
- ✓ *Recruitment phase: 2005-2010*
- ✓ *Median follow-up: 8.3 years*

CLINICAL END-POINTS

- ✓ **Cardio-cerebrovascular disease**
- ✓ **Tumors**
- ✓ **Neurodegenerative disease**
- ✓ **Common intermediate phenotypes:**
  - *Metabolic syndrome*
  - *Obesity*
  - *Hypertension*
  - *Dyslipidemia*
  - *Diabetes*

A typical “Moli-sani” day: *paper-less questionnaires*

- **Anamnestic questionnaire explored the condition of each volunteer from a clinical and lifestyle point of view**

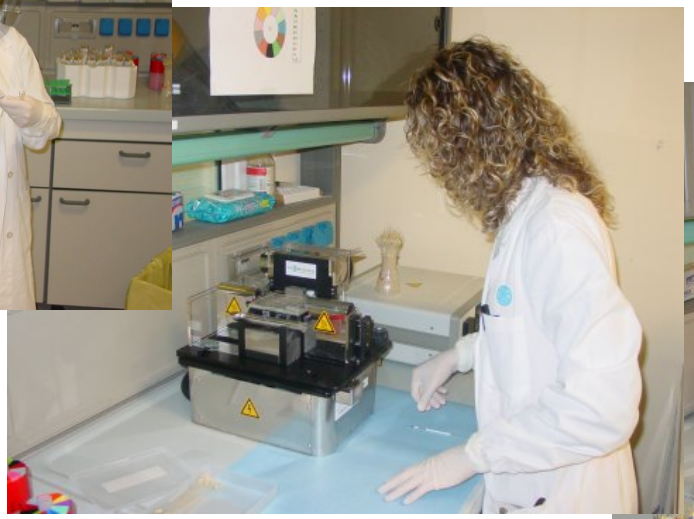


- **EPIC-modified Food Frequency Questionnaire provided detailed information about type and amount of one-year recall food consumption**

A typical “Moli-sani” day: *Laboratory tests*

- **Biological tests**
  - ✓ Blood cell counts
  - ✓ Cholesterol, HDL, LDL, TG
  - ✓ Glucose
  - ✓ C Reactive Protein
  - ✓ D-dimers

- **DNA extraction**



- **Biological samples stored in liquid nitrogen**

The Moli-sani Bio-Bank

700,000 blood samples in
4,080 goblets filled-in
28 paillettes per person:

- ✓ *8 red for plasma EDTA*
- ✓ *6 blue for plasma citrate*
- ✓ *8 yellow for serum*
- ✓ *6 green for pellet*

Urine samples:
3-hr morning collection

✓ 4 vials, 5 ml per person

THE «BIG DATA» OF THE MOLI-SANI PROJECT

VARIABLE	Number/subject	Total number
Clinical history	2100	51 082 5200
Family history	841	20 457 325
ECG	617	15 008 525
Spirometry	153	3 721 725
Biomarkers	592	14 400 400
Dietary habits	1 600	38 920 000
Follow-up	680	16 564 664
TOTAL	**6 583**	**160 155 139**

THE «BIG DATA» OF THE MOLI-SANI PROJECT BECOME BIGGER AND BIGGER…

Moli-SANI

BiomarCaRE

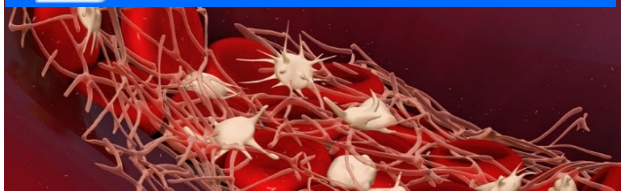
Biomarker for Cardiovascular Risk Assessment in Europe

7th European Framework Programme
Collaborative Project No. 278913

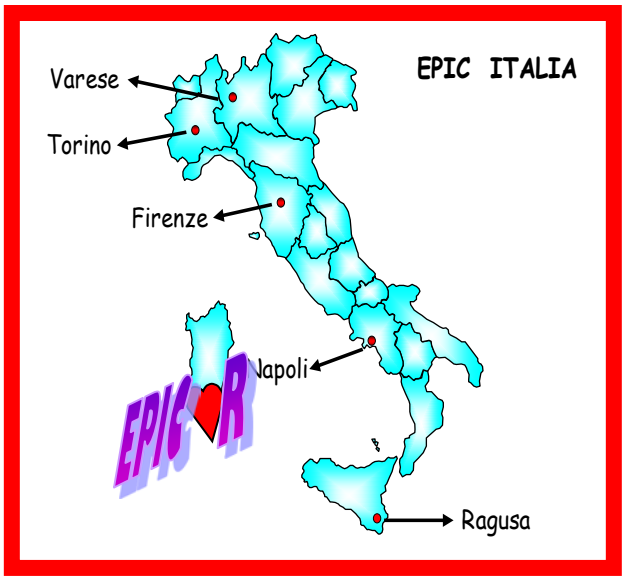
Universitätsklinikum Hamburg-Eppendorf

Scientific Coordinator: Prof. Stefan Blankenberg
University Medical Center Hamburg-Eppendorf (UKE)

RESEARCH INSTITUTE Synapse



Maastricht - The Netherlands



"HYPERCOAGULATION SCREENING AS AN INNOVATIVE TOOL FOR RISK ASSESSMENT, EARLY DIAGNOSIS AND PROGNOSIS IN CANCER"

HYPERCAN – AIRC5XMILLE PROGRAM

Reggia di Caserta

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RESEARCH CENTER FOR BIG DATA AND PERSONALISED HEALTH

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RESEARCH CENTER FOR BIG DATA AND PERSONALISED HEALTH

- **HUB** TO COLLECT DATA FROM THE PATIENTS FROM THE NEUROMED CLINICAL NETWORK
- **BIOBANK** TO STORE BIOLOGICAL SAMPLES
- **BIOTECHNOLOGICAL PLATFORM** FOR «OMICS» MEASUREMENTS (genomics, epigenomics, proteomics, metabolomics, microbioma, …)
- **BIOTECHNOLOGICAL PLATFORM** FOR ENVIRONMENTAL AND FOOD ANALYSES
- **INFORMATIC PLATFORM** FOR STORAGE AND ANALYSIS OF DIAGNOSTIC IMAGING
- **INTEGRATED DIGITAL PLATFORM** FOR BIG DATA ANALYSES TOWARDS PERSONALIZED HEALTH AND MEDICINE

BIG DATA … INGREDIENTS ?

- INDIVIDUAL DATA
- ENVIRONMENTAL DATA
- HEALTH SYSTEM DATA
- DATA FROM WEARABLE DEVICES
- OTHER

AN EXAMPLE OF BIG DATA FROM … BREXIT

OPEN ACCESS

Association between clinically recorded alcohol consumption and initial presentation of 12 cardiovascular diseases: population based cohort study using linked health records

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ABSTRACT

OBJECTIVES

To investigate the association between alcohol consumption and cardiovascular disease at higher resolution by examining the initial lifetime presentation of 12 cardiac, cerebrovascular, abdominal, or peripheral vascular diseases among five categories of consumption.

DESIGN

Population based cohort study of linked electronic health records covering primary care, hospital admissions, and mortality in 1997-2010 (median follow-up six years).

SETTING

CALIBER (ClinicAl research using LInked Bespoke studies and Electronic health Records).

PARTICIPANTS

1937 360 adults (51% women), aged ≥30 who were free from cardiovascular disease at baseline.

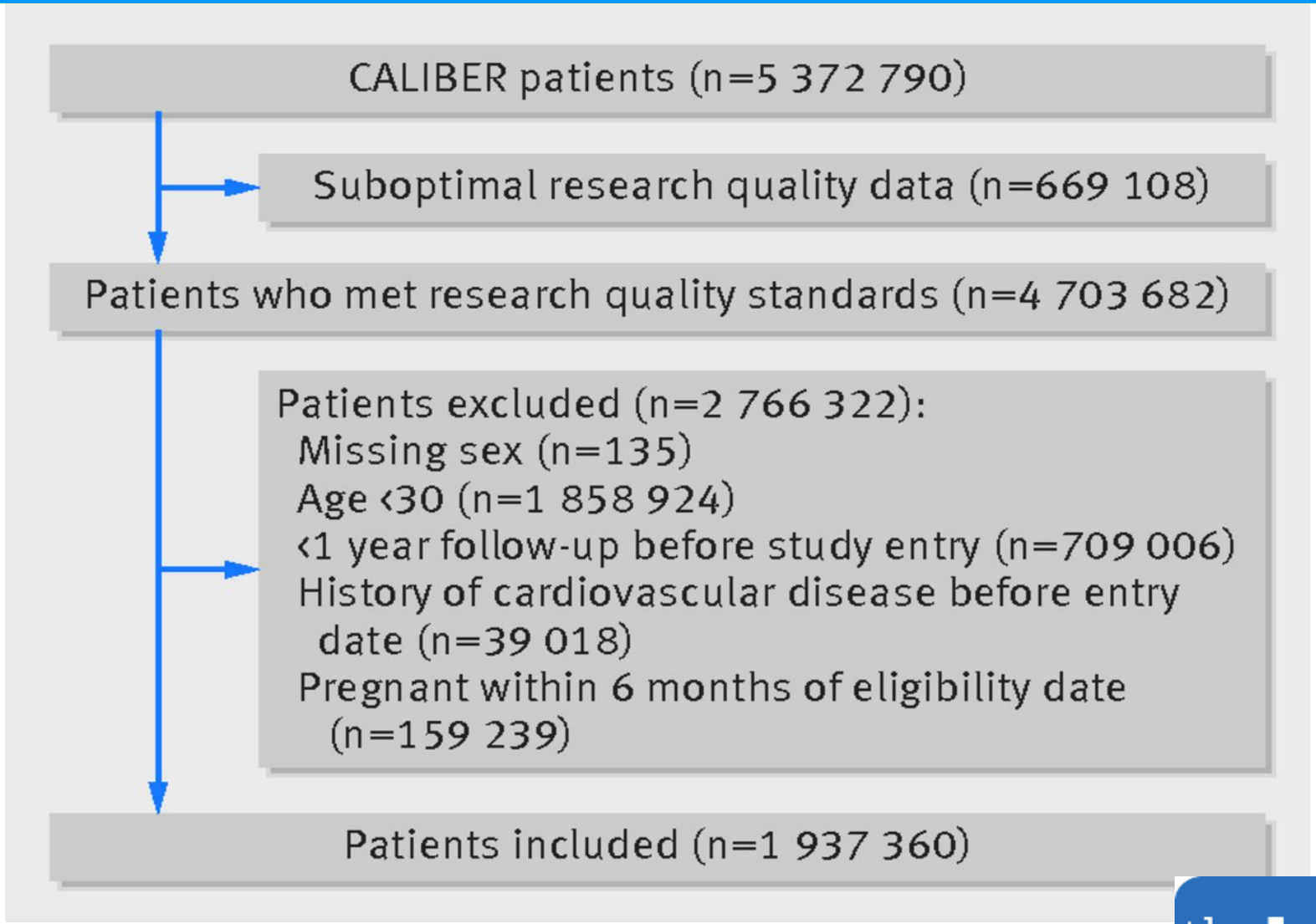
MAIN OUTCOME MEASURES

unheralded coronary heart disease death, heart failure, sudden coronary death/cardiac arrest, transient ischaemic attack, ischaemic stroke, intracerebral and subarachnoid haemorrhage, peripheral arterial disease, and abdominal aortic aneurysm.

RESULTS

114 859 individuals received an incident cardiovascular diagnosis during follow-up. Non-drinking was associated with an increased risk of unstable angina (hazard ratio 1.33, 95% confidence interval 1.21 to 1.45), myocardial infarction (1.32, 1.24 to1.41), unheralded coronary death (1.56, 1.38 to 1.76), heart failure (1.24, 1.11 to 1.38), ischaemic stroke (1.12, 1.01 to 1.24), peripheral arterial disease (1.22, 1.13 to 1.32), and abdominal aortic aneurysm (1.32, 1.17 to 1.49) compared with moderate drinking (consumption within contemporaneous UK weekly/daily guidelines of 21/3 and 14/2 units for men and women, respectively). Heavy drinking (exceeding guidelines)

Inclusion of patients in study of clinically recorded alcohol consumption and initial presentation of 12 cardiovascular diseases



Steven Bell et al. BMJ 2017;356:bmj.j909

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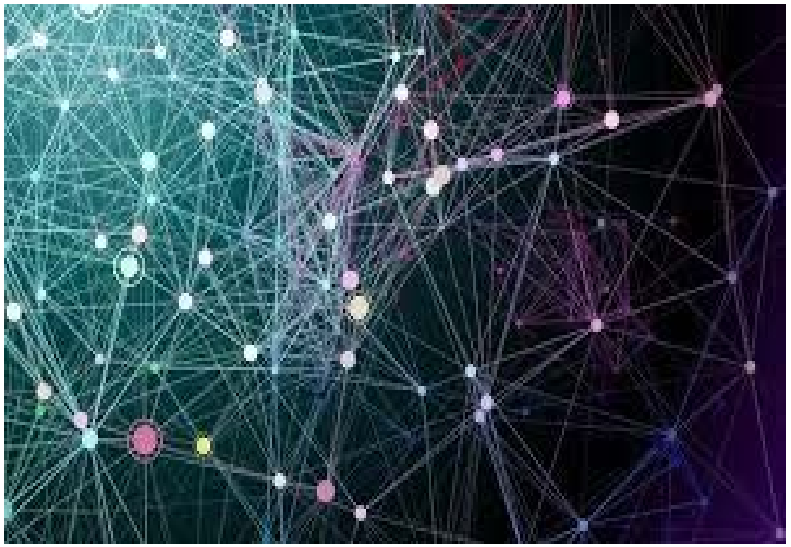
DIGITAL PLATFORM OF BIG DATA

- DATA STORAGE
- DATA MANAGEMENT
- DATA ANALYSIS
- DATA MINING



“DATA-MINING” EXPECTED RESULTS

Algorithms and guidelines for

- interpretation of diagnostic imaging and biochemical parameters
- primary and secondary risk prediction
- personalized management of prevention and therapy
- personalized nutrition and lifestyles
- improving environmental and living conditions relevant for prevention of chronic degenerative disease (cardiovascular, oncological and neurodegenerative)

«4 P» MEDICAL APPROACH

- PREVENTIVE
- PREDICTIVE
- PERSONALIZED
- PARTICIPATED

EUROPEAN
BIG DATA VALUE FORUM
VERSAILLES, NOV 21-23 2017

Mon-SANI

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THANK YOU

Chiara Cerletti