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Clinical Engineering in Enlarged Europe
Ratko Magjarević
University of Zagreb
Faculty of Electrical Engineering and Computing
Zagreb, Croatia
International Federation for Medical and Biological Engineering
President-Elect
X Spring School on
"IoT, economic and management challenges for e-health integration in the enlarged Europe"
Trieste, Italy, 26.- 29.September 2022


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Biomedical engineering
• Biomedical engineers are working at the interface of engineering, life sciences and healthcare.
• Biomedical engineers use principles of:
• applied sciences (including engineering, electronics, chemical and computer engineering) and
• basic sciences (physics, chemistry and mathematics) for applications in biology and medicine
http://www.embs.org/about-biomedical-engineering
Bioengineering
The profession named Bioengineering and/or Biological Engineering is younger then biomedical engineering and emerged with the realization of the possibility of manipulation of living cells
Biological engineering is based on
molecular biology and on
engineering principles used in the design, synthesis and analysis
at the cellular and molecular level
as opposed to biomedical engineering, which uses traditional engineering principles in order to analyze and solve problems in medicine and that solutions need not be based the use of living cells
http://web.mit.edu/be/programs/be_faq.shtml
Clinical engineering
Clinical engineers are professionals who support and enhance patient care by applying engineering and managerial skills to healthcare technology
• trained to solve problems when working with complex human and technological systems of the kind found in health care facilities
• function of technological systems manager for medical equipment including very often, and information systems in health care facilities
• provide valuable feedback on the operation of medical equipment and
• contribute to the research and development from their direct experience
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Inovation in Europe
Top technology fields: Strong growth in healthcare
Medical technology
14 295
+2.6 %
Digital communication
14 122
+1.0 %
Computer technology
13 097
+1.9 %
Electrical, machinery, apparatus, energy
11 346
+0.4 %
Transport
9 020
-5.5%
Pharmaceuticals
8 589
+10.2 %
Measurement
8 582
-5.2 %
Biotechnology
7 246
+6.3 %
12 000
10 000
8 000
6 000
4 000
2 000
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2004
2005
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Biotechnology
Pharmaceuticals
Computer technology
Digital communication
Electrical machinery, apparatus, energy
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https://documents.epo.org/projects/babylon/eponet.nsf/0/817080DFC91C99042C12586950032FD80/$FILE/epo_patent_index_2020_infographic_en.pdf


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ICT in Healthcare
• Accessibility to information and communication technologies (ICT) provides an opportunity to facilitate acquisition of health data from wide populations, their use in research, analytics and finally in improving the outcomes of health care.
Picture from: ICT-based Convergence Technologies Changing Paradigm of Health Care


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Data Analitycs
Data Sources
DB
Flat Files
Text Docs
Assessment, Cleaning, Transformation
Entity Resolution, De-duplication
Imputation
Natural Language Processing
Quality Management
Data Preparation Methods
Data for Analysis
Analysis Results
Descriptive, Exploratory Analysis
Predictive Analysis
Machine Learning
Linear Regression
Non-linear Regression
Classification
Data Mining
Text Analytics
Bayesian Methods
Simulation
Prescriptive Analysis
Stochastic Models under Uncertainty
Optimization under Uncertainty
Data Analytic Techniques
Summaries
Viz
Models
Candidate Solutions
FIGURE 4.1 The evolution from data sources to analysis results passes through several steps. Raw data (captured in databases [DB], flat files, and text documents) must first go through various data preparation methods to prepare them for analysis. The prepared data can then be analyzed using a variety of data analytic techniques to summarize and visualize the data and develop models and candidate solutions.


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https://www.nap.edu/read/23670/chapter/5


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Central European Initiative – CEI Cooperation Activity
Piazzale Europa, Trieste, Italy, September 25-29, 2022
eProcurement in Health
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Program Coordinator, Inter-Municipality Initiative: Cross-border eCollaboration in the eRegion
So-Coordinator, Global Network of Associations & Networks: Retirees Developing Silver Economy
Joze.Gricar@UM.si


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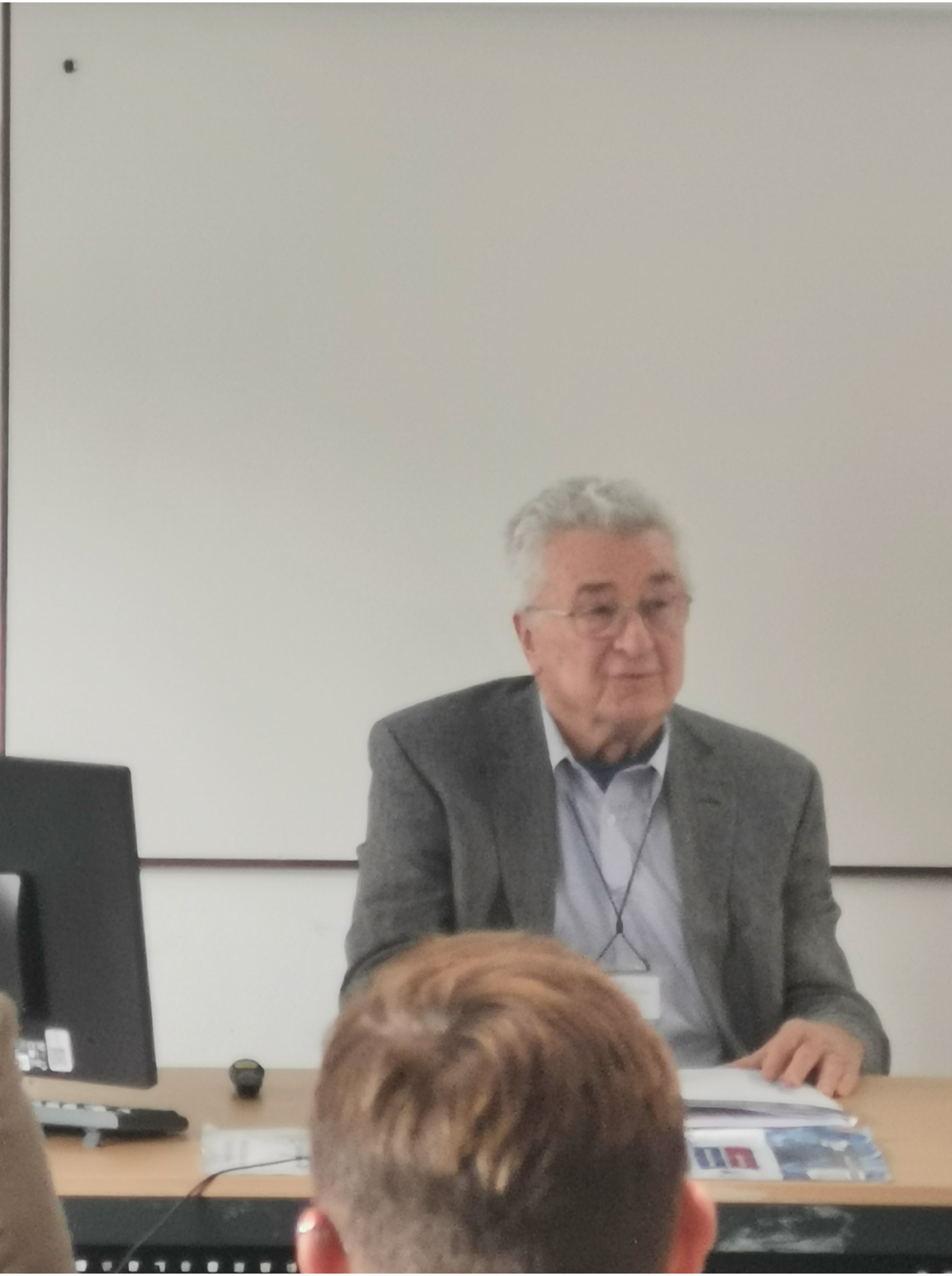


Cloud Computing
Cloud computing is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user.
Large clouds often have functions distributed over multiple locations, each location being a data center.
Cloud computing relies on sharing of resources to achieve coherence and typically using a "pay-as-you-go" model which can help in reducing capital expenses but may also lead to unexpected operating expense.


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we still have everything left.


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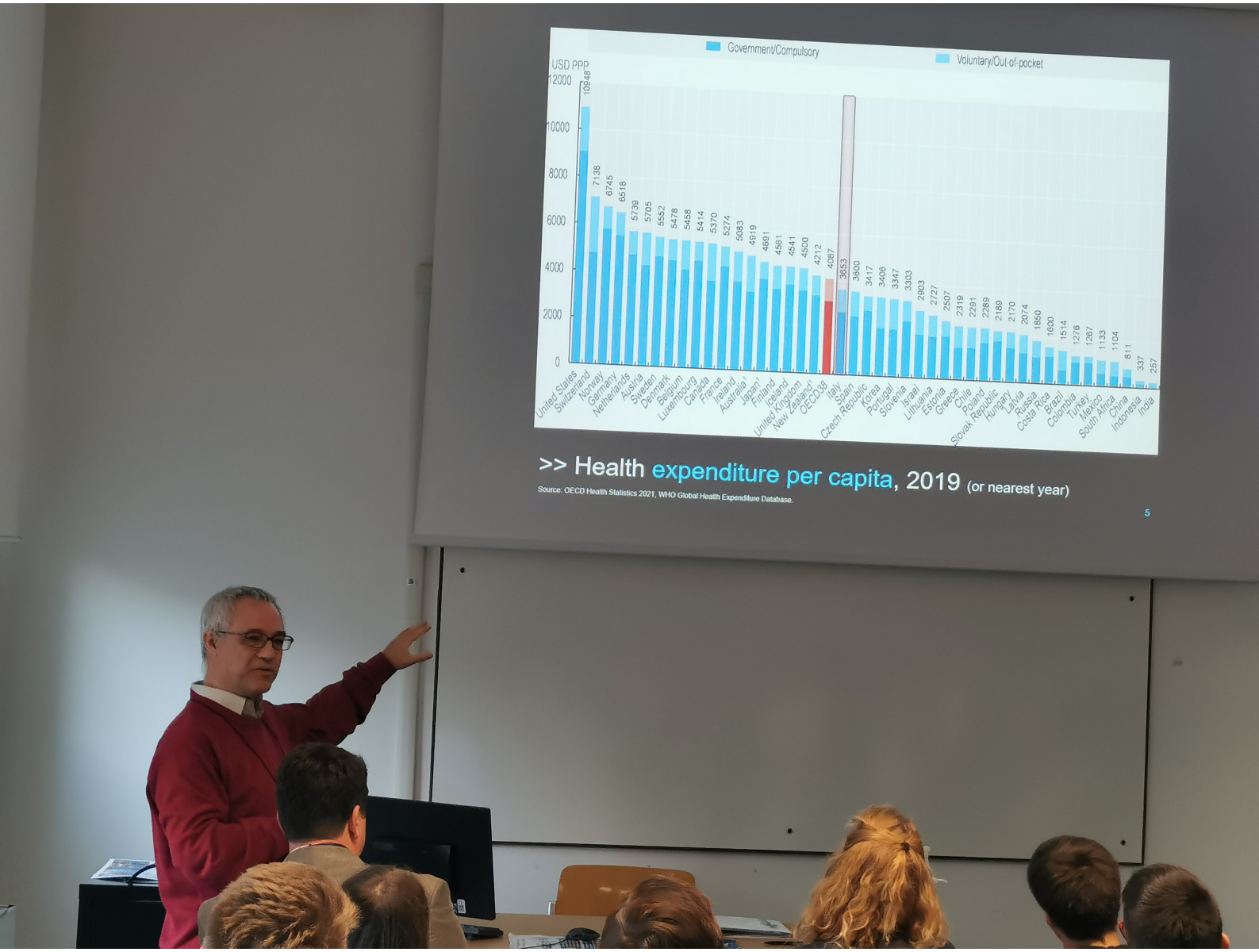
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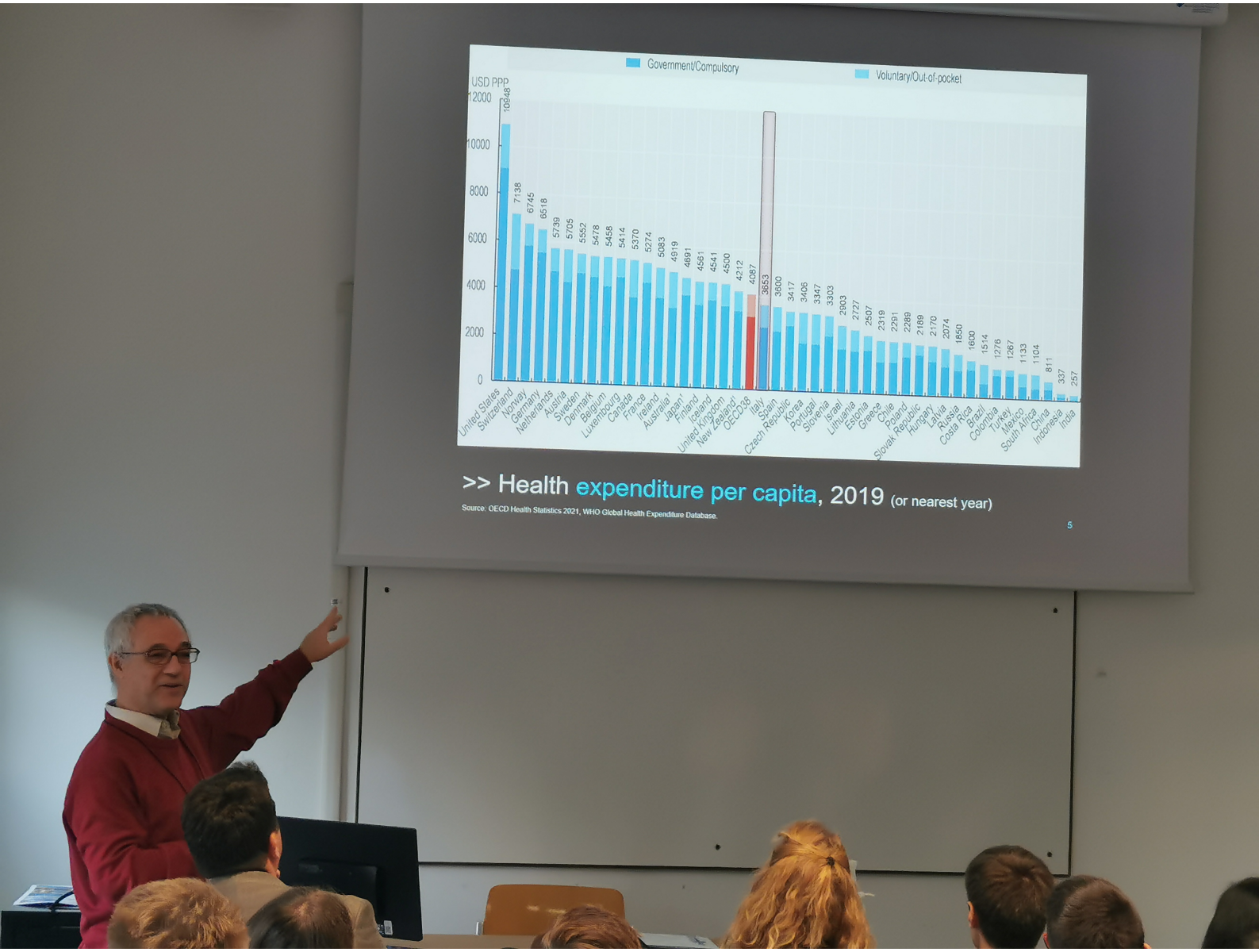
>> Health expenditure per capita, 2019 (or nearest year)
Source: OECD Health Statistics 2021, WHO Global Health Expenditure Database.
5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>> How to impact well-being to manage population health
1 Collect data
Clinical, claims, Rx, lab, biometrics, well-being, device, social networks
2 Analyze & Forecast
Proprietary Analytics and Predictive Models
3 Stratify population
Healthy
At Risk
High Risk
4 Establish Plan
Individualized well-being plan and guidance
5 Engage and Support
Physician and individual directed well-being actions
Self-directed Virtual coaching
Individual and Group Live Coaching
Ongoing Treatment Plan Support
High Risk and Rapid Care Transition Management
Community / Social Determinants
6 Report Impact
All progress and outcomes communicated to PCP / Patient / Sponsor


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All progress and outcomes communicated to PCP / Patient / Sponsor
Source: Healthways


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National Standards Classification of Occupations
IPEM
Job codes for medical physicists and clinical engineers changed in UK
A CHANGE to the job codes used to classify medical physicists and clinical engineers has been achieved thanks to lobbying by the Institute of Physics and Engineering in Medicine.
The clinical engineers code has also been changed to SOC2020 group 2129: *Engineering Professionals N.E.C.* While IPEM believes this is an acceptable coding, a better coding would also be under *health professionals N.E.C.*, reflecting clinical engineers' status as a profession essential to the provision of a cutting edge healthcare service. IPEM is currently in discussions with the ONS about this.


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BioingTS
X Spring School 2022
IoT, economic and management challenges
for e-health integration in the enlarged Europe
University of Trieste, Department of Engineering and Architecture
Central European Initiative – CEI Cooperation Activity
Piazzale Europa, Trieste, Italy, September 25-29, 2022
eProcurement in Health
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Thank you!
If we tell someone everything we know,
we still have everything left.
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>> 2019 F 42,6%
40,4
37,9
35,3
M 37,0%
Fonte: Istat (dati 1993-2013)
>> Italy – persons with at least one chronic condition


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