

ITU Workshop on Artificial Intelligence for Health
Geneva, Switzerland, 25 September 2018

AI in Health – Croatian Experiences

"Country priorities for use of AI for health"

Ass. prof. Antonija Balenović, MD. PhD.
and HCZC Team



European Innovation
Partnership on Active
and Healthy Ageing
REFERENCE SITE

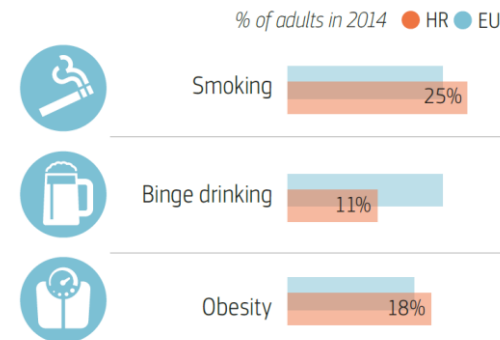
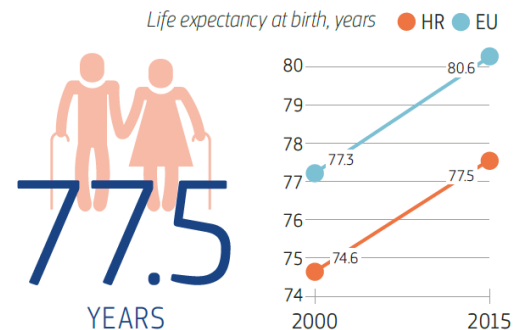
INTRODUCTION

CROATIA – Country Health Profile

Croatia = 4.2 million inhabitants (19% > 65y)
Zagreb = 790.000 (23% of all elderly in Croatia)

Demographic and socioeconomic context in Croatia, 2015

	CROATIA	EU
Demographic factors		
Population size (thousands)	4 208	509 394
Share of population over age 65 (%)	18.8	18.9
Fertility rate ¹	1.4	1.6
Socioeconomic factors		
GDP per capita (EUR PPP ²)	16 700	28 900
Relative poverty rate ³ (%)	13.5	10.8
Unemployment rate (%)	16.3	9.4



Causes of death - remain stable since 2001 and **40% preventable**

	% of all deaths in 2014
Ischaemic heart diseases	21%
Stroke	14%
Other heart diseases	6%
Lung cancer	6%
Colorectal cancer	4%

INTRODUCTION

CROATIA – Health Spending

- Among the **lowest** allocations in EU and **stagnating** last 10 years...
- **High out-of-pocket** spending (↑ than in EU or Slovenia)
- Large **disparities** across income groups
- ↑poorest = ↑out-of-pocket spending

Figure 6. Croatia has among the lowest health spending in the EU

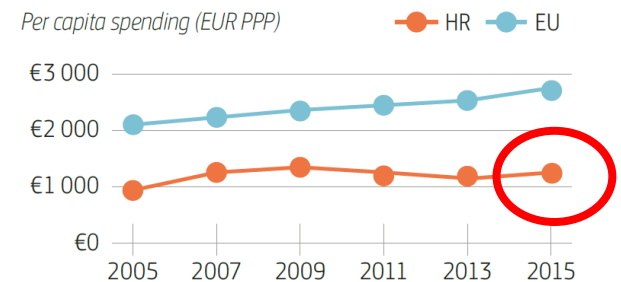
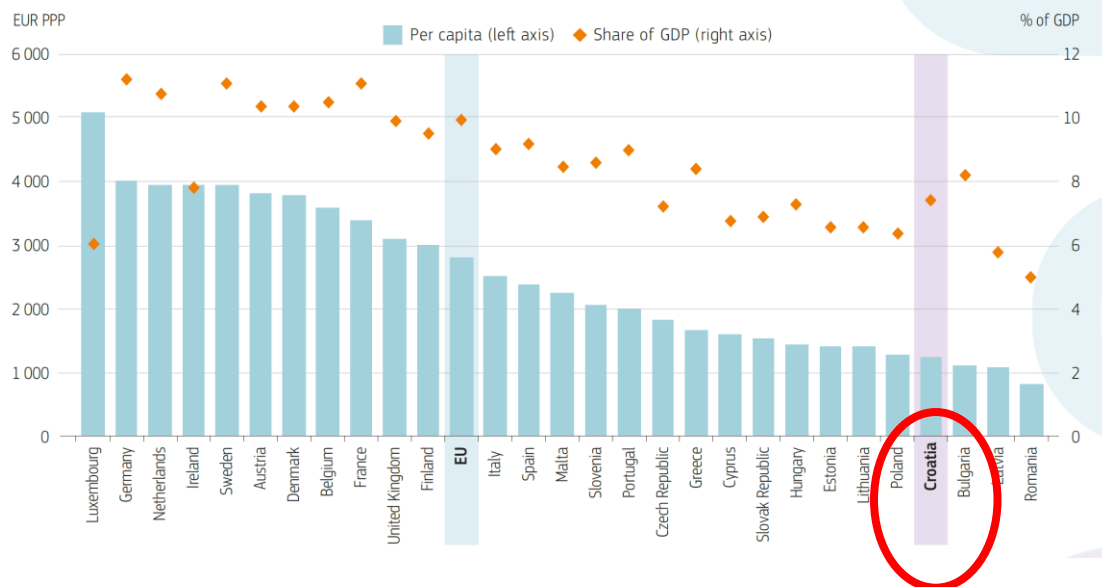
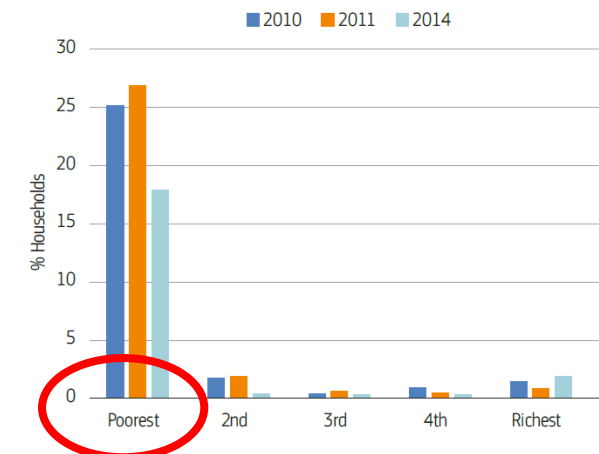


Figure 12. Catastrophic out-of-pocket health care spending in Croatia is particularly high among the poorest households

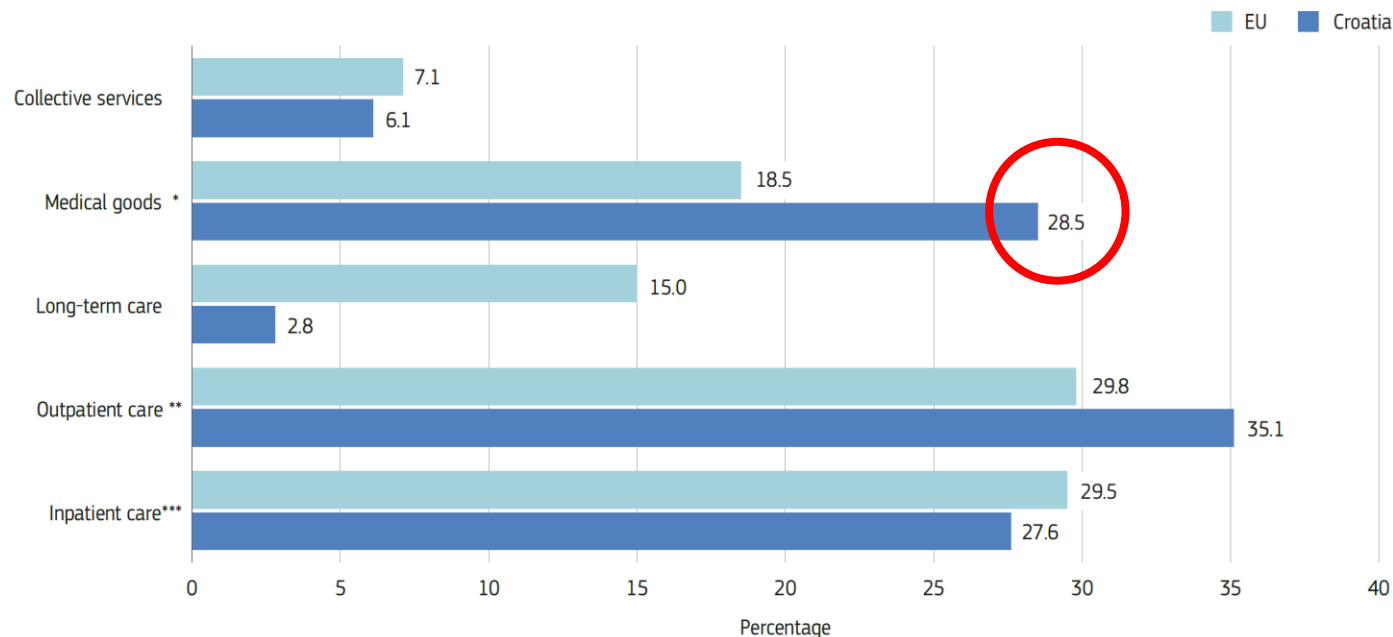


INTRODUCTION

CROATIA – Health Spending

- Mainly on pharmaceuticals ($\approx 30\%$)
- Prevention, primary care and long-term care are undervalued

Figure 15. Pharmaceuticals account for more than a quarter of health spending



Where we are – health outcomes?

Global surveillance of trends in cancer survival 2000–14
(CONCORD-3): analysis of individual records for
37 513 025 patients diagnosed with one of 18 cancers from
322 population-based registries in 71 countries

*Claudia Allemani, Tomohiro Matsuda, Veronica Di Carlo, Rhea Harewood, Melissa Matz, Maja Nikšić, Audrey Bonaventure, Mikhail Valkov, Christopher J Johnson, Jacques Estève, Olufemi J Ogunbiyi, Gulnar Azevedo e Silva, Wan-Qing Chen, Sultan Eser, Gerda Engholm, Charles A Stiller, Alain Monnereau, Ryan R Woods, Otto Visser, Gek Hsiang Lim, Joanne Aitken, Hannah K Weir, Michel P Coleman, CONCORD Working Group**

NATIONAL HEALTH
CARE STRATEGY

2012. – 2020.

Abridged version
SEPTEMBER 2012.

Colon cancer, breast cancer, ALL (children) 2010 -2014



Figure 2: Global distribution by continent and country of age-standardised 5-year net survival for adults (15–99 years) diagnosed during 2010–14 with colon cancer or breast cancer (women) and children (0–14 years) diagnosed with acute lymphoblastic leukaemia

No. of systematic, periodical,
control and preventive visits
in PHC is declining („stedily”)
2001 -2010

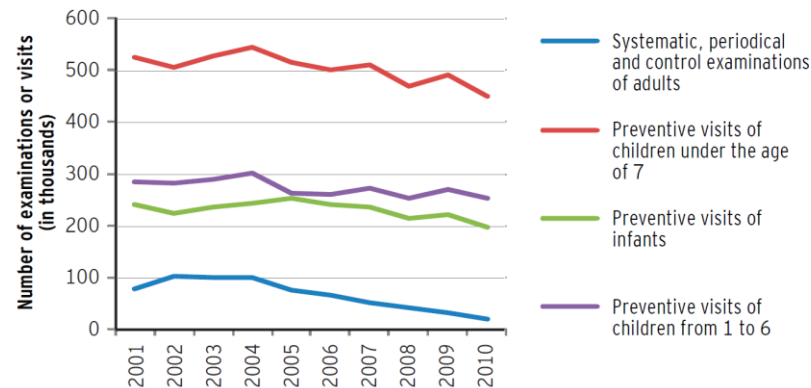
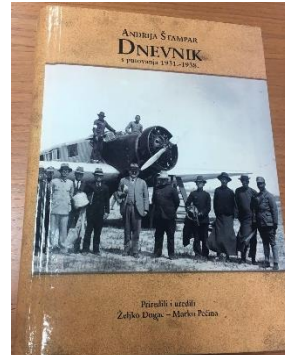


Figure 43. Number of systematic, periodical, control and preventive visits and examinations in the service of general practice/family medicine and health care of pre-school children in Croatia from 2001 to 2010. Source: Croatian Public Health Institute.

Croatian Health System

https://hr.wikipedia.org/wiki/Andrija_Štampar

- Andrija Štampar founded the School of **Public Health** in Zagreb in **1927**
- **Definition of health** – „*health is the state of complete physical, mental and social well-being, not just the absence of disease*“ – today still respected
- Committed to a **wide-ranging public health education** by considering how to effectively counteract many diseases



What methods would Andrija Štampar choose today
to promote public health?

Artificial / Additional Intelligence?

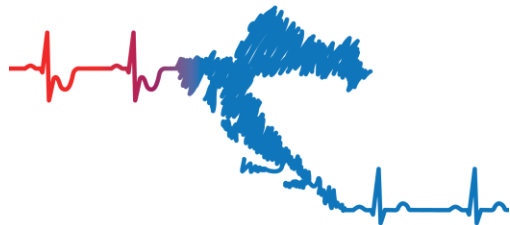
National Health Care Strategy 2012-2020

Strategy Conclusions 2012:

- The share of **expenditures for prevention** several times less than in EU (!)
- IT connections within the Health Care system is incomplete – still no adequate communication between hospitals and PHC or among hospitals (waiting lists!)
- The quality and structure of data, and methodology of collecting data in HC system are not standardised (registers?)



GOVERNMENT OF THE REPUBLIC OF CROATIA
MINISTRY OF HEALTH OF THE REPUBLIC OF CROATIA



NATIONAL HEALTH
CARE STRATEGY
2012.-2020.

Abridged version
SEPTEMBER 2012.

STRATEGIC DEVELOPMENT DIRECTIONS, PRIORITIES AND MEASURES

Priority 1: Informatisation and eHealth development

Integration and standardisation of health information and equalisation of the level of informatisation in the health care system



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Europe's Digital Progress Report (EDPR)

2017 Country Profile Croatia

- Tracks the progress of digitisation
- Combining quantitative evidence from the Digital Economy and Society Indeks (**DESI**) with qualitative information on Country-specific Policies

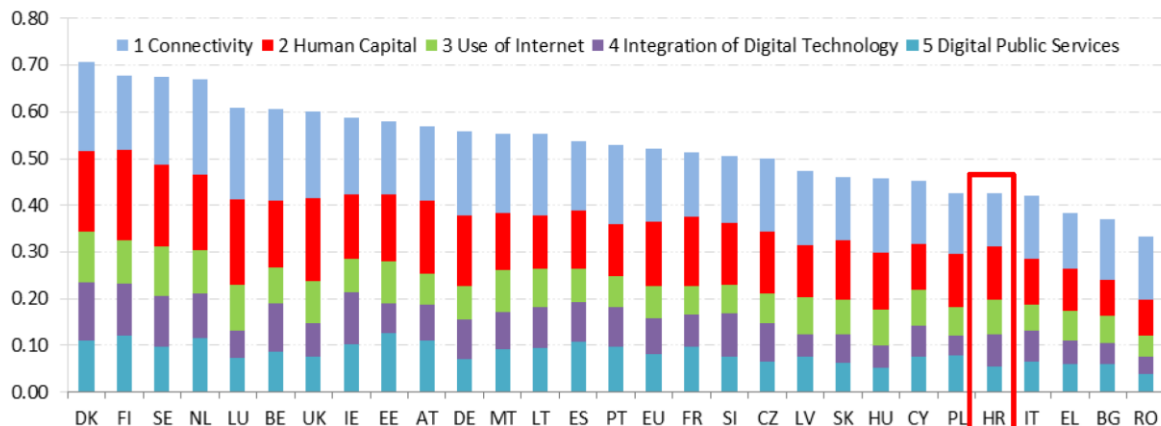
1 Connectivity	Fixed broadband, mobile broadband, broadband speed and prices
2 Human Capital	Internet use, basic and advanced digital skills
3 Use of Internet	Citizens' use of content, communication and online transactions
4 Integration of Digital Technology	Business digitisation and eCommerce
5 Digital Public Services	eGovernment

Croatia ranks 24th out of 28 EU Member States!
(over the last year fell back from 23 to 24)

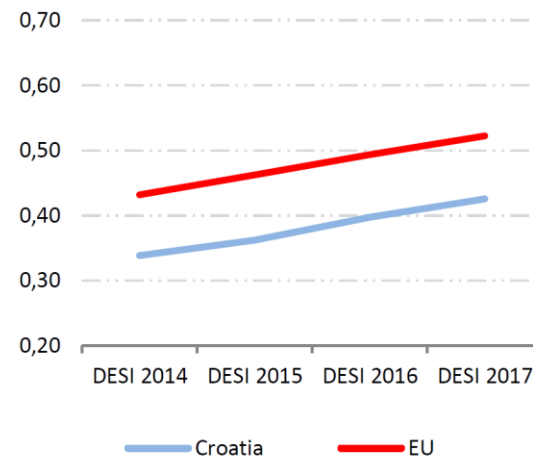
DIGITALIZATION PROGRESS

Croatia – DESI rank 24th (Connectivity?)

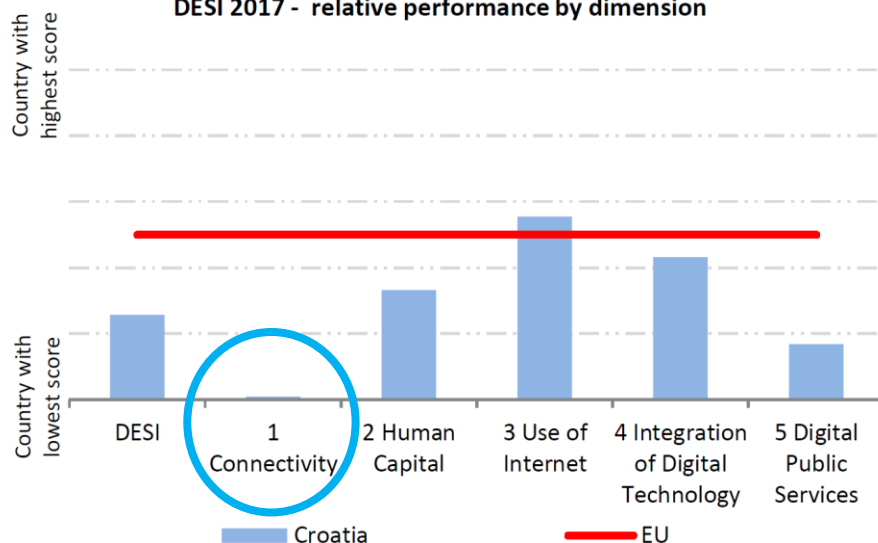
Digital Economy and Society Index (DESI) 2017 ranking



DESI - evolution over time



DESI 2017 - relative performance by dimension



Croatian citizens are above EU average in 3rd. Category - „Internet users”

Croatia DESI rank – Connectivity 28th

1. Connectivity - **28**
2. Human Capital - 19
3. Use of Internet - **14**
4. Integration of DT - 17
5. Digital Public Services - 26

1d1 Fixed Broadband Price⁶

% income

2.9%	↓	28	2.5%	27	1.2%
price 2016, income 2015			price 2015, income 2015		price 2016, income 2015

2a2 At Least Basic Digital Skills

% individuals

55%	↑	13	51%	17	56%
2016			2015		2016

2b1 ICT Specialists⁸

% employed individuals

2.7%	→	18	2.7%	19	3.5%
2015			2014		2015

2b2 STEM Graduates

Per 1000 individuals (aged 20-29)

16	→	18	16	18	19
2014			2013		2014

3a1 News

% individuals who used Internet in the last 3 months

91%	↑	2	89%	4	70%
2016			2015		2016

3a2 Music, Videos and Games¹¹

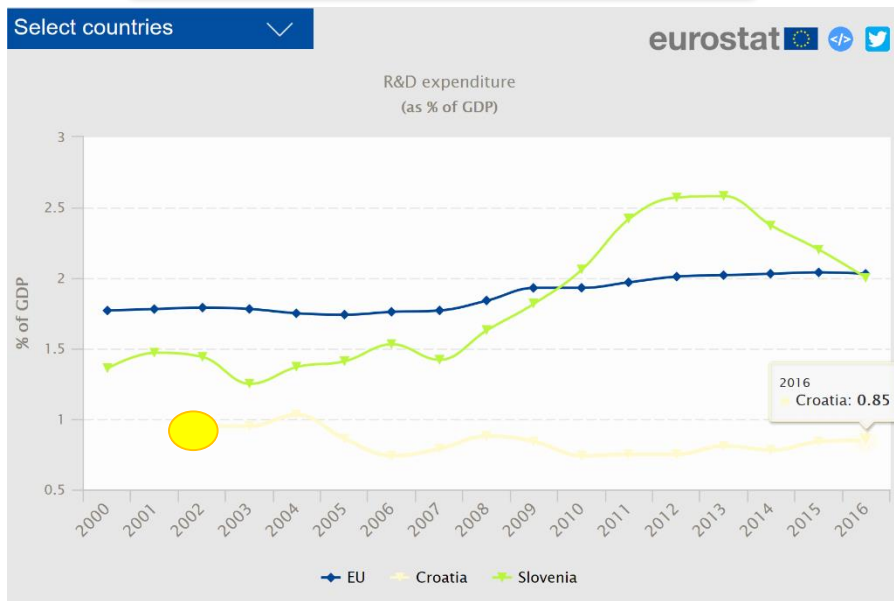
% individuals who used Internet in the last 3 months

85%		8	NA		78%
2016					2016

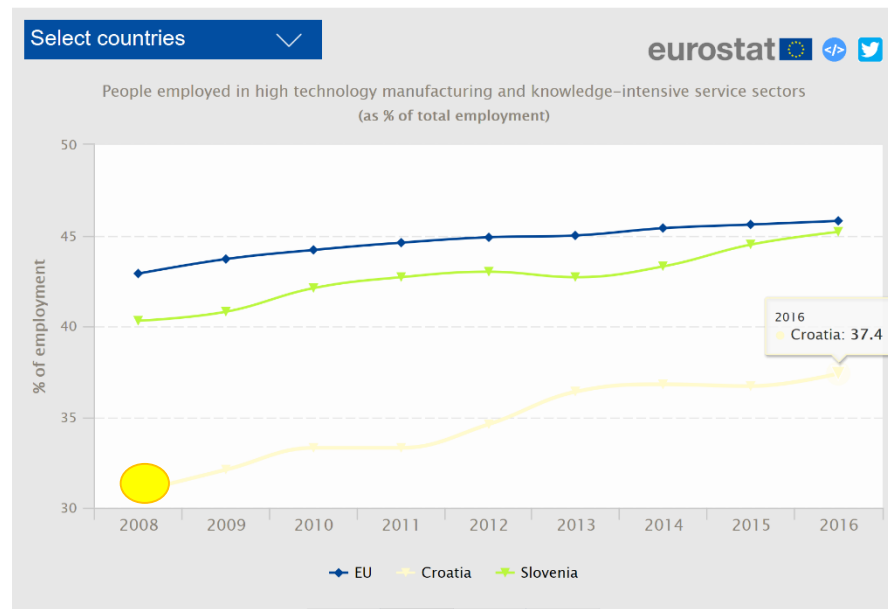
Eurostat – science, technology and education

- Croatia have no strategy in place to address its digital skills challenges
- Education, activities and initiatives in STEM that are being conducted are mostly of a private character or ICT business sector

Research and Development expenditure (% GDP)



Human resources in high tech and knowledge-intensive services





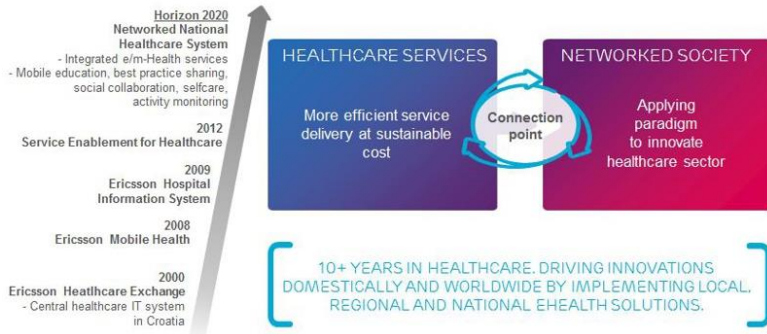
OPPORTUNITIES

CRO- Digital Industries Portfolio

ERICSSON 

Ericsson Nikola Tesla d.d.

ERICSSON HEALTHCARE SOLUTIONS TIMELINE



in2
GROUP

MCS Grupa

IBIS (Integral HOSPITAL Information System)
eWaiting Lists (Cro Health INSURANCE Fund)
eMD appointment (PRIMARY CARE)
eContracting (Private INSURANCE)
eBI Medication (PHARMACIST)

Aktualno • Poslovna scena • Preporučeno

Hrvatski Gideon Brothers najbolji AI startup u Europi

15/06/2018 • Lider



GIDEON BROTHERS WINS £10,000 FOUNDERS FACTORY AI PRIZE

● Gideon Brothers from Croatia uses autonomous robots to solve industrial problems - a **robotic operating system with 3D vision „THE BRAIN“**

● Founders Factory competition to unearth early-stage AI talent from around the world



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Artificial Intelligence in Health - Croatian Point of View

By users:

HEALTHY PEOPLE
(general population)

PATIENTS

PRIMARY CARE

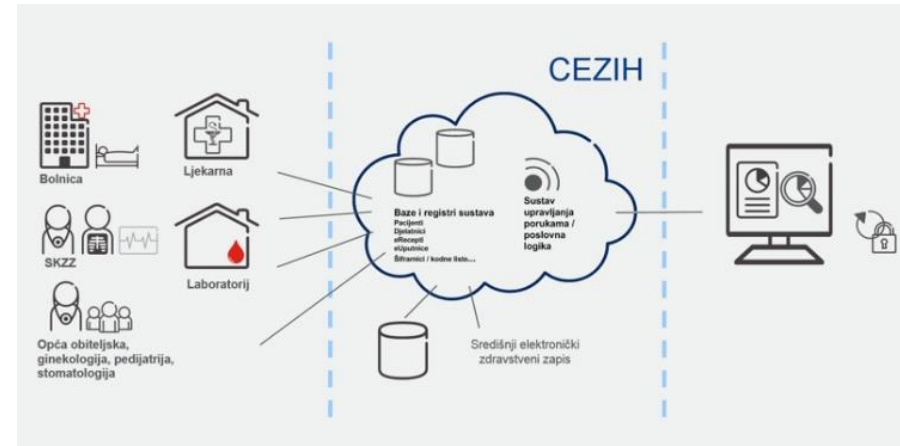
SECONDARY CARE

TERTIARY CARE



CROATIA eHealth solutions – a successful story

- Development of **eHealth solutions** is still one of the national priorities
- **CEZIH - Central Health Information System of Croatia**
- Well-established nation-wide ePrescription system
- Well-established nation-wide eHealth Records system (**EHR**) on the level of primary care with implemented software for:
 - preventive activities for chronic diseases - diabetes mellitus, hypertension, COPD and obesity
 - rational therapy prescribing for the elderly – „chronic patient panels“
- Some secondary health care services included - eLab, eAppointment system

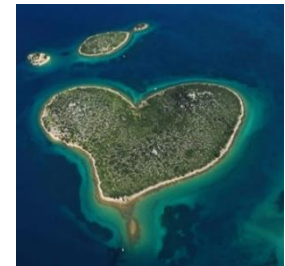


REFERENCE SITES COLLABORATIVE NETWORK

- ❖ Although in Croatia there is **single e-Health strategy** that is carried out on national level, **City of Zagreb** has important role in development and testing of e-Health solutions that are in pilot-phase before scaling-up nationwide
- ❖ City of Zagreb can influence the quality and the level of services to be implemented nationwide



e-Health solutions:
Scaling-up nationwide



- ❖ The concept of a **European Innovation Partnership (EIP)** - can help strengthen EU research and innovation
- ❖ EIP-AHA - an initiative launched by the EC to foster innovation and digital transformation in the field of active and healthy ageing





ACHIEVEMENTS ZAGREB

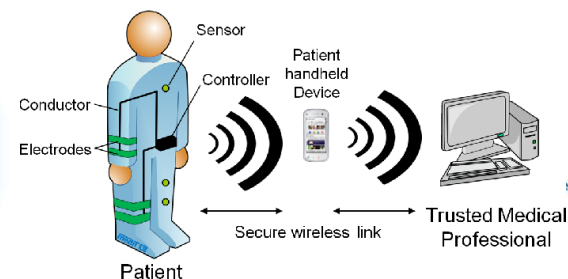
mHealth – next e-step forward...

- **2017 new communication modules (mHealth platforms) by HCCZ and ICT, built on top of existing EHR:**

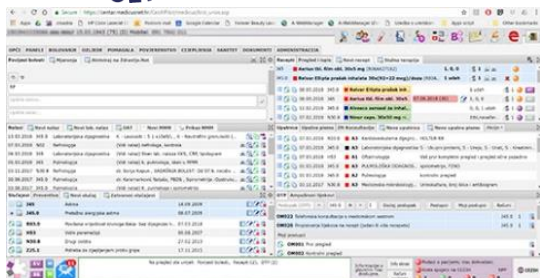
„Patient Health Diary“, for input patients vital signs (blood pressure, heart rate), glucose levels (fasting, before meal, after meal), height/weight/waist

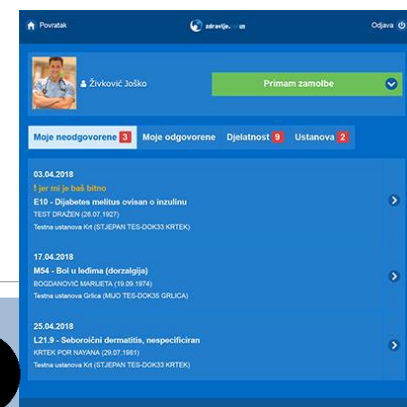
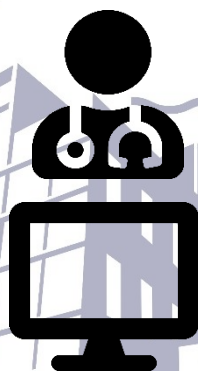
The measurement data is momentarily available in the GPs application within the patient's EHR, so GPs can track their patients' health on daily basis and react immediately if the values are concerning (call the patient in for a check-up, refer him to a specialist) and use it as a prevention tool to engage a patient to keep track of his own health and quality of life

„Health.net“, a secure web application - enables patient to GP communication in real time, prescription requests, message exchange, booking appointments and delivery of specialist's findings or lab results;



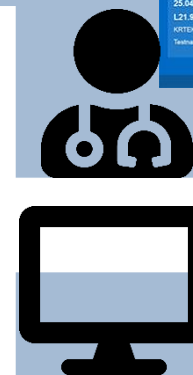
Direct cross-specialty medical consultations



eConsultation

A5 referral



Hrvatski
zavod za
zdravstveno
osiguranje

Croatian
Health
Insurance
Fund



European Innovation
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REFERENCE SITE

ACHIEVEMENTS

Users: PATIENTS

Mostly about:

- Chronical diseases
- Personalized medicine
- Assistive communication
- Robotics (neuro-rehabilitation, etc.)

Mostly by:

- Private sector (companies, clinics)
- Partnerships (hospital & company)
- Few examples in hospitals (*Virtual Reality Environment, rehabilitation after stroke – UHC Zagreb and Rijeka*)

- **Usually is not free**
 - Free is only trial version
 - Usually paid from projects or donations

TinnitusOFF - developed to help people with tinnitus



Users: Healthy people



- [Teddy the Guardian](#) - *Personal guard with special powers*
 - **The Guardian Animals** - **the first smart toy line on the market** - equipped with sensors that monitor children's wellbeing „Touch based technology”
- **Teddy bear** equipped with a sensor, measures body, skin and ambient temperature
- **Brave Lion** - heart rate and oxygen saturation
- **Tall Giraffe** - body posture and activity level
 - Made in Europe from carefully picked finest materials, machine washable



Consumer
Technology
Association™

WINNER 2014
Josipa and Ana



ANY STRATEGY IN MIND??

CRO Country priorities for use of AI for health

Artificial or Augmented Intelligence??

TMcapital
An Oaklins Member Firm



The Next Generation of Medicine:
Artificial Intelligence and Machine Learning



AMA Passes First Policy Recommendations on Augmented Intelligence

For immediate release: Jun 14, 2018



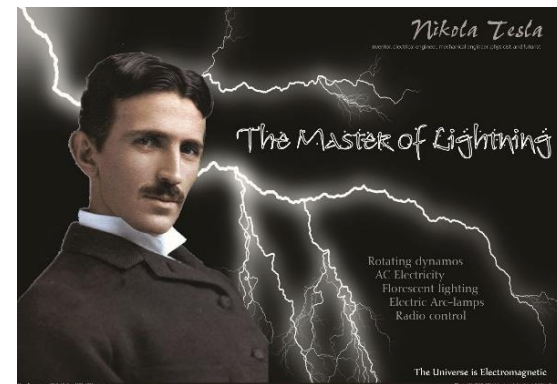
CHICAGO—The promise of augmented intelligence (AI) in spurring

CROATIAN INVENTIONS

In the past and future...

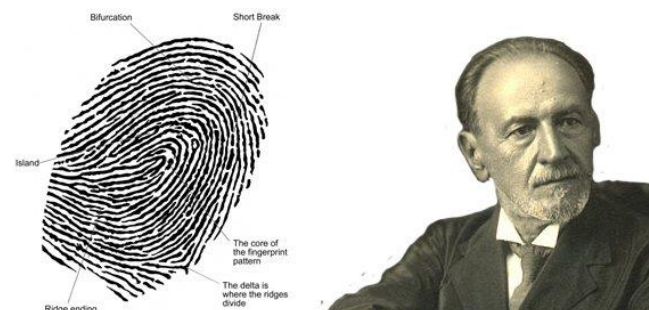
Nikola Tesla (wireless energy, NYC 1885)

Ivan Vučetić (fingerprint-dactiloscopia, Buenos Aires 1904)



**Slobodan, Gabrijela, Gorjana
and Zrinka, Zagreb 1980**

Azithromycin (Sumamed) one of
world's best-selling antibiotics -
Croatian company PLIVA
(company sold 2006)



Marin Soljačić (WiTricity -wireless non-
transmitting energy, MIT-USA 2007)



Inventor of WiTricity Technology and WiTricity
Founder Dr. Marin Soljačić Receives 2014 Blavatnik
National Award

Dr. Soljačić honored for his myriad contributions to the science community, including his pioneering work on wireless power transfer technology Watertown, MA – WiTricity, an industry pioneer in wireless power transfer over distance, today announced that the company's founder and Professor of Physics at the Massachusetts Institute of Technology (MIT), Dr. Marin Soljačić, Ph.D., has been...

Mate Rimac (electric car,
Zagreb 2011),



SUSTAINABILITY OF RD AND HEALTH FINANCING

Technology Park Zagreb - Story

The **sustainability of Health Financing in CRO** is a significant concern – due to the high unemployment rates, the ageing population, low fertility rate and high rate of emigration (young, whole families)

New movements! „Where good ideas turn into entrepreneurship!”

Entrepreneurs can get all the infrastructure and consulting needed to facilitate and expedite the journey from idea to market (currently NO HEALTH institutions)



Tehnološki
park Zagreb



Where to invest - future funding 2021-2027



A STRONG HEALTH DIMENSION IN THE FUTURE EU BUDGET

Health-related resources will be part of the budget of several priority areas: social protection, research and innovation, the digitisation of society, cohesion and global responsibility. Health policies will get EU funding through various mechanisms, mainly:

European Social Fund Plus (ESF+)

European Regional Development Fund (ERDF)

Horizon Europe (EU research programme)

Digital Europe Programme

InvestEU Fund

Emergency Aid Rescue (rescEU)



ESF+ AS CORNERSTONE

The new European Social Fund Plus (ESF+) Programme is the EU's main instrument to invest in people, promoting equal opportunities, social protection and inclusion. One of the three strands in the programme will be the financing of health policies and projects, with a proposed budget of EUR 413 million.

The health strand will ensure a higher level of health protection, reduce inequalities and address the challenges identified in the European Semester. The main objectives are:

- Improving crisis **preparedness and response** against cross-border health threats
- Supporting **EU health legislation** (medicines, HTA, tobacco, cross-border care)
- Strengthening **health systems** (digital transformation, EU health information, support to national reforms)
- Supporting **integrated work** (European Reference Networks, implementation of best practices for health promotion and disease prevention)



DRAW ON SUCCESSES AND EMPHASISE ADDED VALUE OF EU INTERVENTION

EU health investments strengthen recent initiatives and roll out new ones, all with the potential to make a **real difference in the life of citizens**. By integrating the funding into other priority mechanisms, the **overall impact and added value** will increase.



EUROPEAN REFERENCE NETWORKS

WHAT & WHY?

- 24 networks** with **900+ healthcare units**
- Working together to better diagnose and treat **rare and complex diseases** affecting the lives of 30 million EU citizens

FUTURE FUNDING 2021-2027

- Support and consolidate functioning, improve accessibility and outreach, strengthen research synergies

ESF+

Horizon Europe

Digital Europe



FIGHTING INFECTIOUS DISEASES AND OTHER HEALTH THREATS

WHAT & WHY?

- Cooperation to increase **vaccine coverage**
- Joint **preparedness** and response to cross-border pandemics
- EU strategy on **anti-microbial resistance** currently causing 25 000 deaths per year in the EU

FUTURE FUNDING 2021-2027

- Strengthen cooperation and support and innovation

ESF+

Horizon Europe

ERDF

rescEU



DIGITAL HEALTH AND CARE

WHAT & WHY?

- Digital infrastructure** for health services; cross-border access and exchange of patients' data
- Data-based **pharmaceutical breakthroughs** or pandemic prevention
- Advanced telemedicine and development/uptake of **new care models**

FUTURE FUNDING 2021-2027

- Develop and roll out EU-wide electronic health records
- Outreach, strengthen research synergies

Digital Europe

Horizon Europe

ESF+



REFORM OF EU HEALTH SYSTEMS

WHAT & WHY?

- Data collection, analysis and **knowledge sharing** (e.g. "State of Health in the EU" cycle)
- Support** national and regional policy makers to make **health systems** more effective, accessible and resilient

FUTURE FUNDING 2021-2027

- Support capacity building, policy implementation and transnational cooperation
- Develop new care models

ESF+

InvestEU

ERDF

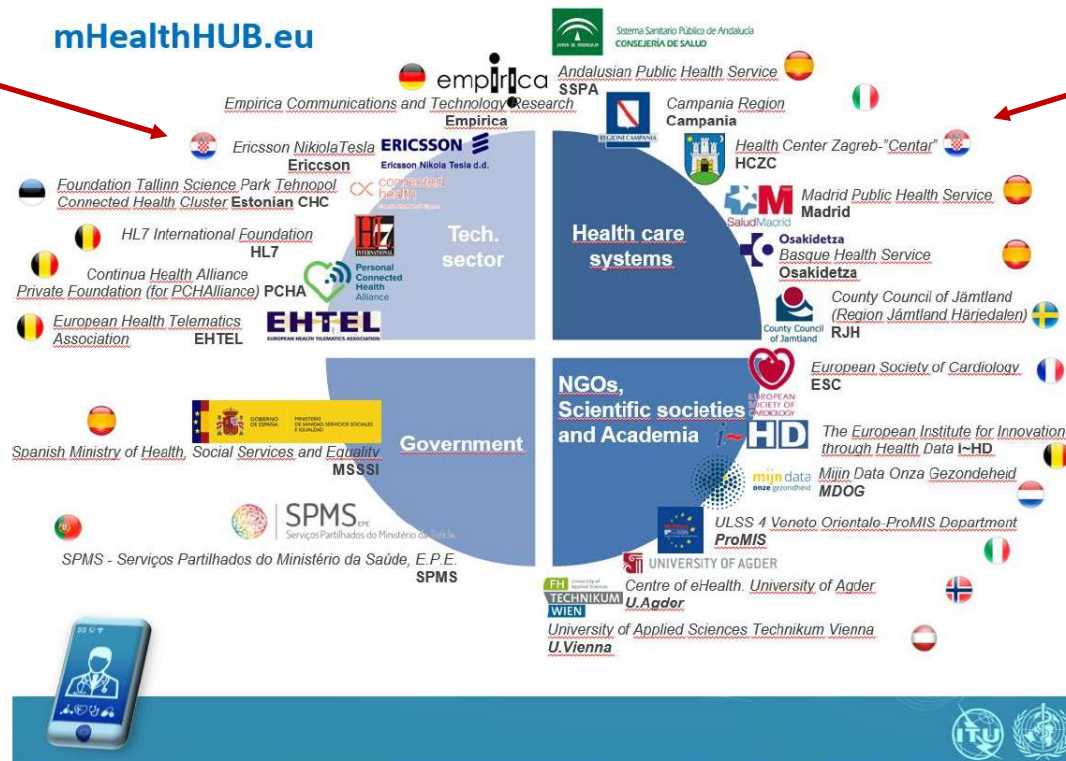
Horizon2020: WHO - ITU JOINT INITIATIVE

mHealth HUB – EU 2018

- mHealth HUB - to support services for EU countries and regions for deploying and scaling up mHealth programs
- The Consortium holder – Spain (Sevilla) – **Andalusian Public Health Service**

ERICSSON
Ericsson Nikola Tesla d.d.

mHealthHUB.eu



From the Magazine

ELON MUSK'S BILLION-DOLLAR CRUSADE TO STOP THE A.I. APOCALYPSE

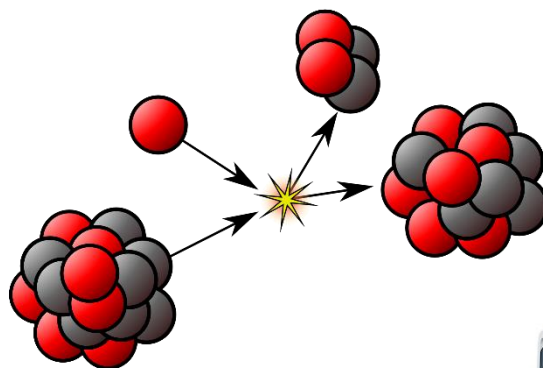
Elon Musk is famous for his futuristic gambles, but Silicon Valley's latest rush to embrace artificial intelligence scares him. And he thinks you should be frightened too. Inside his efforts to influence the rapidly advancing field and its proponents, and to save humanity from machine-learning overlords.

BY MAUREEN DOWD

APRIL 2017



BUT WE HAVE SEEN THE FUTURE ALREADY





Thank you very much!



Zagreb 2018 - Health Team Visiting Tech Park Zagreb

Supported by City of Zagreb, Ministry of Health, and by their own instinct... to go on... 😊



Zagreb 2001 - the first City in EU introduced **mPayment** for City Transport (tram) and **mParking** for Car Parking, so almost 20 years ago!



Zagreb 2016, 2017, 2018 – PEOPLE voted the best Christmas market in Europe