Universität Zürich[UZH]
Digital Society Initiative

AI is Different: Embracing Opportunities and Tackling Challenges to Shape Evidence-Based Care

Claudia M. Witt, MD, MBA
Professor of Medicine
Co-Director Digital Society Initiative
University of Zurich
Director Institute for Complementary and Integrative Medicine
University Hospital Zurich
Cochrane Satellite Complementary Medicine Switzerland
claudia.witt@uzh.ch
LinkedIn

"I care deeply about life – that's why I'm passionate about Health & AI"

Disclosures

- **Honoraria** for scientific presentations on AI & digitals health, integrative oncology and mind body medicine from Swiss Hospitals and non-industry organizations
- **Active research grants** to the University for **digital health research** from:
  - Swiss Cancer Research, newsenselab, Digitalization Initiative of the Zurich Higher Education Institutions (DIZH), Rothenfußer Foundation, DLR (Innofond)
- **Active research grants** to the University **for AI in evidence synthesis** from:
  - Swiss National Foundation (SNF, NRP 83): Artificial Intelligence (AI) to Expedite Sex/Gender Analysis in Evidence Synthesis (2025-2028)
  - Swiss MS Foundation: Living Evidence and Gap Map (EGM): A Pilot Study Integrating Artificial Intelligence (2025-2026)

The World is Connected

Total Population

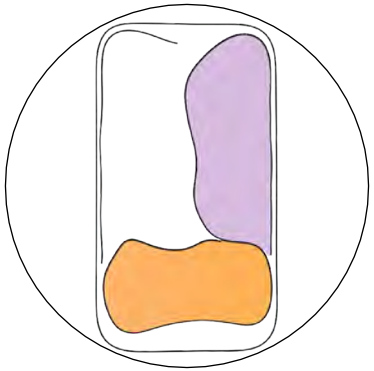
8.20

Billion

Urbanization

58.1%

Unique mobile phone subscribers



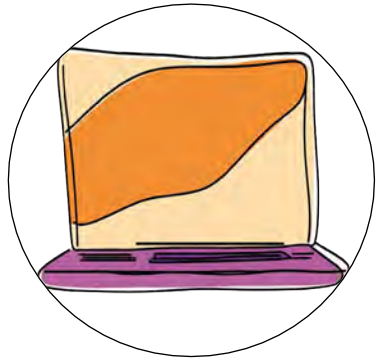
5.78

Billion

vs. population

70.5%

Individuals using the internet



5.56

Billion

vs. population

67.9%

!

Datareportal, Digital 2025: Global Overview Report

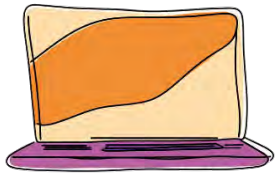
Digitalization in Health Care

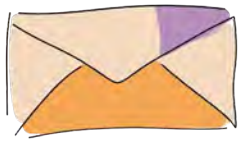
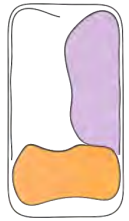
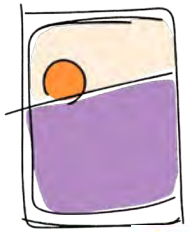
- Healthcare is just one part of our increasingly digitilized lives
- Digital health systems can capture nearly everything:
  - Health records
  - Everyday can be data transformed into health insights
  - The analytics that drive diagnoses and treatment plans

AI is part of digitalization!

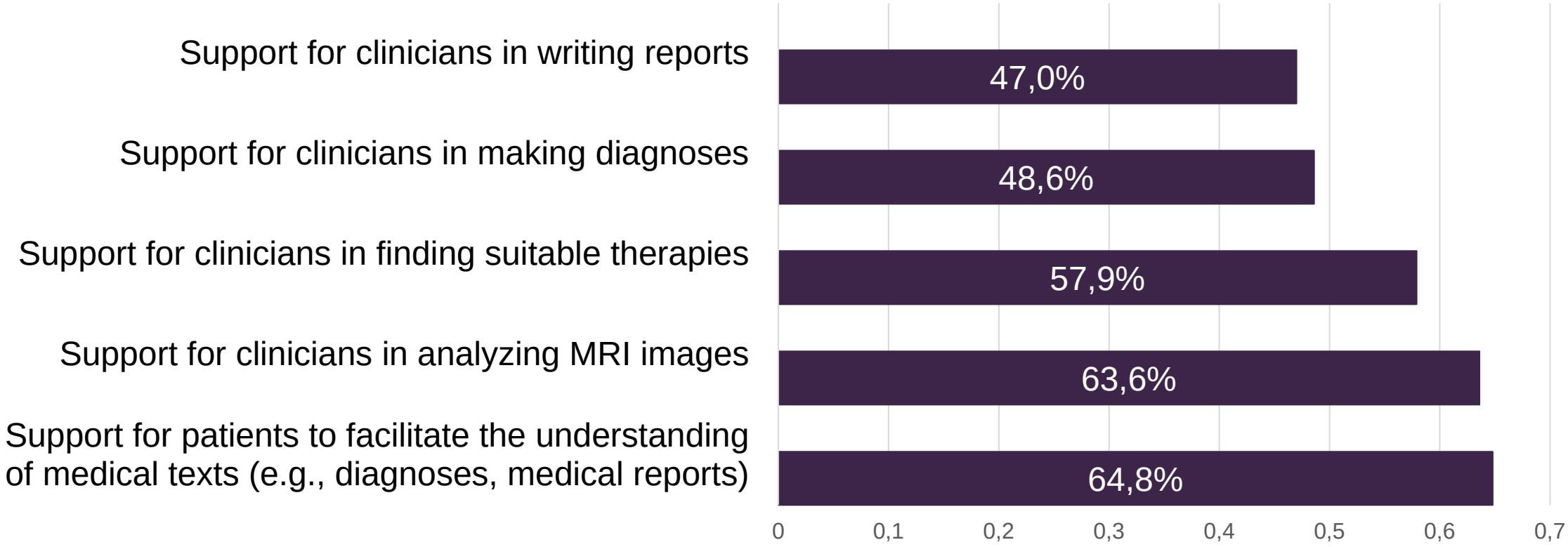
Which of the following health services have you used in the last 12 months?

Online appointment booking	Online consultation	Online questionnaire	Receive reports via e-mail	Use of my health insurance app	Use of healthcare providers' app
27%	6%	11%	35%	48%	8%

For which medical services would you evaluate the use of artificial intelligence positively?



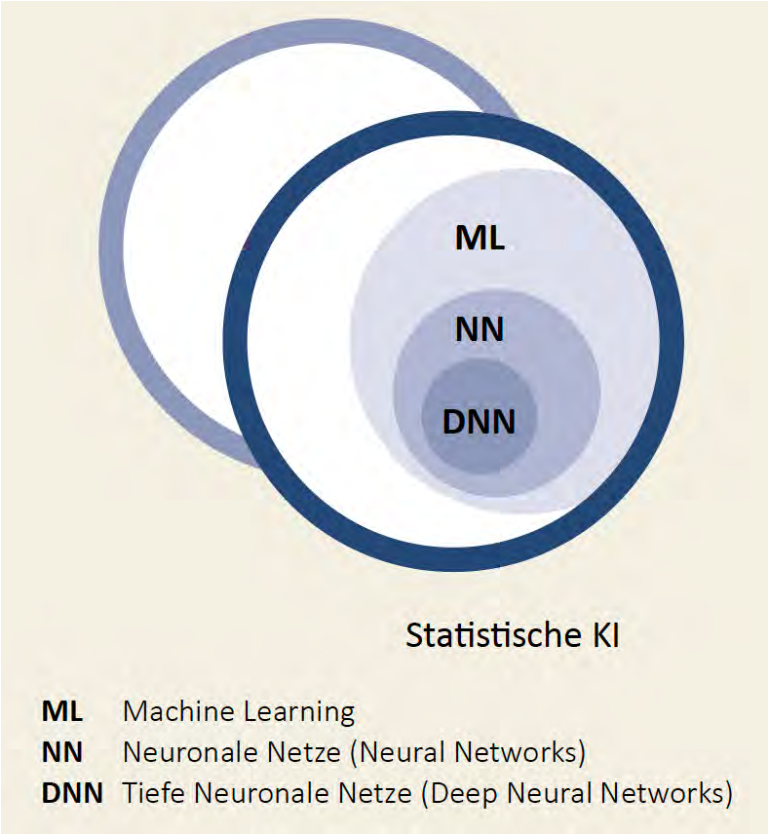
AI IS DIFFERENT

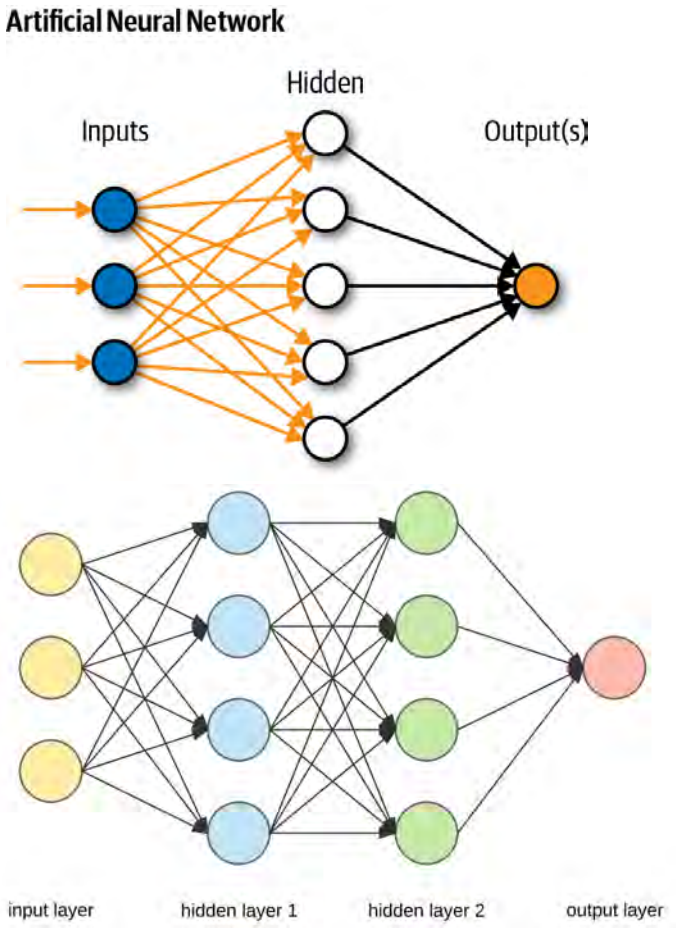
AI can handle nearly every task that involves **human thinking**,
no limits, it is impossible to fully oversee

developing faster than anything we've
ever seen in medicine

vast scope: there will be no singular AI experts,
only
collective community knowledge

AI Basics





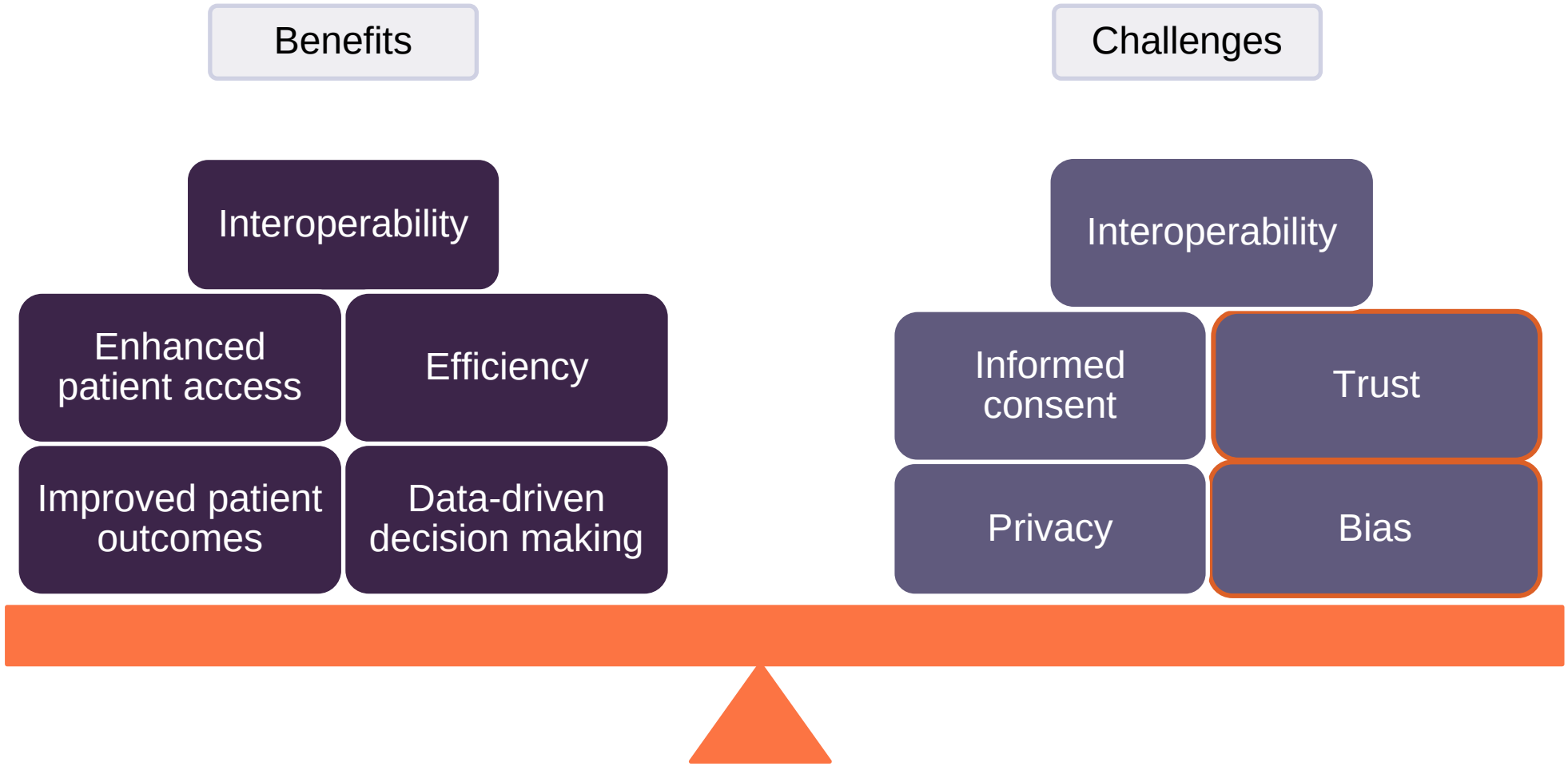
Supervised Learning:
- Labelled data
- Direct feedback
- Output prediction

Unsupervised Learning:
- No label
- No feedback
- Clustering

Reinforcement Learning
- Decision process
- Reward system
- Interaction with environment

In medicine: AI = software as medical device (MDR)

Keeping the Balance: Benefits vs. Challenges of Digitalization in Health Care



Trust: Clinicians

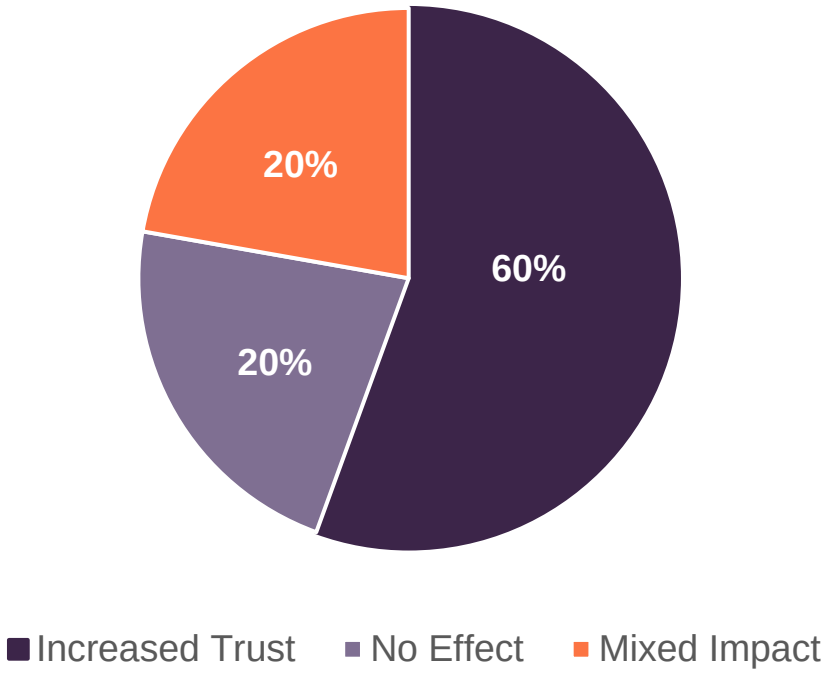
Impact of AI Explanations on Clinician Trust

Dynamics of Trust[1]

Clinician trust in AI depends on*: clarity, relevance, and usability of explanations*

Cognitive-Based Trust: Understanding AI's logic and accuracy

Affect-Based Trust: Emotional perceptions and past experiences



Challenges[2]

- *Over-trust*: Blind reliance on AI systems
- *Distrust:* Skepticism from unclear explanations
- *Privacy concerns*: Fear of data misuse[1]
- *Fear of automation* replacing jobs
- *System failures* in critical scenarios

[1]Rosenbacke et al. JMIR AI 2024 Policy Press 2023
[2]Zhang et al. Frontiers in Robotics and AI 2023

Trust: Patients

Key Influencing Factors

Human Interaction: AI to augment not replace[1,2]

Transparency: Patients are more likely to trust AI when its processes and decisions are explainable[1,3]

Privacy/Security: Fear of data misuse or unauthorized sharing significantly reduces trust[1,3]

Statistics

59.7% of patients worry about *data privacy* in AI applications[1]

94% of surveyed patients believe radiologists should always provide final interpretations of mammograms

while

88% of those participants acknowledged AI's utility in diagnostics[2]

15.3% fewer concerns about misuse and bias are exhibited by patients with higher AI knowledge[4]

Challenges

Fear of losing human connection[1,3]

Accountability[1,3]

Cultural and demographic variations[1,2]

Patients value AI as a tool but demand transparency, privacy, and human oversight

[1]Wu et al. BMJ Open 2022
[2]Pesapane et al. Life 2024
[3]Robertson et al. PLOS Digital Health 2023
[4]Wang et al. Transactions of Technology and Society 2024

AI Development

Technology-Centric Perspective

- Dominates current research
- Technical & engineering aspects
- Views AI as an autonomous agent

vs.

Human-Centric Perspective

- Advocates for a socio-technical system
- Prioritizes trust, adaptability & collaboration
- Recognizes AI as a teammate

76% of publications showed a predominant focus on the technical orientation of AI over human-centered approaches[1]

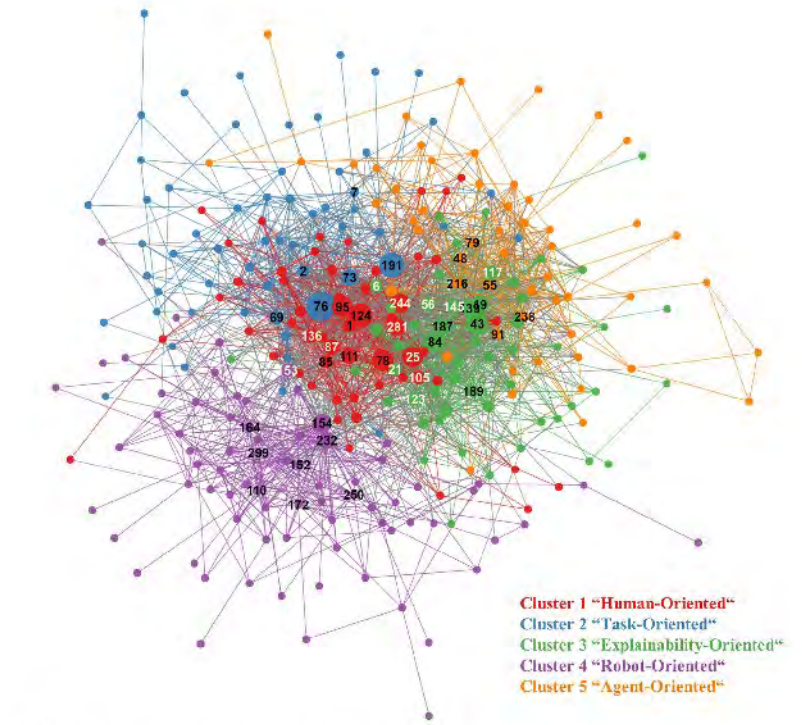
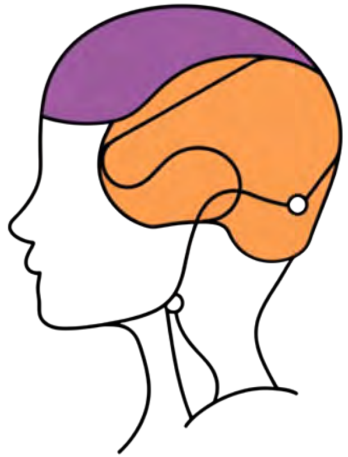


FIGURE 3
Graph of the bibliometric network. Numbers indicate publications included in the content analysis. Publications are matched to their reference numbers in Table 2. White numbers represent papers included based on their relevance for the whole network, black numbers represent papers selected based on their relevance in their cluster. The clusters' titles will be further explained in section 4.2.

Berretta et al. Frontiers in Artificial Intelligence 2023

Biases in AI Algorithms

1. **Lack of fair data**
2. Absence of guidelines or recommendations
3. **Limited awareness in the existence of biases in AI**

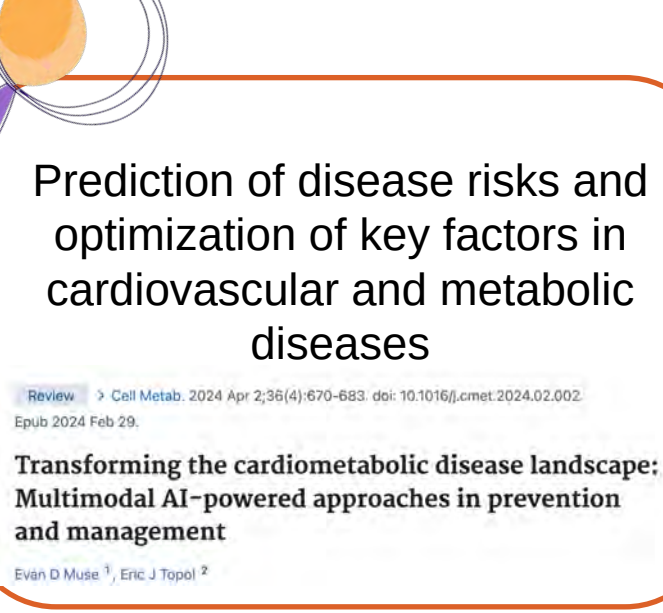


4. Challenges in data integration
5. **Inherent biases in research data**
6. Healthcare disparities

Vorisek et al, J Med Internet Res, 2023

More Data Sources → More Precision

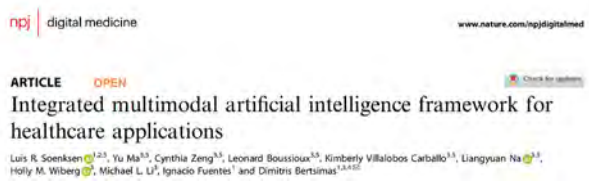
Prediction of disease risks and optimization of key factors in cardiovascular and metabolic diseases


Review · Cell Metab. 2024 Apr 2;36(4):670-683. doi: 10.1016/j.cmet.2024.02.002 Epub 2024 Feb 29.

Transforming the cardiometabolic disease landscape: Multimodal AI-powered approaches in prevention and management

Evan D Muse [1], Eric J Topol [2]

Disease detection, health analyses, and treatment recommendations


npj | digital medicine

ARTICLE OPEN

Integrated multimodal artificial intelligence framework for healthcare applications

Toxicity prediction in the development of new drugs.


JCIM JOURNAL OF CHEMICAL INFORMATION AND MODELING

Review

Artificial Intelligence in Drug Toxicity Prediction: Recent Advances, Challenges, and Future Perspectives

Thi Tuyet Van Tran, Agung Surya Wibowo, Hilal Tayara,* and Kil To Chong*

Cite This: J. Chem. Inf. Model. 2023, 63, 2628−2643 Read Online

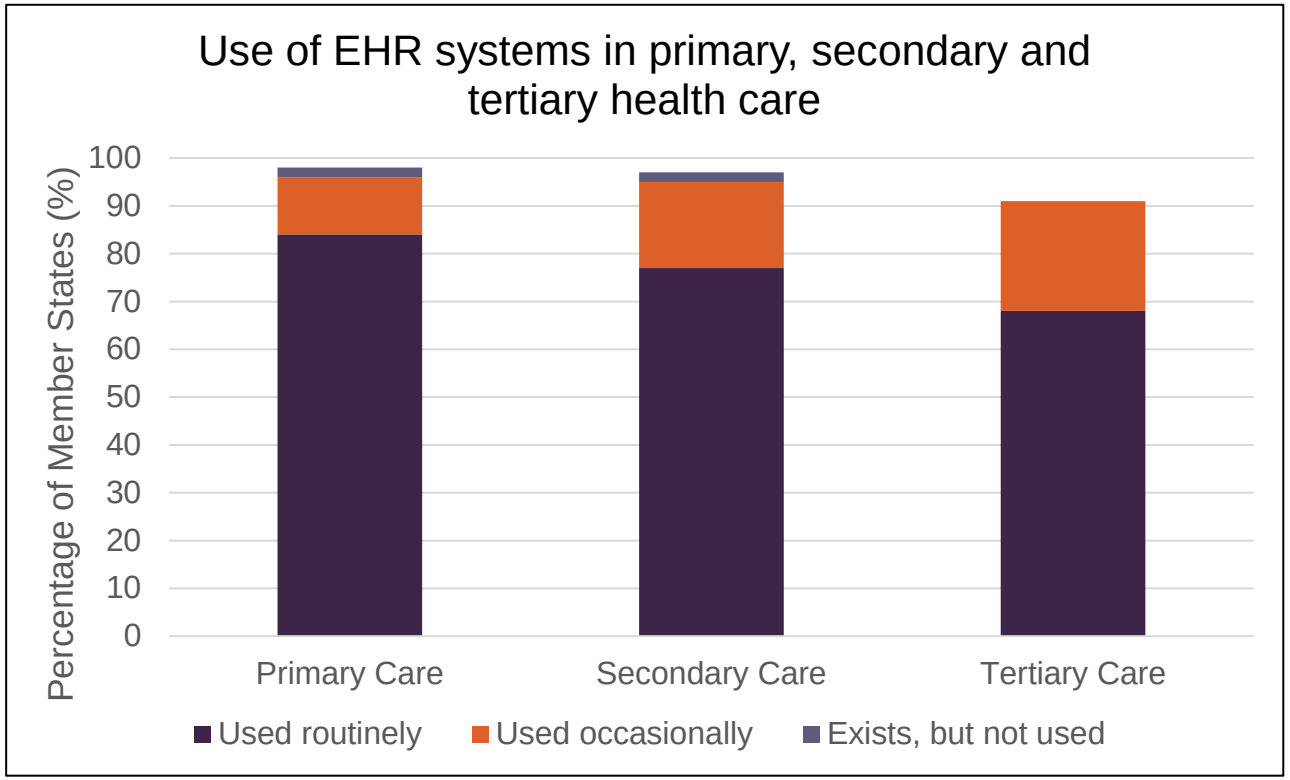
Electronic Health Records (EHRs): WHO European Region

EHRs are real-time, patient centered records providing immediate, secure access to authorized users

87% of Member States have a national EHR system, regional EHRs, or a patient portal

91% of Member States have legislation supporting NEHR use

37% of Member States cite insufficient funding as the biggest barrier to EHR implementation



World Health Organization. WHO Regional Office for Europe 2023

Implementing Big Data in Healthcare: WHO European Region

Current Trends

- Treatment tracking and risk assessment
- Disease surveillance & public health planning
- Clinical decision support systems

Key Challenges

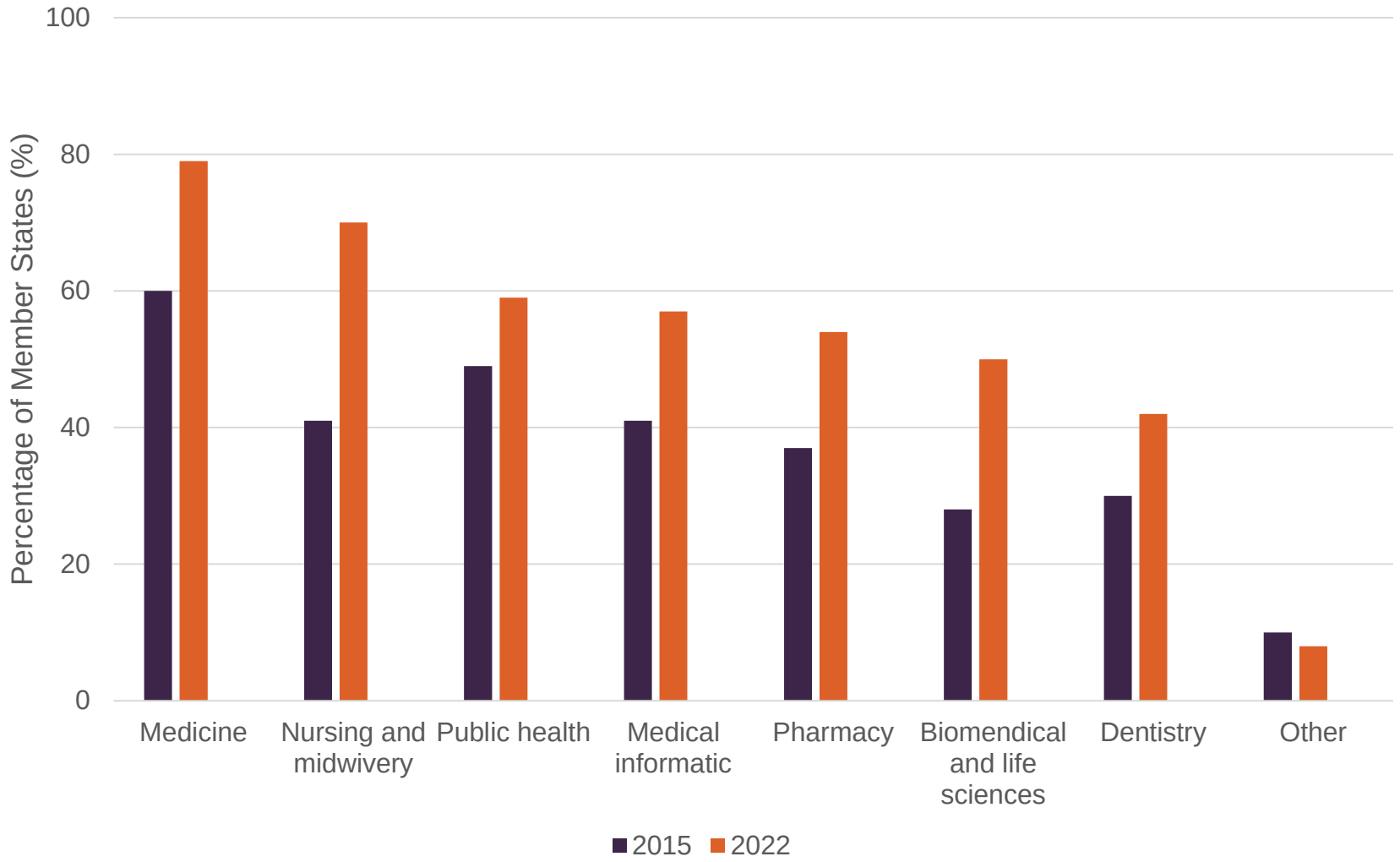
- Ethical concerns: AI bias
- Privacy: 32% regulate private sector use
- Interoperability: Inconsistent data formats
- Funding: 37% of countries lack resources

Future Direction

- Standardized global policy frameworks
- Enhanced AI integration in diagnostics
- Responsible data governance models

World Health Organization. WHO Regional Office for Europe 2023

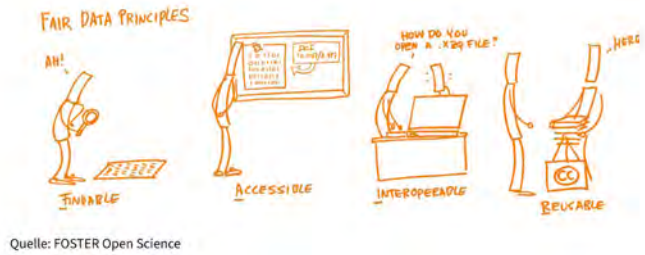
Training for Health Professionals on Digital Health



World Health Organization. WHO Regional Office for Europe. 2023

Open Science & Reproducibility at UZH

Public and free access to scientific work and data, code, educational materials, and publications is a core concern of open science



Quelle: FOSTER Open Science

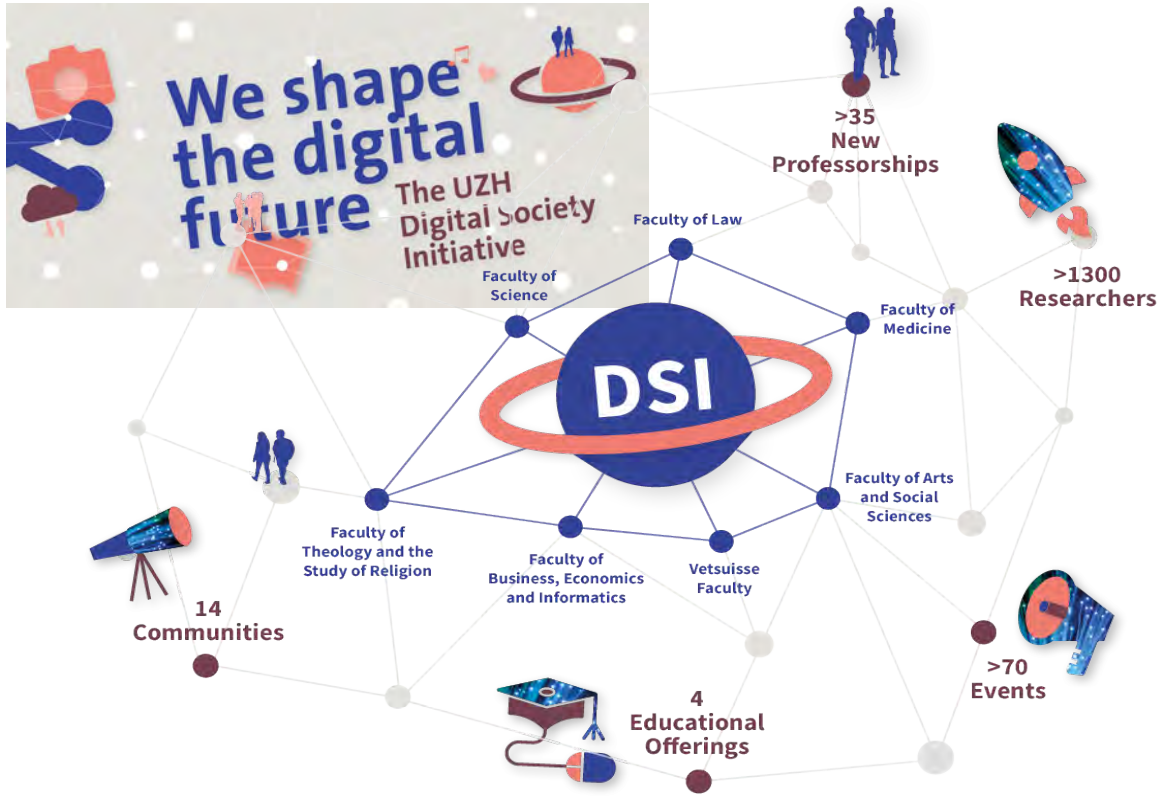
Center for Reproducible Science

Das Center for Reproducible Science forscht und bietet Kurse rund um Methoden und Techniken zur Reproduzierbarkeit von Forschungsergebnissen an. Ziel ist die Effizienz und Qualität der Forschung zu verbessern und damit die Glaubwürdigkeit empirischer Wissenschaft zu erhöhen.

Universität Zürich[UZH]
Digital Society Initiative

Digitalization at UZH: An Interdisciplinary Approach

Since 2018 **UZH's competence center for digital transformation**



www.dsi.uzh.ch

Digital Strategy Board advises the Executive Board of the University on strategic matters of digitalization

www.digital.uzh.ch

Universität Zürich[UZH]
Digital Society Initiative

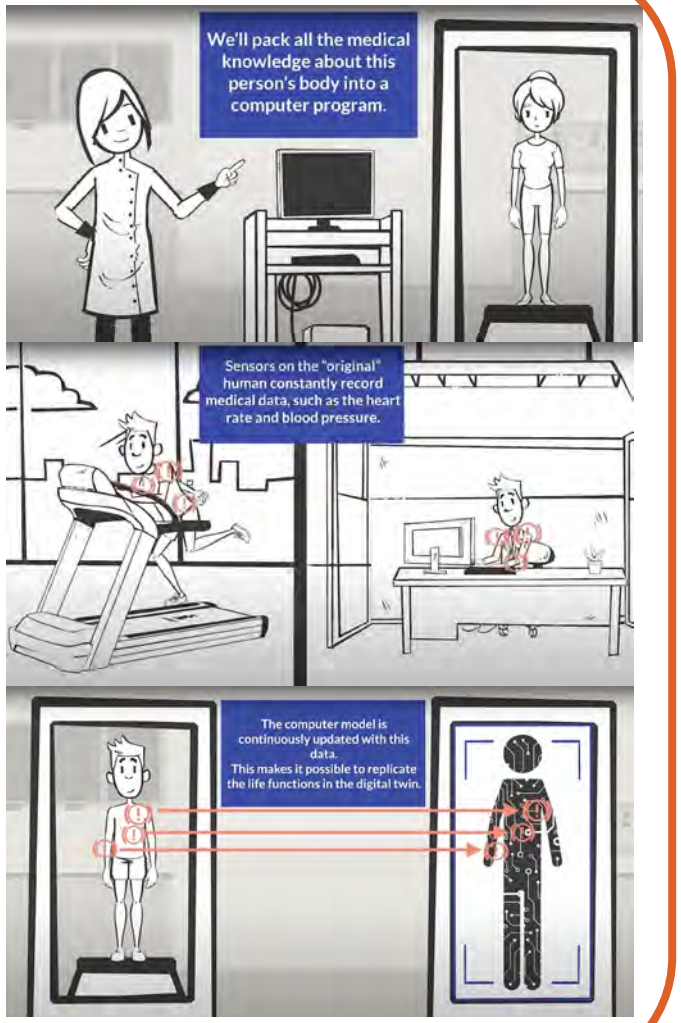
DSI Strategy Lab: AI in Medicine - A Participatory Process

Faculty	Experts	Citizens Health Professionals Media	Experts	Swiss Population N = 1500
Survey	**Workshop**	**Focus Groups & Talks**	**Workshop**	**Survey**
AI in hospitals	Scenario based case studies - Prevention (Cancer) - Diagnosis - Treatment (Cancer) - Resource Allocation	Optimized case studies ↓ **Digital Twin** as far future scenario	Recommendations for Digital Twins from different perspectives	

www.dsi.uzh.ch

Digital Twins / Digital Twin Services

A software = a virtual representation of an individual's physiological state, updated using real-time data from sensors and medical devices, with the purpose of simulating, predicting and optimizing health outcomes through advanced analysis and modelling.



Scoping Reviews on Digital Twins Applications

Table 1 | Various types of DTs in healthcare

Physical Entity	Entity	Mechanism	Endpoint
Lung	Lexma[12]	Runs simulations of blood and oxygen flow	Predict ventilation requirements
Heart	Dassault[13], Medtronic, Boston Scientific, FDA;	Simulates the structure and physiologic function of the heart	Customization and optimization of cardiac devices
Heart	Siemens Healthineers[23]	Simulates the structure and physiologic function of the heart	Cardiac resynchronization
Heart	Heart Navigator[40]	simulated TAVR implantations with different aortic prosthesis	Surgical planning
Spine	Ahmadian et al.[42]	Predict Vertebral Fracture after Stereotactic Body Radiotherapy	Optimal radiation plan to minimize treatment side effects
Alzheimer's disease	Unlearnai[14]	Predicting the individual outcome in neurological diseases	DT of controls of clinical trial and ultimately clinical interventions
Breast lesions	VICTRE trial[51]	Image based virtual patients comparing digital mammography to tomosynthesis	Determine which imaging tool is better at detecting breast lesions
Oropharyngeal cancer	Tardini et al.[61]	Optimal treatment selection	Determine optimal treatment plan for oropharyngeal cancer
Type 2 Diabetes	Cleveland Clinic Twin Health NCT05181449[88]	Disease reversal in type 2 diabetes	Randomized control trial examining twin precision treatment vs. standard of care
Mental health	MindBank AI[65], IBM[66], Babylon[67], DigiTwin[68]		Wellness

Katsoulakis et al npj digital medicine 2024

Opportunities for Digital Twins in Health Care

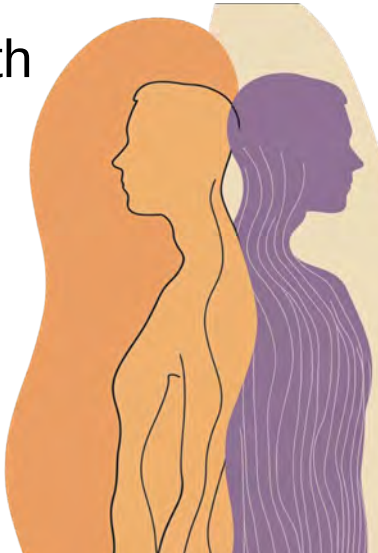
Diagnosis: Your digital twin analyzes symptoms in real-time, enhancing accuracy

Prognosis: Simulates disease progression in your virtual counterpart before it happens

Treatment: Tests therapies on your digital twin first, minimizing real-world side effects

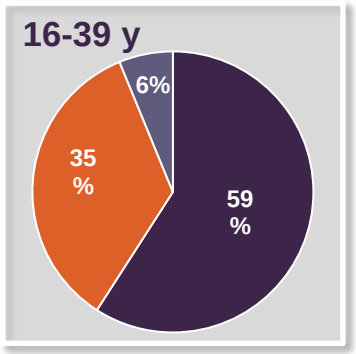
Prevention: Identifies risk patterns early, transforming reactive care into proactive health

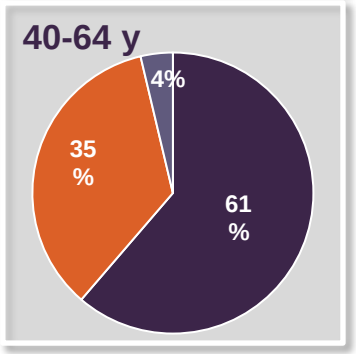
How will this change the framework of Evidence Based Medicine?

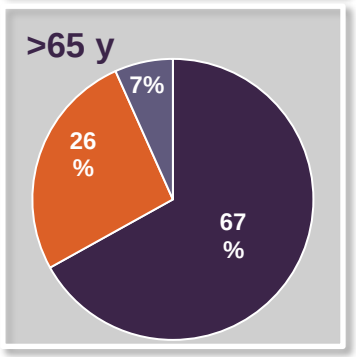


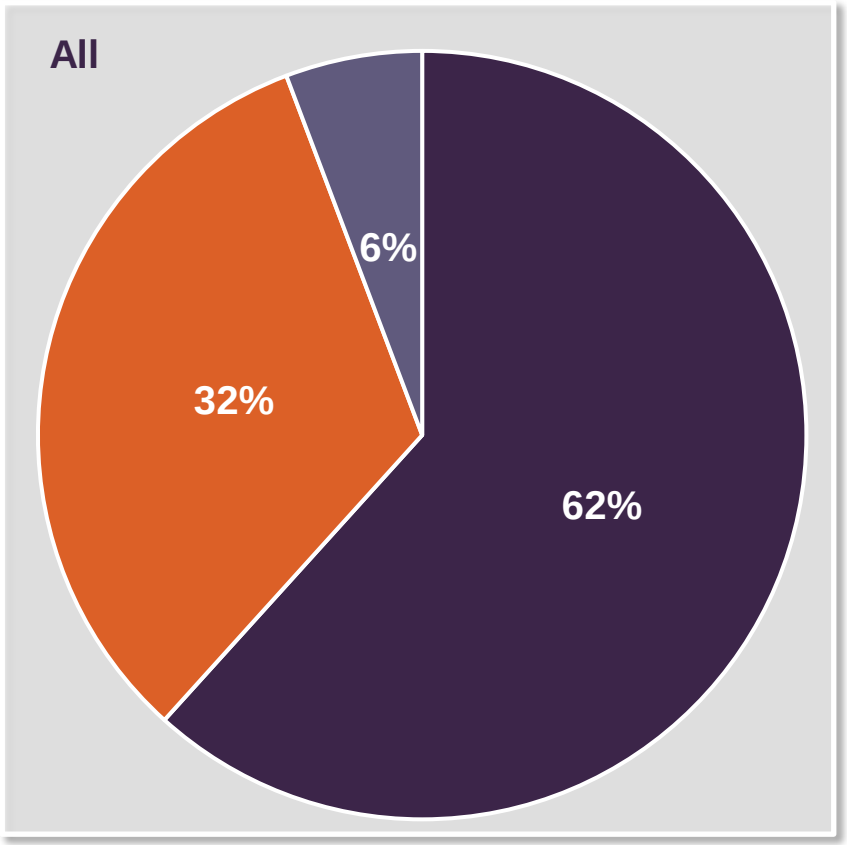
Acceptance of Digital Twins

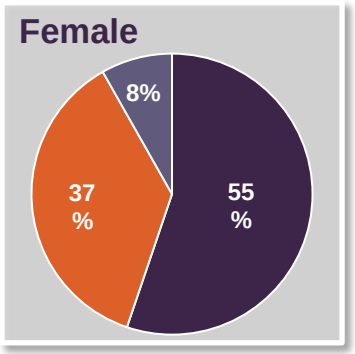
Suppose there were already digital twins: Would you yourself welcome the existence of a digital twin so that your health could be maintained and any illnesses could be better treated?

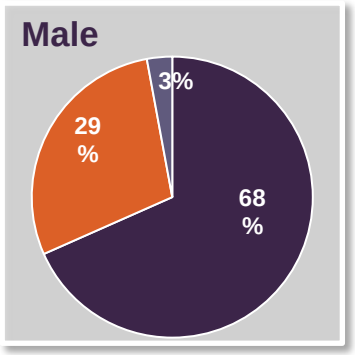


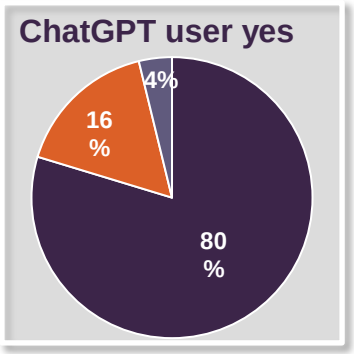


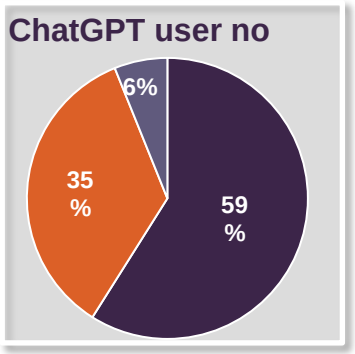












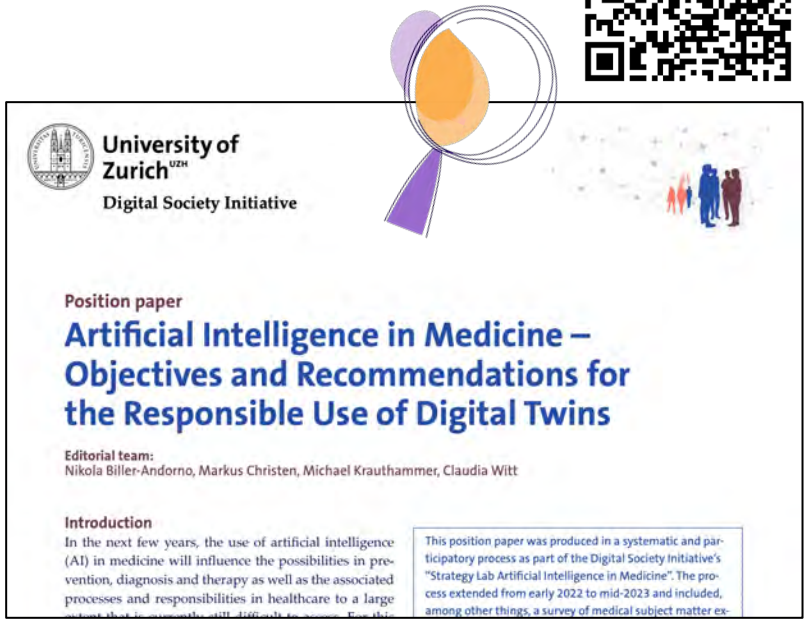
Yes | No | Don't know

Recommendations for Digital Twins: Choice & Access to Health Care

Personal control – Individuals decide if/how their **digital twin** is created and used

Flexible healthcare – Care remains available for those opting out

Empowerment through education – Investment in Digital Skills


University of Zurich[UZH]
Digital Society Initiative

Position paper

Artificial Intelligence in Medicine – Objectives and Recommendations for the Responsible Use of Digital Twins

Editorial team:
Nikola Biller-Andorno, Markus Christen, Michael Krauthammer, Claudia Witt

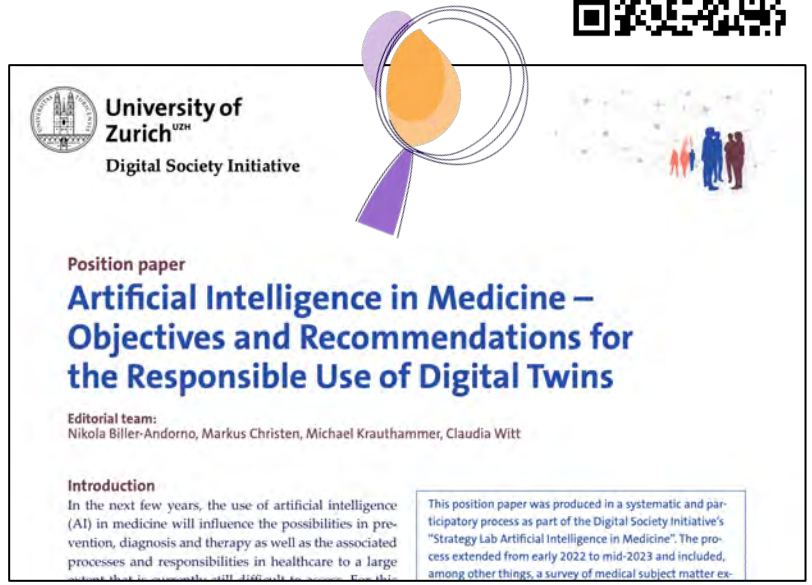
Introduction

In the next few years, the use of artificial intelligence (AI) in medicine will influence the possibilities in prevention, diagnosis and therapy as well as the associated processes and responsibilities in healthcare to a large

This position paper was produced in a systematic and participatory process as part of the Digital Society Initiative's "Strategy Lab Artificial Intelligence in Medicine". The process extended from early 2022 to mid-2023 and included, among other things, a survey of medical subject matter ex-

Recommendations for Digital Twins: Collaboration & Communication in a Human- Digital Twin - Team

Digital twins are integrated into interprofessional treatment teams, where the necessary competencies are available, and responsibilities are clarified.


University of Zurich[UZH]
Digital Society Initiative

Position paper

Artificial Intelligence in Medicine – Objectives and Recommendations for the Responsible Use of Digital Twins

Editorial team:
Nikola Biller-Andorno, Markus Christen, Michael Krauthammer, Claudia Witt

Introduction

In the next few years, the use of artificial intelligence (AI) in medicine will influence the possibilities in prevention, diagnosis and therapy as well as the associated processes and responsibilities in healthcare to a large

This position paper was produced in a systematic and participatory process as part of the Digital Society Initiative's "Strategy Lab Artificial Intelligence in Medicine". The process extended from early 2022 to mid-2023 and included, among other things, a survey of medical subject matter ex-

What do we know about Human - AI Teams (from Economics Research)

Replacement (AI only) vs. Augmentation (AI Assistance)

COMBINING HUMAN EXPERTISE WITH ARTIFICIAL INTELLIGENCE:
EXPERIMENTAL EVIDENCE FROM RADIOLOGY

Nikhil Agarwal
Alex Moehring
Pranav Rajpurkar
Tobias Salz

Working Paper 31422
http://www.nber.org/papers/w31422

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2023, Revised March 2024

Abstract

Full automation using Artifical Intelligence (AI) predictions may not be optimal if humans can access contextual information. We study human-AI collaboration using an information experiment with professional radiologists. Results show that providing (i) AI predictions does not always improve performance, whereas (ii) contextual information does. Radiologists do not realize the gains from AI assistance because of errors in belief updating – they underweight AI predictions and treat their own information and AI predictions as statistically independent. Unless these mistakes can be corrected, the optimal human-AI collaboration design delegates cases either to humans or to AI, but rarely to AI assisted humans.

Demir et al.

- Worse coordination in Human-AI teams compared to Human-only teams
- Less proactive communication (anticipation)
- Generally less communication in teams with AI

Dell'Acqua et al.

Working with AI...

- More coordination errors
- Worse performance
- Less effort

Dell'Acqua et al. Review of Economics and Statistics 2023
Demir et al. Proceedings of the Human Factors and Ergonomics Society Annual Meeting 2017

Human – AI – Teams

Collaboration between humans and AI systems where both act as team members with ***complementary skills, dynamic roles, and shared goals***

Four Conditions for Successful Teams

1. *Understanding AI behavior*: Humans to anticipate AI
2. *Trust in AI systems*: Key to appropriate use
3. *Accurate decision-making*: Leveraging AI outputs effectively
4. *Control*: Humans as directors

Berretta et al. Frontiers in Artificial Intelligence 2023

"We need a future where healthcare is not only centered around human needs and values but also fosters ***a meaningful, symbiotic relationship between humans and AI****. Therefore, we must contribute to a healthcare ecosystem* ***that leverages technology to enhance well-being, without losing the essence of what makes us human****"*

C.M. Witt, www.digital-health-space.ch, 2024