Facultatea de Electronică,
Telecomunicații și
Tehnologia Informației

# SISTEME INTELIGENTE DE SUPORT DECIZIONAL

Ș.l.dr.ing. Laura-Nicoleta IVANCIU

## Curs 12 – AI-DSS în domeniul medical – implementare și studii de caz.

# Cuprins

- AI-DSS în domeniul medical – context, nevoi, soluții
- Integrarea AI
- Aplicații
- Regularizare
- Provocări

## Context/motivație

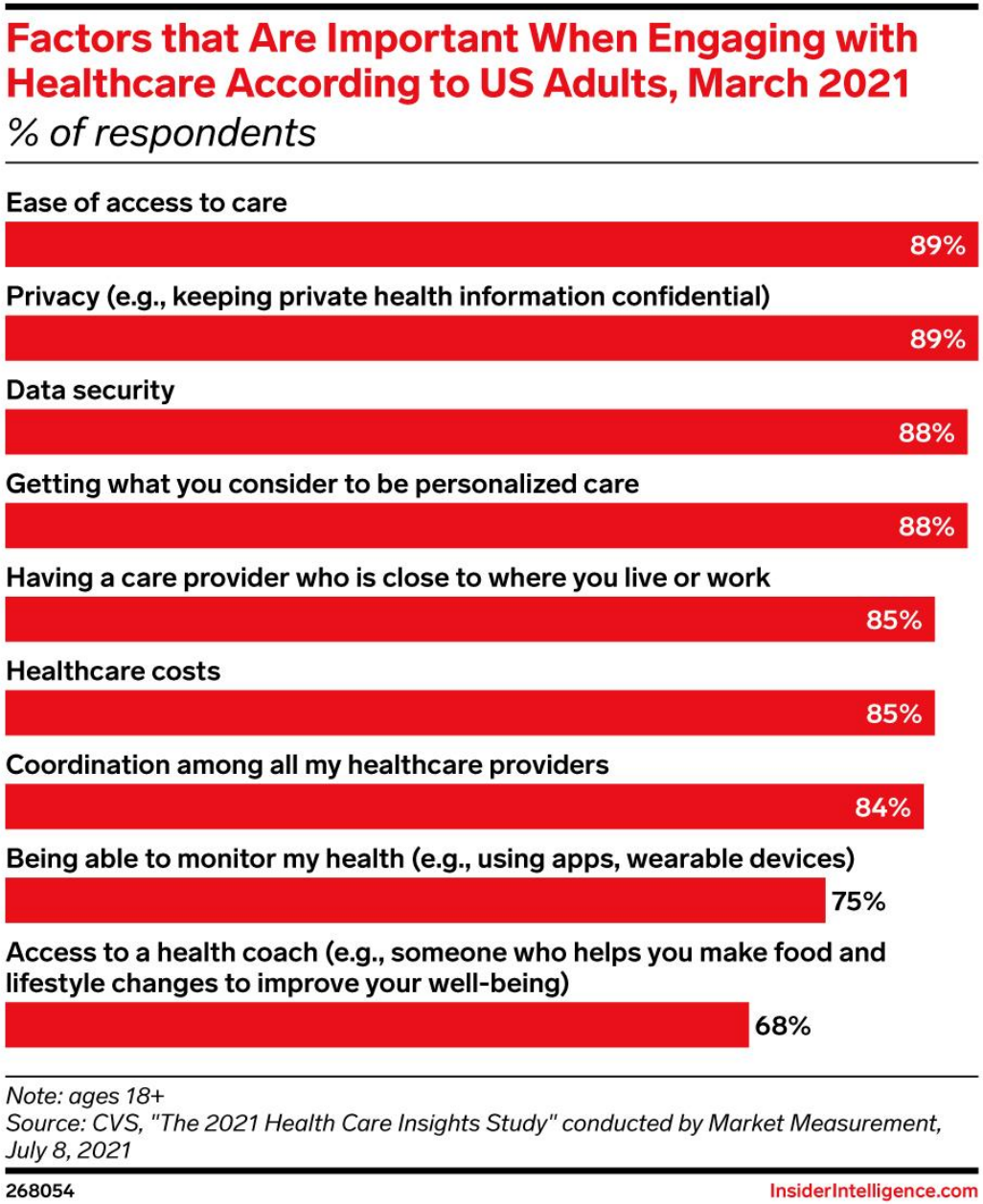
- viteză mare de analiză și procesare a datelor cu ajutorul AI
- accelerarea proceselor de digitalizare impusă de pandemie
- diagnoză și monitorizare la distanță (*remote medicine*)

## Nevoi apărute ca urmare a utilizării AI în domeniul medical

- regularizări ale operațiunilor desfășurate prin intermediul AI
- mecanisme de supervizare
- "locked vs. adaptive" AI challenge

## Soluții?

# Ce spun pacienții?

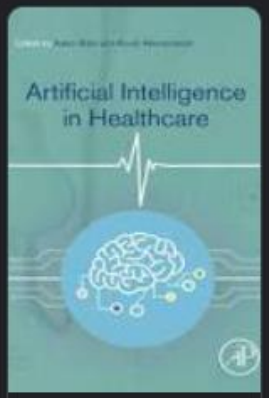



[US Healthcare Industry 2022: Sectors, Trends & Statistics (insiderintelligence.com)]

AI in medicine book

Artificial Intelligence in …

2019




Artificial Intelligence in …

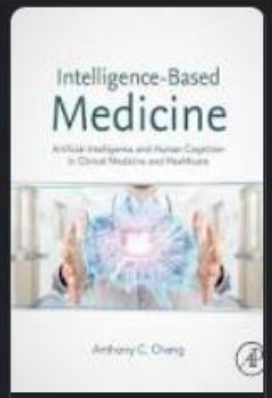
2020

Artificial Intelligence in …

2022

Artificial Intelligence in …

2022




Intelligence-Based Medici…

Anthony C. C…

Artificial Intelligence in …

2019

Artificial Intelligence in …

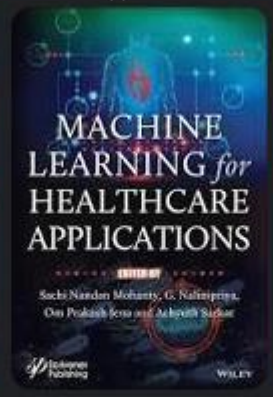
2022

Machine Learning in Healthcare...

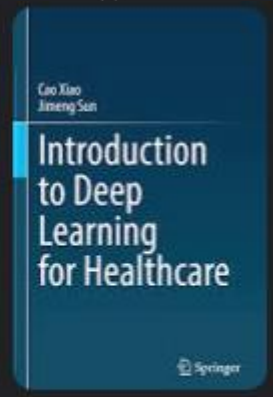
Deep Learning in Healthcare...

Machine Learning and AI for...

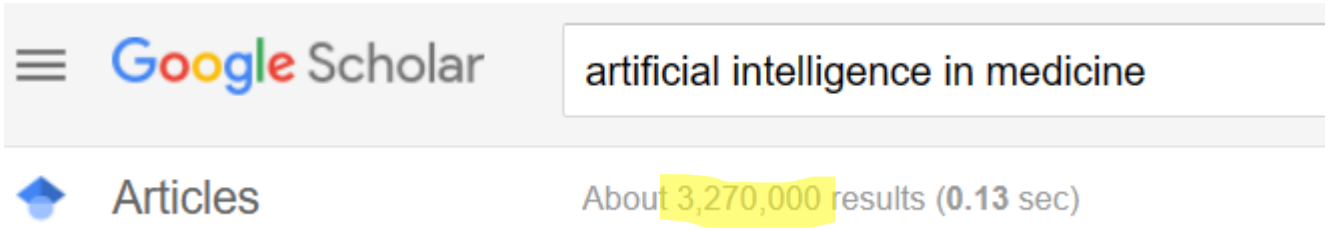
Demystifyi... Big Data and Machi...

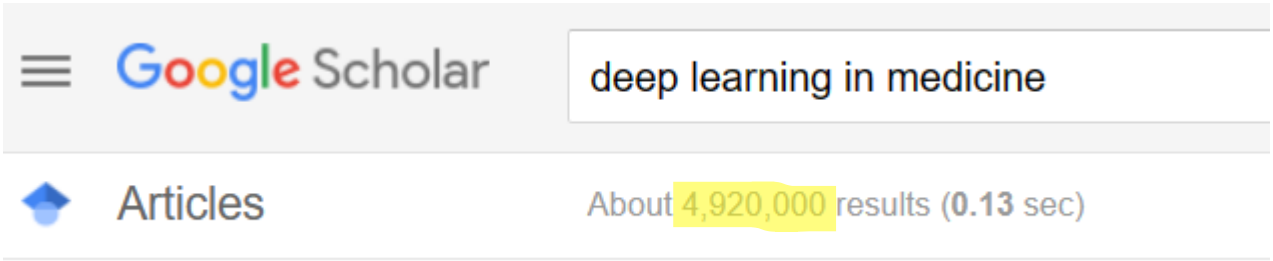


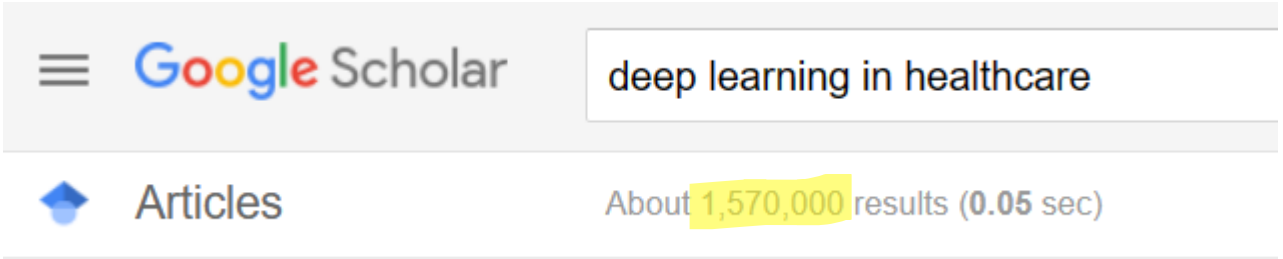

Machine Learning for Healthcare...




Introduction to Deep Learning f...


Google Scholar
artificial intelligence in medicine
Articles
About 3,270,000 results (0.13 sec)


Google Scholar
deep learning in medicine
Articles
About 4,920,000 results (0.13 sec)


Google Scholar
deep learning in healthcare
Articles
About 1,570,000 results (0.05 sec)

# Avantaje

- ❑ Reducerea erorilor
- ❑ Creșterea siguranței pacienților
- ❑ Reducerea costurilor
- ❑ Creșterea interacțiunii medic-pacient
- ❑ Creșterea vitezei de diagnoză
- ❑ Reducerea timpului de stabilire a tratamentului

Artificial Intelligence in Medicine | IBM

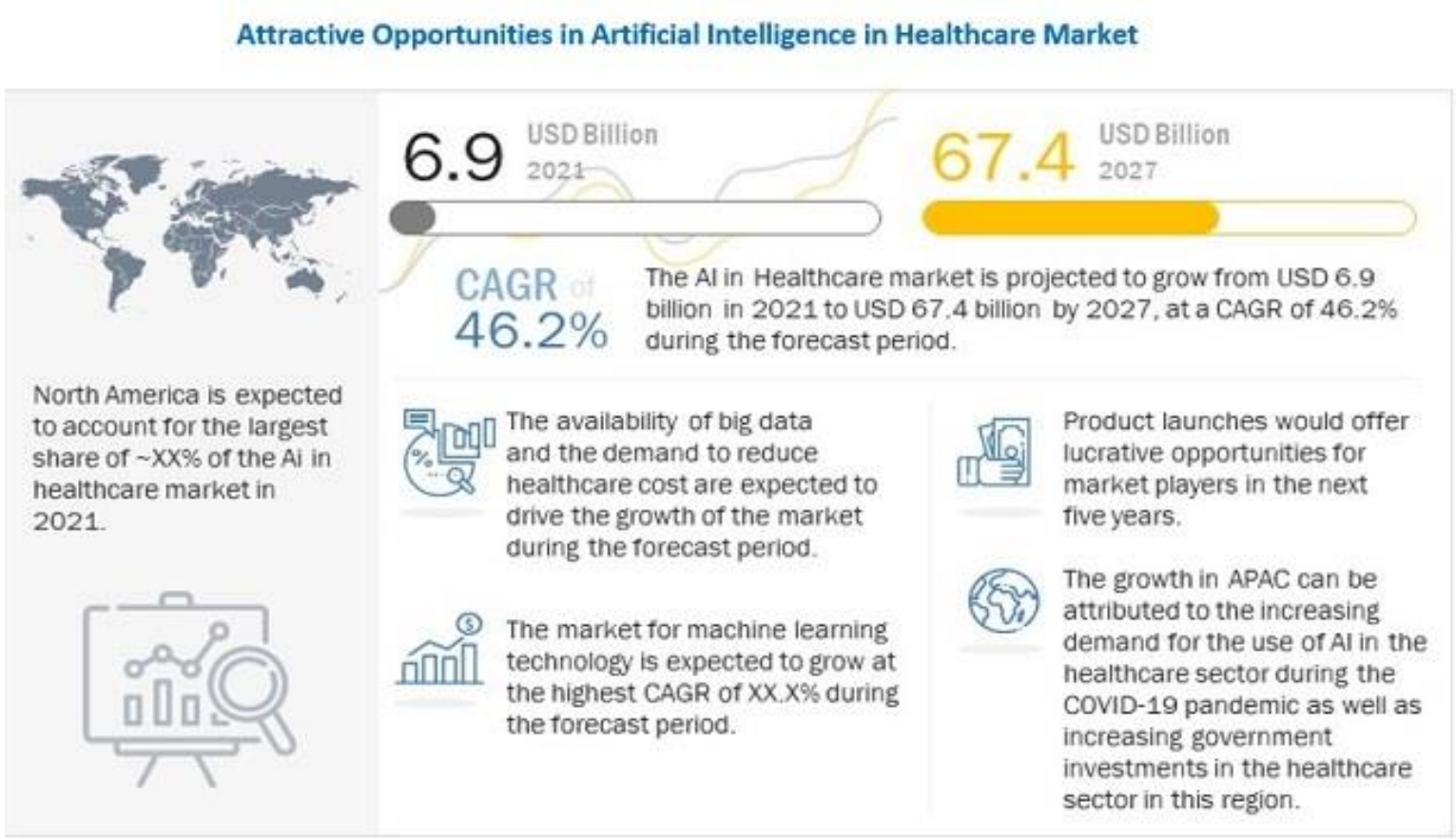
# Integrarea AI în domeniul medical - tipuri

- Patient-oriented
- Clinician-oriented
- Administration-oriented

## Termeni de specialitate

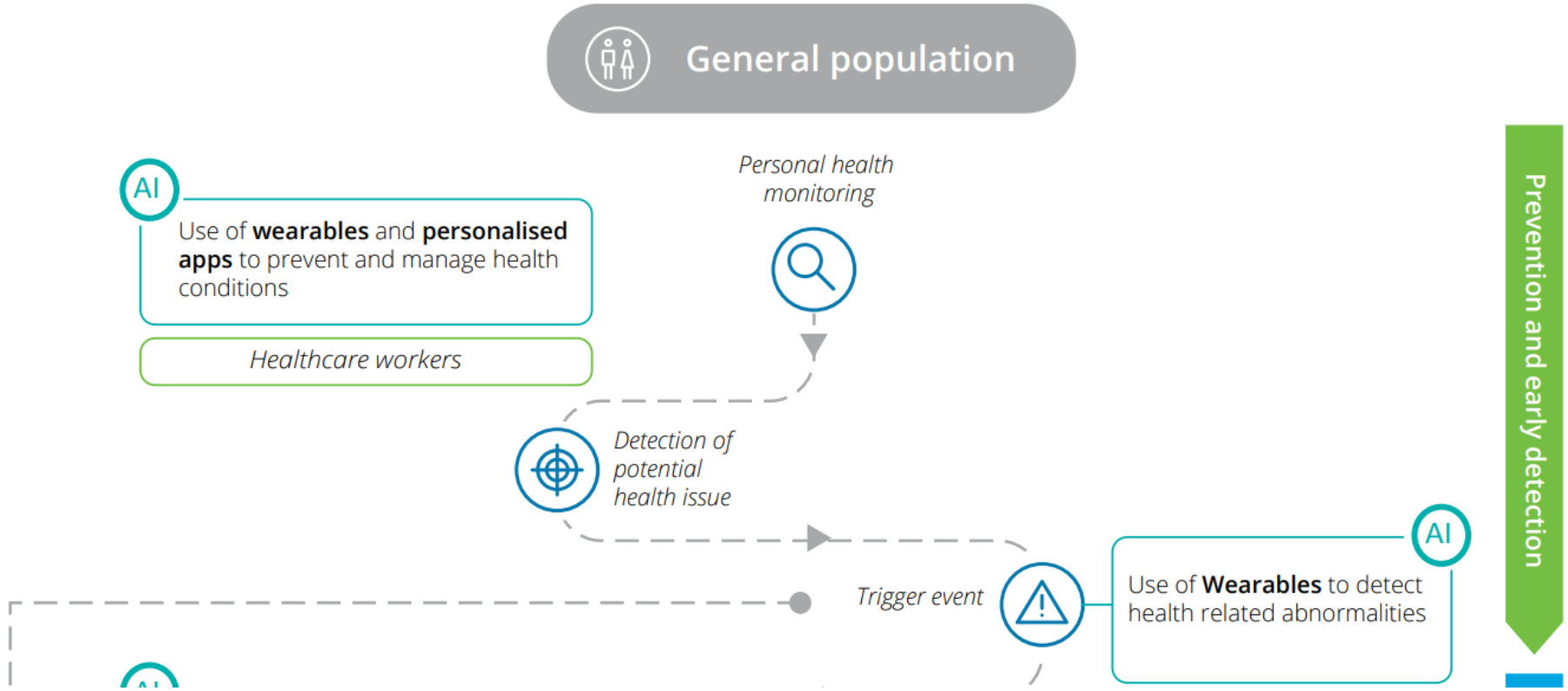
**MML** – Medical Machine Learning
**EHR/EMR** – electronic health record/electronic medical record
**RPM** – remote patient monitoring
**IoMT** – Internet of Medical Things

# Integrarea AI în domeniul medical - prognoză



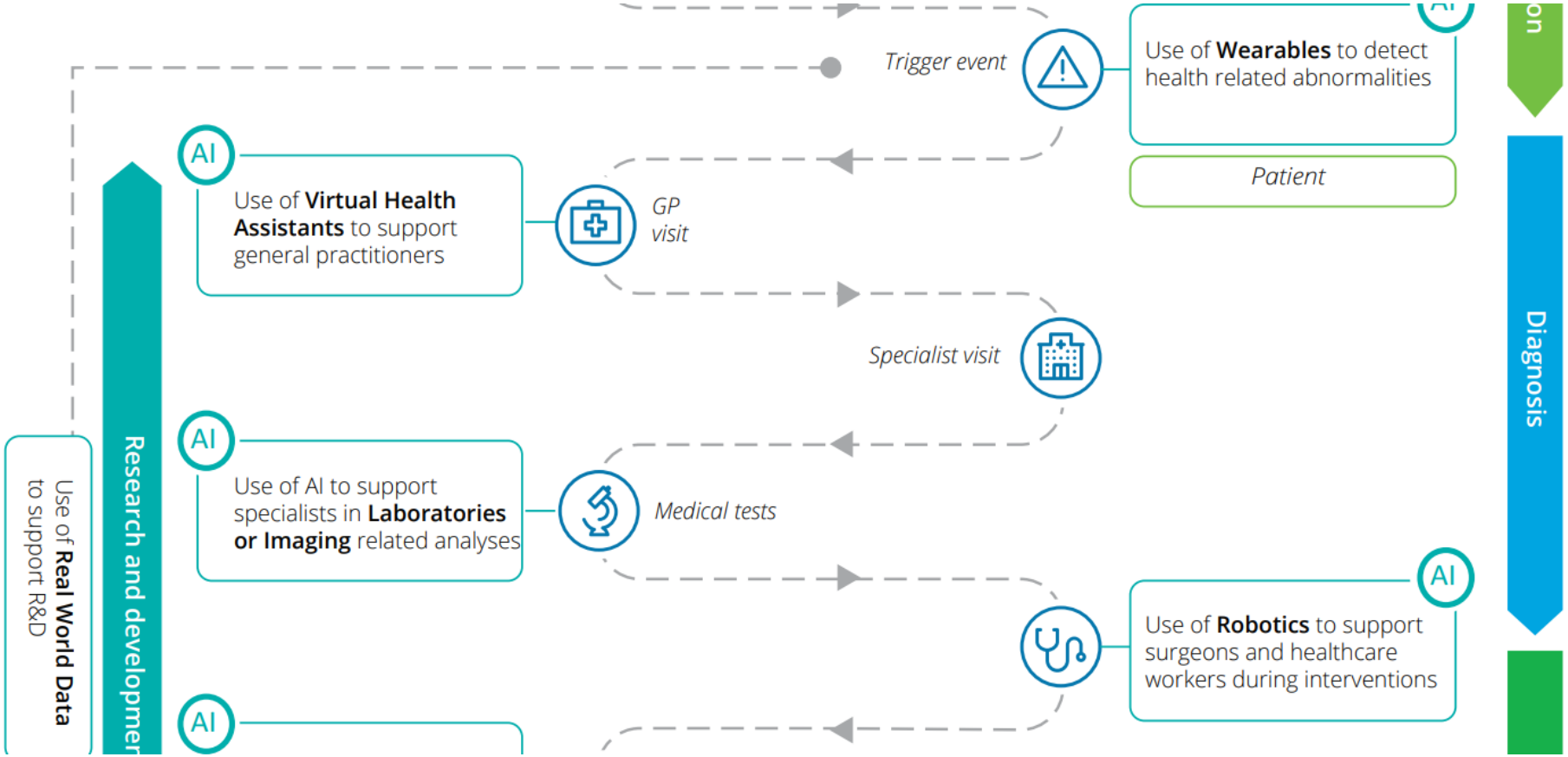

Source: Secondary Literature, Annual Reports, Press Releases, Journals, Industry News, White Papers, Expert Interviews, Blogs, and MarketsandMarkets Analysis

# Flux de integrare a AI în domeniul medical



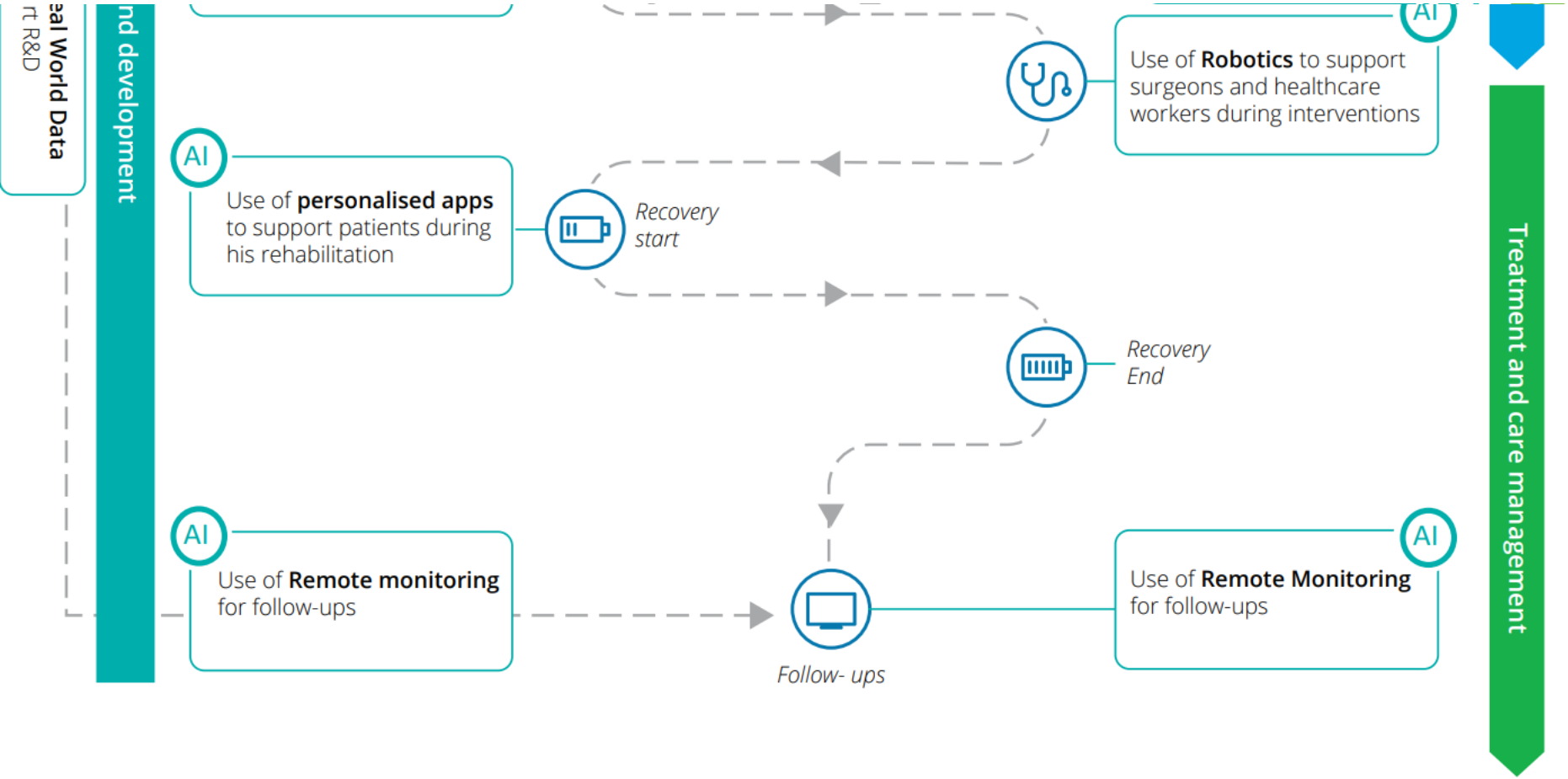

AI-event-flyer-digital (medtecheurope.org)

# Flux de integrare a AI în domeniul medical



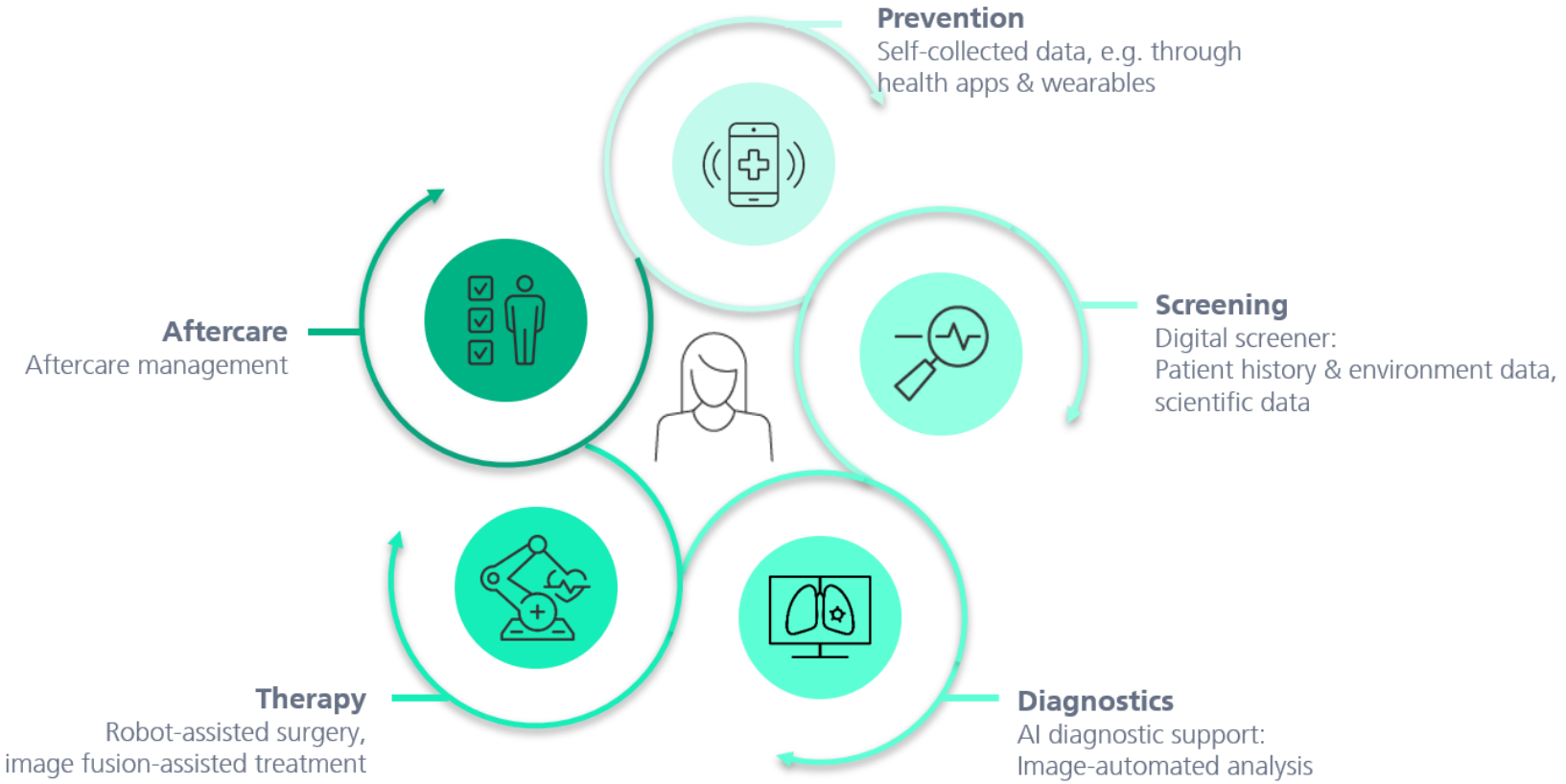

AI-event-flyer-digital (medtecheurope.org)

# Flux de integrare a AI în domeniul medical




AI-event-flyer-digital (medtecheurope.org)

# Digital medical experience




[Artificial Intelligence in Medicine - Fraunhofer IKS]

# Unde poate ajuta AI în medicină?

- Detecție boli și stabilire diagnostic
- Tratament personalizat
- Imagistică și radiologie
- Chirurgie robotică
- Eficientizare teste clinice
- Dezvoltare de noi medicamente
- Automatizarea proceselor administrative

Artificial Intelligence in Medicine | IBM

# Unde poate ajuta AI în medicină?

- Detecție boli și stabilire diagnostic

Detecting **lung cancer** from CT Scans

Assess **cardiac health** from electrocardiograms

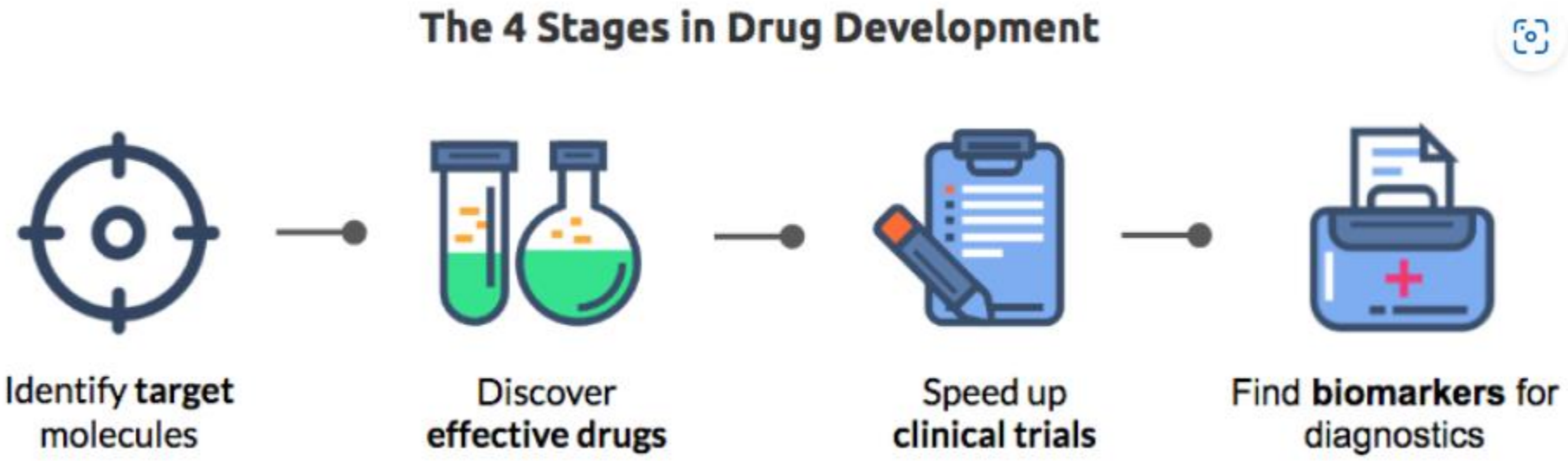
Classify **skin lesions** from images of the skin

Identify **retinopathy** from eye images

[Artificial Intelligence in Medicine | The Top 4 Applications (datarevenue.com)]

# Unde poate ajuta AI în medicină?

- Dezvoltare de noi medicamente




[Artificial Intelligence in Medicine | The Top 4 Applications (datarevenue.com)]

# Unde poate ajuta AI în medicină?

| | |
|---|---|
| DynaMed® and Micromedex® with Watson™ | Provide AI-powered support to clinicians to help them make more informed, evidence-based decisions. |
| IBM® Watson Annotator for Clinical Data | Extract key clinical information, like diagnoses, medications and more, from clinical notes and other medical records. |
| IBM® Watson Assistant for Health Benefits | Answer real-world questions about complex health plan benefits quickly and easily. |
| IBM® Clinical Development | Manage clinical trials end-to-end, including an AI component to ease medical coding. |

Artificial Intelligence in Medicine | IBM

# Unde poate ajuta AI în medicină?

[Vicarious Surgical | Surgical Robotics Technology]

THE VICARIOUS SURGICAL ROBOT

## Technology So Advanced, You Won't Know It's There.

The Vicarious Surgical robot design intends to maximize visualization, precision, and control of instruments in robotic-assisted minimally invasive surgery. It's almost as if **the surgeon is transported** into the patient's body.

# Unde poate ajuta AI în medicină?

[PathAI | Pathology Transformed]

PathAI

### Accurate

AI-based pathology can produce more accurate results, reducing the subjectivity that can result in significant error rates.

### Reproducible

AI and Image Analysis can improve the reproducibility of pathological diagnoses.

### Predictive

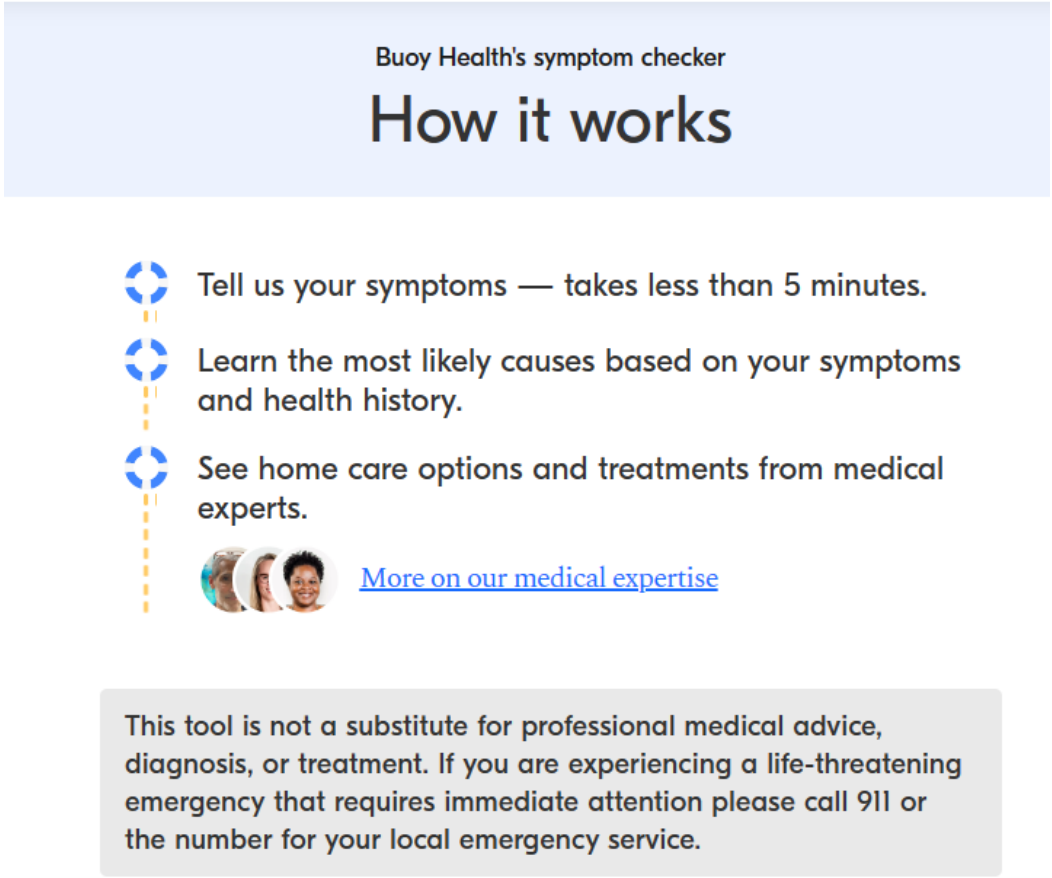
AI-based pathology can precisely predict response to new therapies.

# Unde poate ajuta AI în medicină?

[BenevolentAI | AI Drug Discovery]

# Unde poate ajuta AI în medicină?

[Check your symptoms and find the right care | Buoy (buoyhealth.com)]



# Unde poate ajuta AI în medicină?

Wearable devices for:

fall detection

activity recognition

eating monitoring

fitness tracking

hydration monitoring

stress detection

emotion recognition

sleep monitoring

arrhythmia detection

seizure detection

Machine Learning for Healthcare Wearable Devices: The Big Picture - PMC (nih.gov)

## Regularizarea AI în domeniul medical

- Artificial Intelligence Act (2021) – Comisia Europeană
- Artificial Intelligence/Machine Learning (AI-ML)-Based Software as a Medical Device (SaMD) Action Plan (2021) – FDA (SUA)

## Niveluri de risc în utilizarea AI:

- inacceptabil, ridicat, mediu, scăzut
- AI în medicină -> risc ridicat

How the challenge of regulating AI in healthcare is escalating (ey.com)

# Regularizarea AI în domeniul medical

Criterii de îndeplinit pentru ca un sistem bazat pe AI să primească aprobare:

1. Adequate risk assessment and mitigation systems
2. High quality of the datasets feeding the system to reduce risks and discriminatory outcomes
3. Logging of activity to ensure traceability of results
4. Detailed documentation providing all information necessary on the system and its purpose, for authorities to assess its compliance
5. Clear and adequate information to the user
6. Appropriate human oversight measures to reduce risk
7. High level of robustness, security and accuracy

How the challenge of regulating AI in healthcare is escalating (ey.com)

# Provocări

AI has come to healthcare: What are the pitfalls and opportunities? | MobiHealthNews

- Disponibilitatea datelor (în special pentru boli rare)
- Lipsa de încredere a pacienților
- Transparența și trasabilitatea deciziilor – *black box*, sisteme ce nu își pot explica deciziile
- Mentenanță și actualizare continuă
- Confidențialitate și protecția datelor
- *Alert fatigue* – sistemul generează un număr ridicat de alerte; unele alerte critice ar putea fi ignorate
- Discriminare – *fair AI, algorithmic bias*

PAIR (People + AI Research)Measuring Fairness (pair.withgoogle.com)

# Provocări

- Vor fi medicii înlocuiți de AI în viitor?
  - empatie
  - creativitate și abilități de rezolvare a problemelor complexe

*Ex. House MD*

  - alegerea metodei/tratamentului final (human-in-the-loop)
  - manevre/proceduri care nu pot fi efectuate de roboți

*Ex. resuscitare, intubare, manevra Heimlich*

  - Tech vs. Human devine Tech plus Human

5 reasons why Artificial Intelligence won't replace physicians - Hunimed

## Sumar

- AI-DSS în domeniul medical – context, nevoi, soluții ✓
- Integrarea AI ✓
- Aplicații ✓
- Regularizare ✓
- Provocări ✓

În episodul următor: Decizii strategice în mediul economic. Studii de caz.