

Laboratorij – jučer, danas i sutra



As is your Pathology, so is your Practice

William Osler

Editorial

Mario Plebani*

Value-based laboratory medicine: the time is now

Opinion Paper

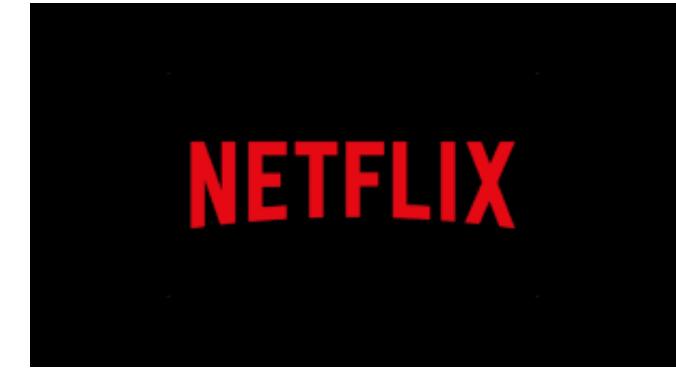
Rossella Tomaiuolo* and Giuseppe Banfi

From volume to value: a watershed moment for the clinical laboratory

Zamislite da vaš laboratorij prestane raditi,
jednog običnog utorka u 9.30 ujutro

Telefoni počinju zvoniti za:

- a) Sat vremena
- b) Dva sata
- c) Tri sata
- d) Ne očekujem telefonske pozive



Laboratorij je neophodan za sve ključne grane medicine

- Interna medicina
- Pedijatrija
- Neurologija
- Intenzivna medicina/anesteziologija
- Onkologija
- Infektologija
- Kirurgija
- Kardiologija

Technicon, 1957





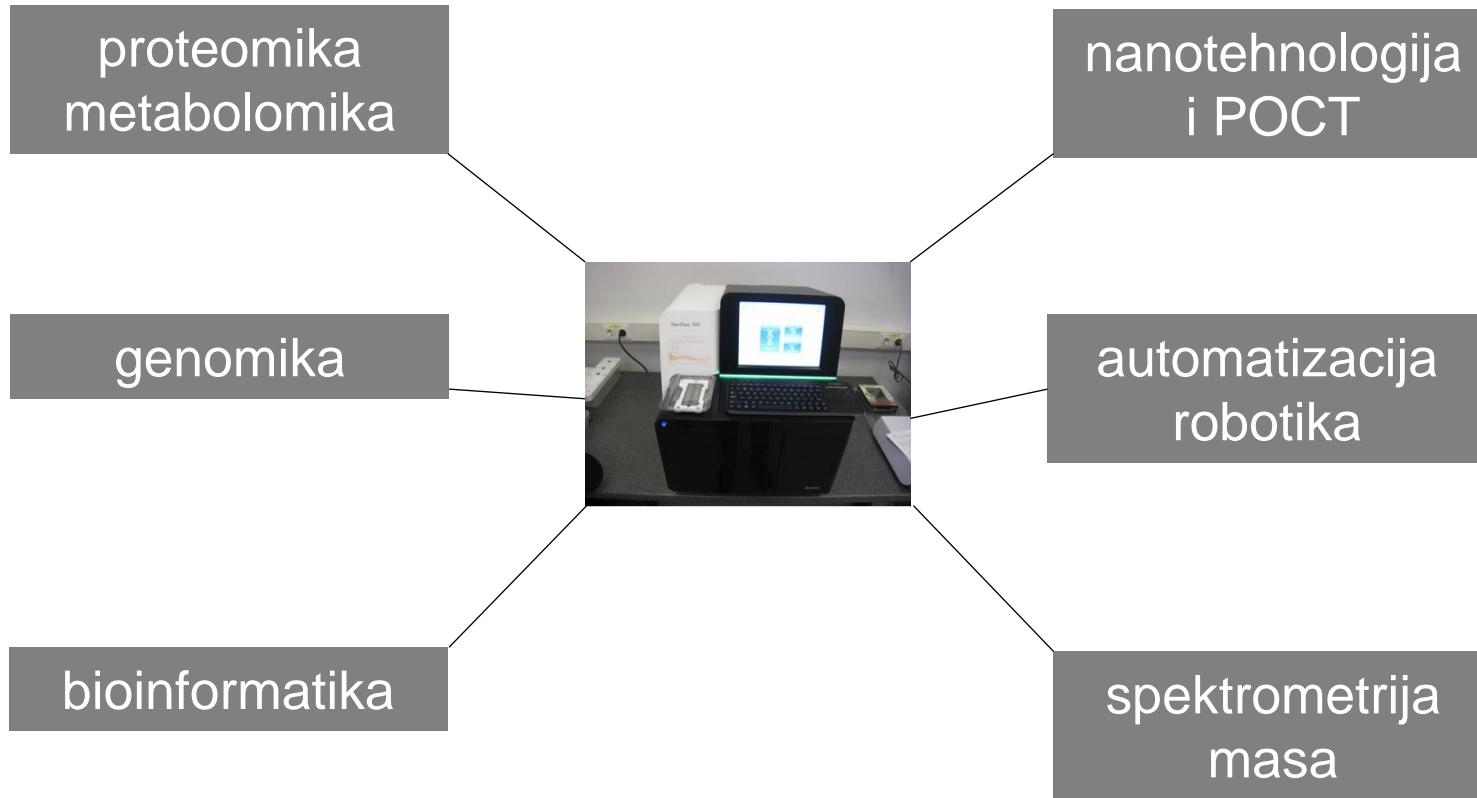


Što je posao medicinskog biokemičara danas?

- Rad na analitičkim uređajima?
- Kalibracije?
- Unutarnja i vanjska kontrola kvalitete?
- Validacija nalaza?
- Narudžbe?
- Raspored rada?
- Kritične vrijednosti?
- Praćenje TAT-a?
- Uvođenje novih pretraga?
- Uklanjanje starih pretraga?
- IT?

Tehnologije nezaustavljivo napreduju

Software vs. Hardware



Disruptive innovations

Osmišljavanje i upravljanje laboratorijskim procesima

Partneri:

In vitro dijagnostička industrija

Kliničari

Bolesnici – vratimo ih u fokus!

Promjena paradigme



Povjerenstvo za
stručna pitanja

**PREPORUKE POVJERENSTVA ZA STRUČNA
PITANJA
ZAPISI ZA KORISNIKE**

**PROMJENA REFERENTNIH VRIJEDNOSTI LDL
KOLESTEROLA NA NALAZIMA**

PPSP-ZK
10.0-1/2

25.03.2021.

Sukladno prijedlogu predsjednika relevantnih liječničkih stručnih društava te nakon pregleda važećih međunarodnih smjernica, Povjerenstvo za stručna pitanja donosi preporuku za promjenu referentnih vrijednosti LDL kolesterola na nalazima, kako slijedi:

- za osobe s vrlo velikim rizikom <1.4 mmol/L
- za osobe s velikim rizikom <1.8 mmol/L
- za osobe s umjerenim rizikom <2.6 mmol/L
- za osobe s malim rizikom <3.0 mmol/L.

Individualnu pripadnost kategoriji rizika razvoja akutnog kardiovaskularnog događaja procjenjuje liječnik temeljem važećih međunarodnih smjernica.

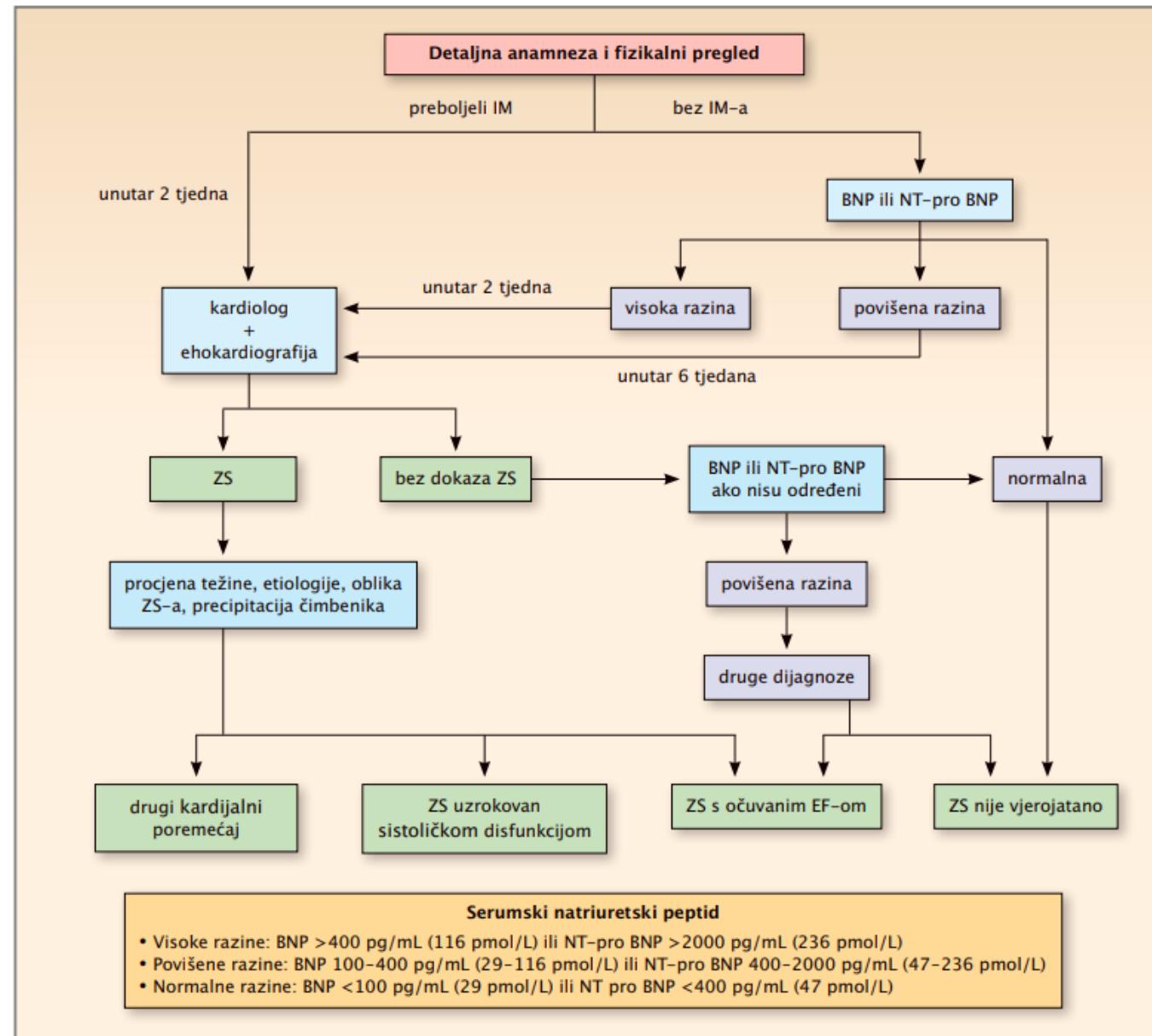
Kako uvodimo nove pretrage?

Poticaj IVD - nedovoljan

Poslovna odluka (PZZ i privatni laboratorijski) – pitanje etičnosti

Inicijativa kliničara

SLIKA 3. Algoritam dijagnostike zatajivanja srca



Modificirano prema nadopunama preporuka *National Institute for Health and Clinical Excellence Guideline*, Velika Britanija 2010. g.

Legenda: IM – infarkt miokarda; BNP – moždani natriuretski peptid; NT-pro BNP – N-terminalni fragment moždanog natriuretskog

McDonagh, TA, Metra, M, Adamo, M, Gardner, RS, Baumbach, A, Böhm, M, et al.. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J*. 2021;42:3599-726

Letter

<https://doi.org/10.1038/s44161-024-00422-z>

Markers of imminent myocardial infarction

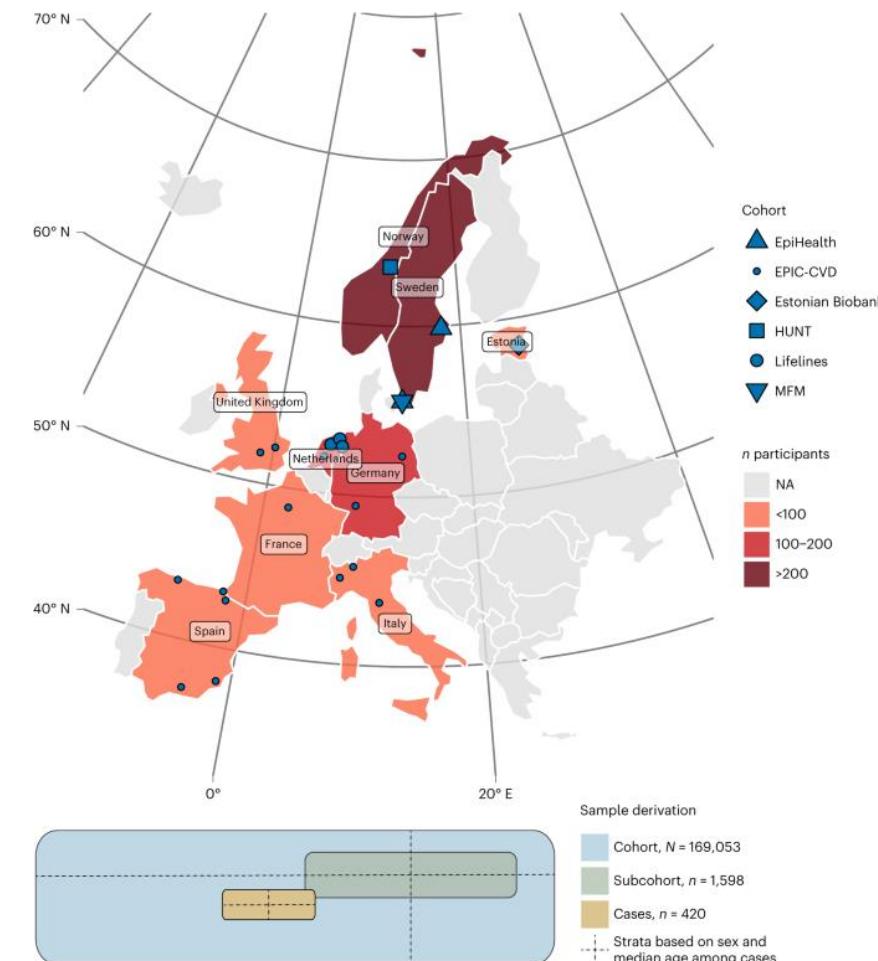
Received: 28 April 2023

Accepted: 4 January 2024

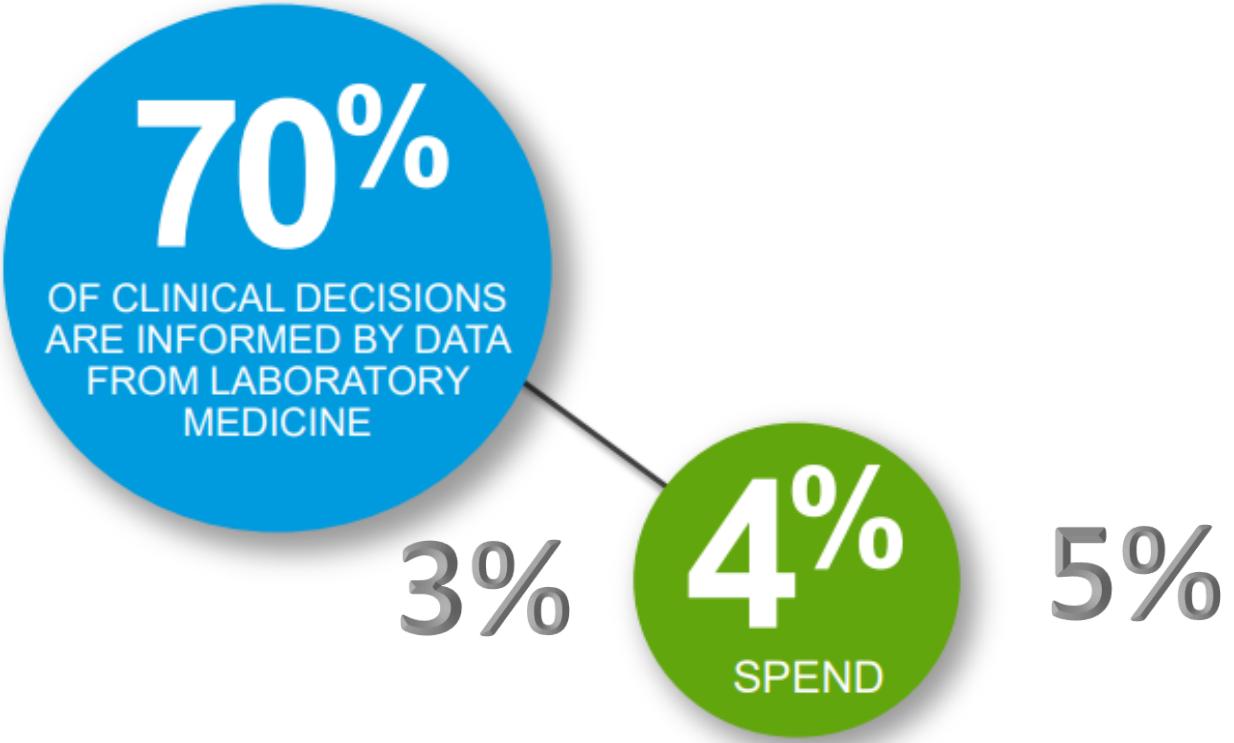
Published online: 12 February 2024

Check for updates

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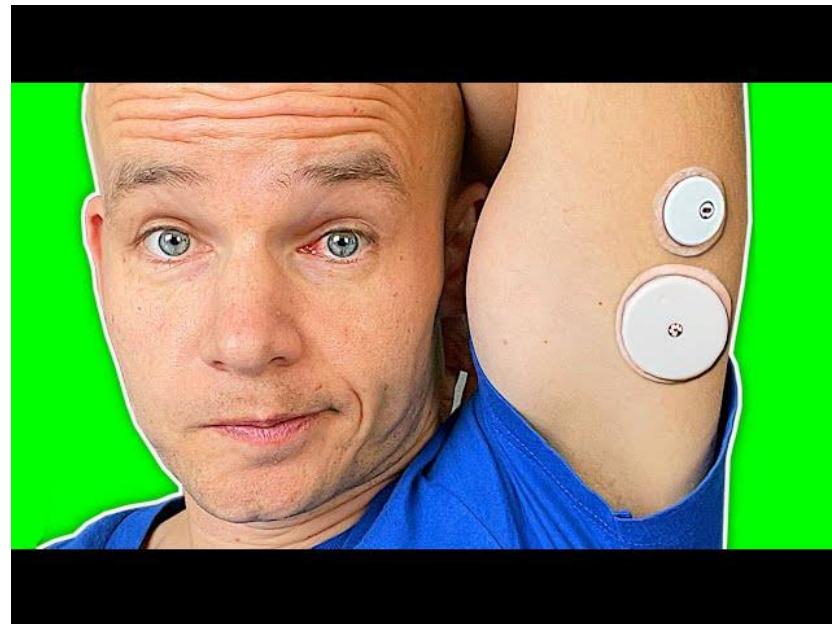
Neyazi, Meraj, Bremer, Jan P., Knorr, Marius S., Gross, Stefan, Brederecke, Jan, Schweingruber, Nils, Csengeri, Dora, Schrage, Benedikt, Bahls, Martin, Friedrich, Nele, Zeller, Tanja, Felix, Stephan, Blankenberg, Stefan, Dörr, Marcus, Vollmer, Marcus and Schnabel, Renate B.. "Deep learning-based NT-proBNP prediction from the ECG for risk assessment in the community" *Clinical Chemistry and Laboratory Medicine (CCLM)*, vol. 62, no. 4, 2024, pp. 740-752.



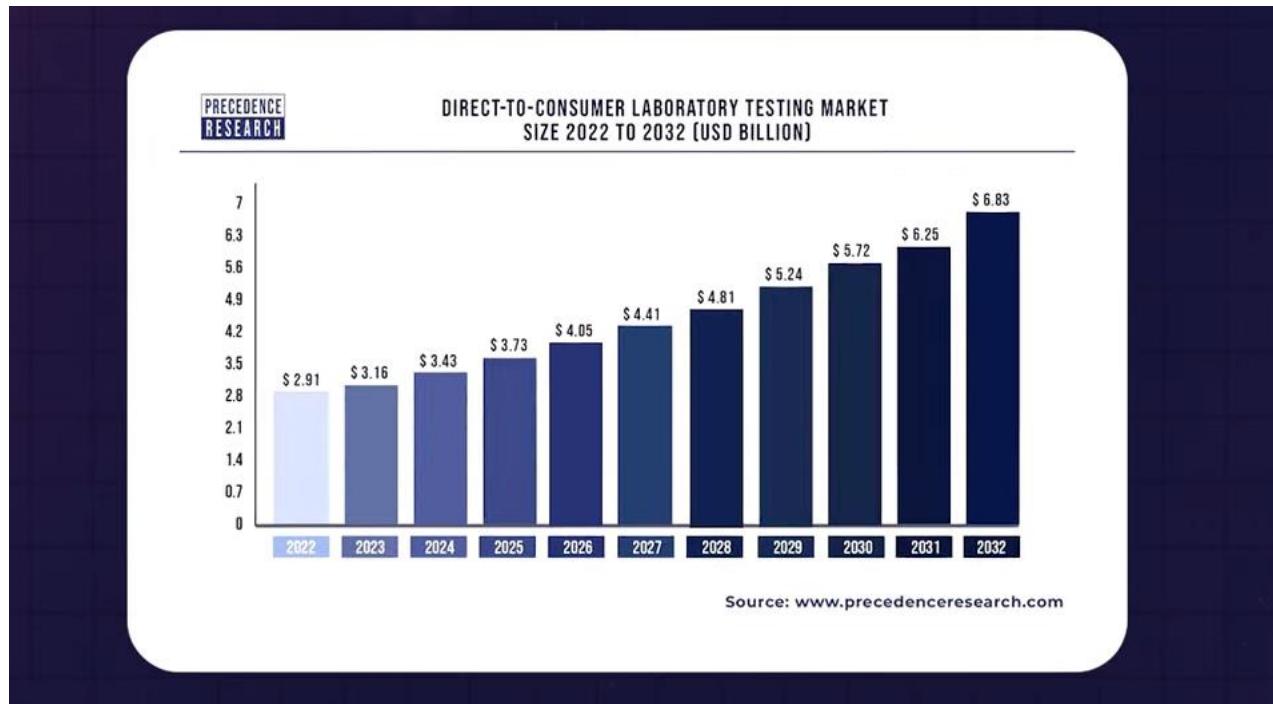
POCT

- Nije prijetnja, nego baš obratno – nova dodatna šansa za struku
- Koristi za bolesnika neupitne

POCT 2.0



Pretrage kod kuće





RANDOX
HEALTH | Tasso

AT HOME
TESTING
JUST GOT
EASIER

A promotional graphic for Randox Health and Tasso. It features a woman from the previous image using the Tasso device. The background is teal with a white jagged line border. To the right, there is a black and white illustration of a megaphone. The text "AT HOME TESTING JUST GOT EASIER" is written in large, bold, white letters with a red outline. The Randox Health logo is at the top left, and the Tasso logo is next to it. The overall theme is making at-home testing more accessible and easier.

**Everyman / Everywoman**

£295.00 in clinic

Get unrivalled health insights relating to your full body well-being with a simple blood test and take action to help protect your future health. Repeat testing is included to help you track your health data and identify areas for further improvement.

4 interest-free payments with
clearpay

[Learn More](#)**Everyman | Everywoman plus tumour associated markers**

£857.00 in clinic

Get unrivalled health insights into your full body well-being with a simple blood test to help protect your future health. Repeat testing is included.

4 interest-free payments with
clearpay

[Learn More](#)**Signature Prestige**

£1750.00 in clinic

With 1 test, measure 350 health data points investigating stress health, tumour markers and neurological markers with private GP consultation included.

[Learn More](#)**Signature Platinum**

£2600.00 in clinic

Expanding on prestige, Platinum provides a second health check within 12 months of your first visit, giving you the ability to effectively evaluate the progress of your health journey.

[Learn More](#)

Chat now!
Hello! How can I help?

OVER 5 MILLION TESTS PROCESSED IN THE LAST 12 MONTHS

Here's what our customers say...



USPOSTAVA HITNE POMORSKE MEDICINSKE SLUŽBE BRZIM BRODICAMA



Projekt je sufinancirala Evropska unija iz Europskog fonda za regionalni razvoj

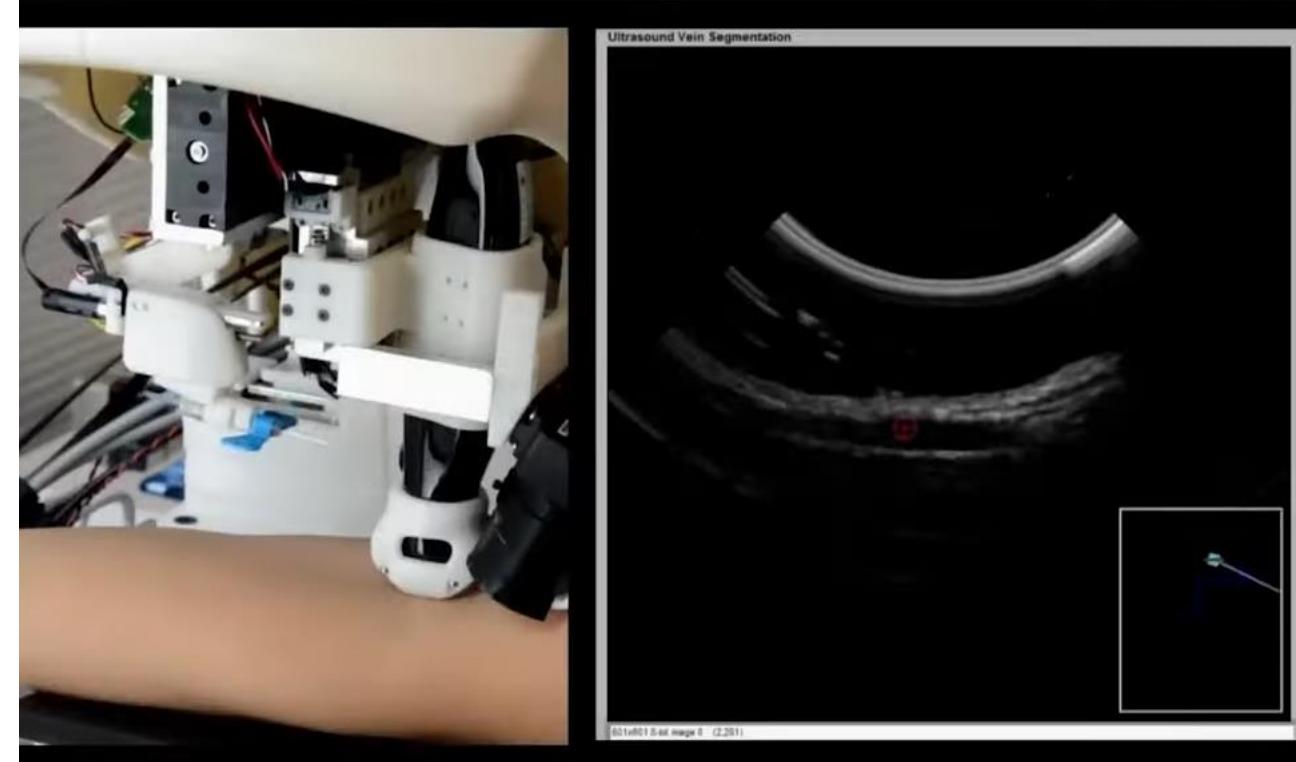
Kako bi se prevenirali nepotrebni visoki troškovi prijevoza s otoka na kopno brzim brodicama, u ambulantama na početnim destinacijama zbrinjavanja pacijenata, omogućit će se izvođenje jednostavnih kvalitativnih ili kvantitativnih medicinsko-biokemijskih pretraga pomoću automatskih biokemijskih analizatora radi utvrđivanja neophodnosti hitne intervencije prijevoza u najbližu ustanovu hitne medicine/bolničku ustanovu na kopnu.

Kroz projekt su nabavljeni automatski biokemijski analizatori krvi koji služe u procjeni hitnih slučajeva prije upućivanja pacijenta u bolnicu, a raspoređeni su u 12 ispostava zavoda za hitnu medicinu: Blato na Korčuli, Korčula, Lastovo, Mljet, Cres, Mali Lošinj, Rab, Jelsa na Hvaru, Supetar, Šolta, Vis i Preko.



Vitestro starts largest-scale clinical trial worldwide for autonomous blood drawing device with enrollment of first patients in A.D.O.P.T.

Utrecht, The Netherlands, 5 September 2023 – Vitestro, expert in medical robotics, has launched an A.D.O.P.T. Trial for her autonomous blood drawing device ([image](#)). With an anticipated sample size of over 10,000 patients, this is the most significant study worldwide to date of autonomous blood collection. Vitestro expects to obtain CE marking by the end of 2024.





About BD MiniDraw™ Capillary Blood Collection System

BD MiniDraw™ Collection System is a novel device that collects lab-quality blood samples from the patient fingertip, without the need for phlebotomy. The FDA 510(k) cleared system is less-invasive than venous collection methods, using only one-tenth the volume required for a traditional venous draw, and can be used in new settings, like retail pharmacies. By expanding access to less-invasive collection methods, the BD MiniDraw™ Collection System has the potential to transform blood collection for diagnostic testing.



BD Receives FDA 510(k) Clearance
→

Babson Diagnostics™

A health care technology company with a new vision for diagnostic blood testing

Explore our technology ▶





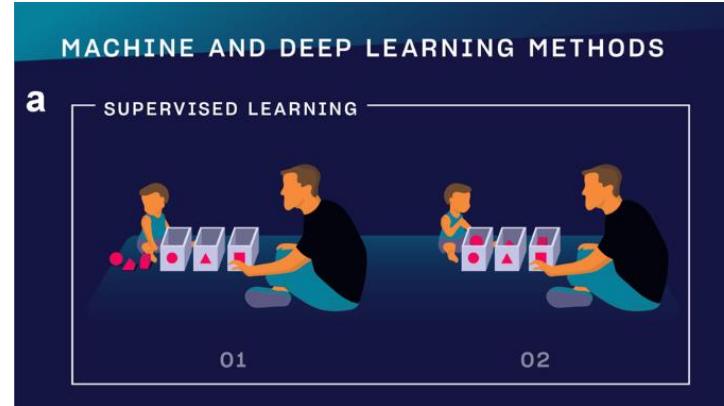
**Clinically equivalent results to
traditional venous methods for 16
analytes¹**

The BD MiniDraw™ Collection System has demonstrated clinical equivalence to venous samples for 16 analytes, including a lipid panel, selected chemistry tests, and hemoglobin and hematocrit (H&H) testing.² These are among the most commonly ordered laboratory tests and can be used to diagnose and monitor a variety of chronic conditions from hypertension to high cholesterol.

Kako i kuda dalje?

- Sve bolji i bolji uređaji (veći kapacitet, manji volumen uzorka) – treba li još bolje i još brže?
- Programska podrška (middleware)
- Autovalidacija
- Minimalni retestni intervali
- A što ćemo sad?

Autovalidacija



- U usporedbi s manuelnim pristupom, to je nedostižno učinkovit i beskompromisno **točan** način eliminacije nepotrebnog ljudskog rada
- Kreiranje pravila: nema prostora za grešku
- Zašto je u našim laboratorijima još uvijek rijetkost? Zar zaista još uvijek mislimo da nam autovalidacija oduzima kruh?



Laboratory demand management

- Uvijek vruća i aktualna tema
- Bez naše inicijative – ništa od toga
- AI pristup bio bi primjer kvantnog pomaka u odnosu na postojeće mogućnosti

<input type="checkbox"/> 1 L0001 - Glukoza (S)	<input type="checkbox"/> 1 L0034 - Osmolalnost (S...)	<input type="checkbox"/> 1 L0053 - Urati (U)	<input type="checkbox"/> 1 L0069 - Okultna krv (F)	<input type="checkbox"/> 1 L0842
<input type="checkbox"/> 1 L0002 - Bilirubin ukupni...	<input type="checkbox"/> 1 L0035 - Proteini ukupni...	<input type="checkbox"/> 1 L0054 - Kalij (dU)	<input type="checkbox"/> 1 L0070 - Ukupni lipidi (F)	<input type="checkbox"/> 1 L0843
<input type="checkbox"/> 1 L0003 - Bilirubin konjugi...	<input type="checkbox"/> 1 L0036 - CRP (S)	<input type="checkbox"/> 1 L0055 - Kalij (U)	<input type="checkbox"/> 1 L0071 - Probavljivost (F)	<input type="checkbox"/> 1 L0844
<input type="checkbox"/> 1 L0004 - Ureja (S)	<input type="checkbox"/> 1 L0039 - MOKRAĆA-Kv...	<input type="checkbox"/> 1 L0056 - Natrij (dU)	<input type="checkbox"/> 1 L0075 - Proteini ukupni...	<input type="checkbox"/> 1 L0845
<input type="checkbox"/> 1 L0005 - Kreatinin (S)	<input type="checkbox"/> 1 L0021 - Kalij (S)	<input type="checkbox"/> 1 L0040 - Morfologija eritr...	<input type="checkbox"/> 1 L0057 - Natrij (U)	<input type="checkbox"/> 1 L0076 - LDH-IZLJEV (a...
<input type="checkbox"/> 1 L0006 - Urati (S)	<input type="checkbox"/> 1 L0022 - Natrij (S)	<input type="checkbox"/> 1 L0058 - Kloridi (dU)	<input type="checkbox"/> 1 L0077 - Glukoza - IZLJ...	<input type="checkbox"/> 1 L0847
<input type="checkbox"/> 1 L0007 - ALP (S)	<input type="checkbox"/> 1 L0023 - Kloridi (S)	<input type="checkbox"/> 1 L0059 - Kloridi (U)	<input type="checkbox"/> 1 L0078 - Sediment - IZLJ...	<input type="checkbox"/> 1 L0848
<input type="checkbox"/> 1 L0008 - ...	<input type="checkbox"/> 1 L0024 - Kalcij ukupni (S)	<input type="checkbox"/> 1 L0044 - Osmolalnost (U...	<input type="checkbox"/> 1 L0060 - Kalcij (dU)	<input type="checkbox"/> 1 L0849
<input type="checkbox"/> 1 L0009 - ALT (S)	<input type="checkbox"/> 1 L0025 - Fosfati an. (S)	<input type="checkbox"/> 1 L0045 - Amilaza (U)	<input type="checkbox"/> 1 L0061 - Kalcij (U)	<input type="checkbox"/> 1 L0850
<input type="checkbox"/> 1 L0010 - GGT (S)	<input type="checkbox"/> 1 L0026 - Magnezij uk.(S)	<input type="checkbox"/> 1 L0046 - Glukoza (dU)	<input type="checkbox"/> 1 L0062 - Fosfati an.(dU)	<input type="checkbox"/> 1 L0851
<input type="checkbox"/> 1 L0011 - CK (S)	<input type="checkbox"/> 1 L0027 - Željezo (S)	<input type="checkbox"/> 1 L0047 - Glukoza (U)	<input type="checkbox"/> 1 L0063 - Fosfati an.(U)	<input type="checkbox"/> 1 L0084 - Desferalski test...
<input checked="" type="checkbox"/> 1 L0012 - ...	<input type="checkbox"/> 1 L0028 - UIBC (S)	<input type="checkbox"/> 1 L0048 - Ureja (dU)	<input type="checkbox"/> 1 L0064 - Magnezij ukupn...	<input type="checkbox"/> 1 L0085 - Pokus acidifika...
<input type="checkbox"/> 1 L0013 - LD (S)	<input type="checkbox"/> 1 L0029 - TIBC (S)	<input type="checkbox"/> 1 L0049 - Ureja (U)	<input type="checkbox"/> 1 L0065 - Magnezij ukupn...	<input type="checkbox"/> 1 L0086 - Procjena GFR-...
<input type="checkbox"/> 1 L0014 - Amilaza (S)	<input type="checkbox"/> 1 L0030 - Bakar (S)	<input type="checkbox"/> 1 L0050 - Kreatinin (dU)	<input type="checkbox"/> 1 L0066 - Bakar (dU)	<input type="checkbox"/> 1 L0087 - Procjena GFR -...
<input type="checkbox"/> 1 L0015 - Lipaza (S) na p...	<input type="checkbox"/> 1 L0031 - ...	<input type="checkbox"/> 1 L0051 - Kreatinin (U)	<input type="checkbox"/> 1 L0067 - Proteini ukupni...	<input type="checkbox"/> 1 L0092 - Osmolalnost (dU)
<input type="checkbox"/> 1 L0016 - ...	<input type="checkbox"/> 1 L0033 - Selen (S)	<input type="checkbox"/> 1 L0052 - Urati (dU)	<input type="checkbox"/> 1 L0068 - Proteini ukupni...	<input type="checkbox"/> 1 L0093 - Vađenje kapilar...

TAT

- Zahvaljujući automatizaciji, impresivan, ali ne zadugo – ubrzo postane očekivan
- Pretjerano inzistiranje na TAT-u je kontraproduktivno

Koliko dugo kliničari čitaju laboratorijske nalaze?

- Prosječno vrijeme: 9 sekundi

Brown, P.J.; Marquard, J.L.; Amster, B.; Romoser, M.; Friderici, J.; Goff, S.; Fisher, D. What Do Physicians Read (and Ignore) in Electronic Progress Notes? *Appl. Clin. Inform.* 2014, 5, 430–444

Clinical Decision Support programska rješenja

- pomoć kliničaru
 - brža i racionalnija dijagnostička obrada
 - interpretativni komentari
-
- smanjenje nedovoljnog i neodgovarajućeg korištenja laboratorijskih usluga

Clinical Decision Support (CDS) programska rješenja – barijere implementacije:

- Pitanje kompatibilnosti programskih rješenja
- Licence, zaštita podataka
- Negativna selekcija IT osoblja u bolnicama
- Understaffed, underpaid, overworked (J. Cadammuro, 2022)

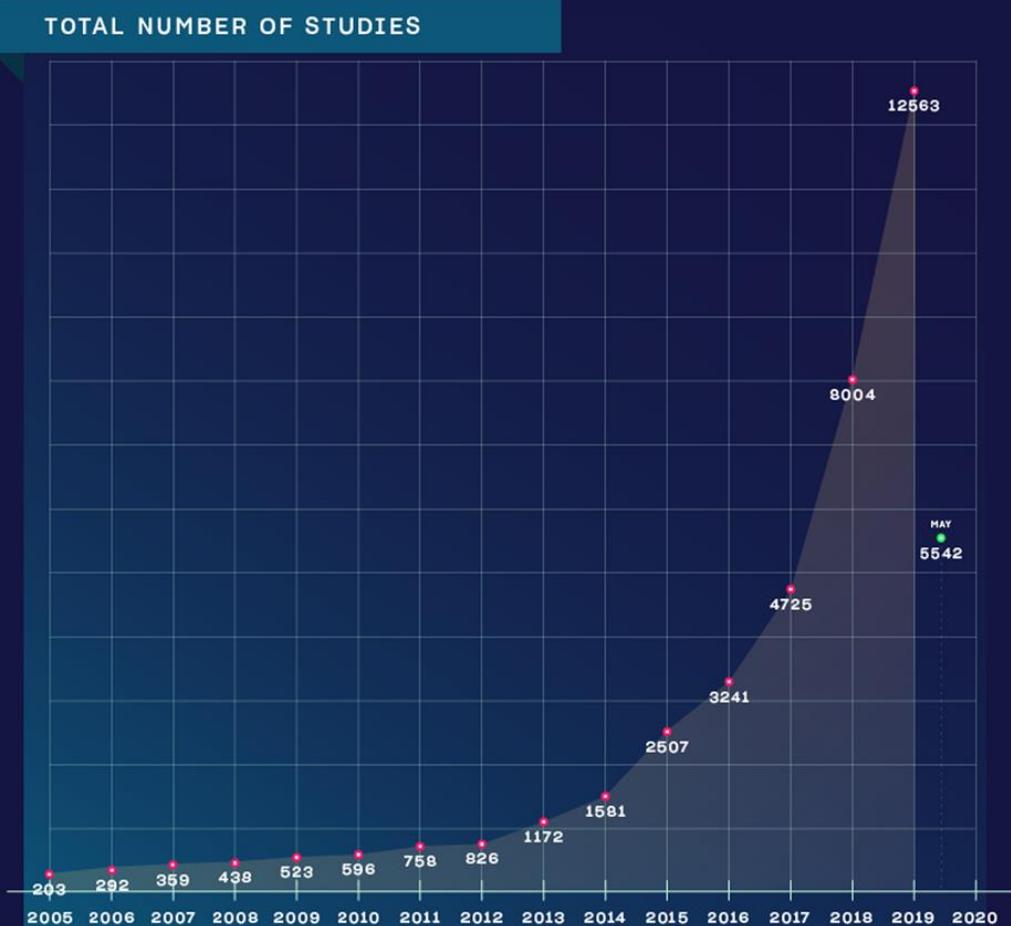
“Your ATM card works in outer Mongolia, but your electronic health record can’t be used in a different hospital across the street

Kako promijeniti paradigmu profesije?

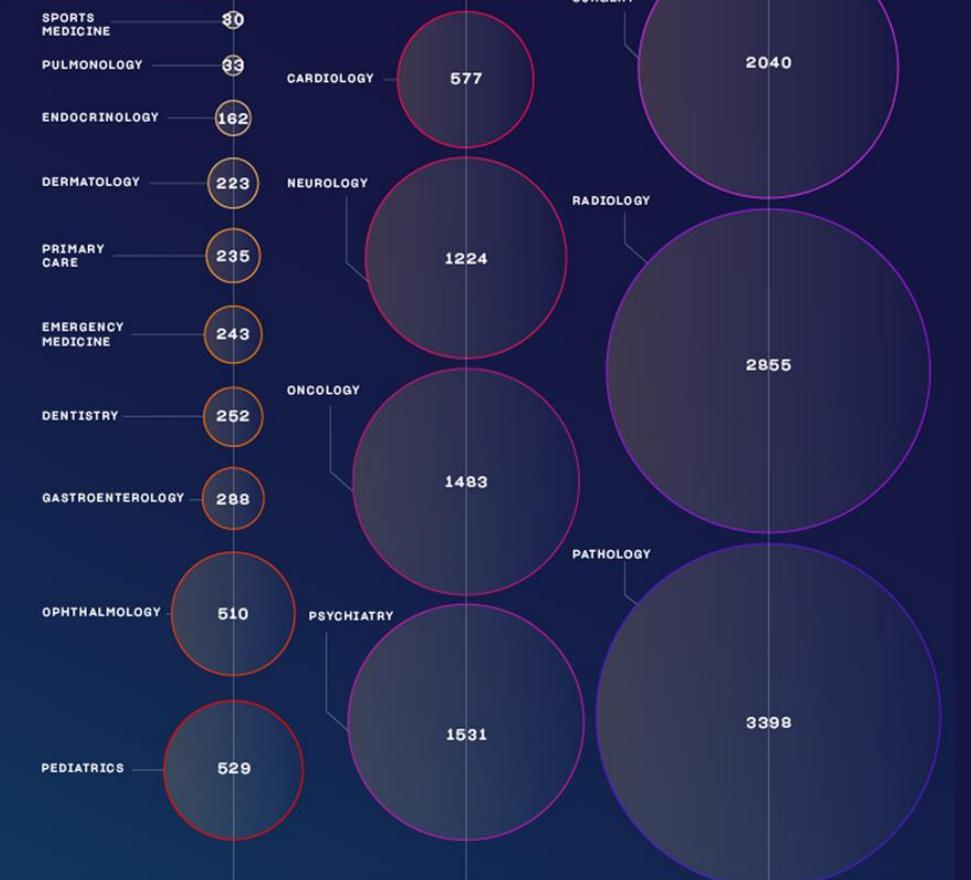


a

MACHINE AND DEEP LEARNING STUDIES ON PUBMED.COM

**b**

STUDIES PER SPECIALTY



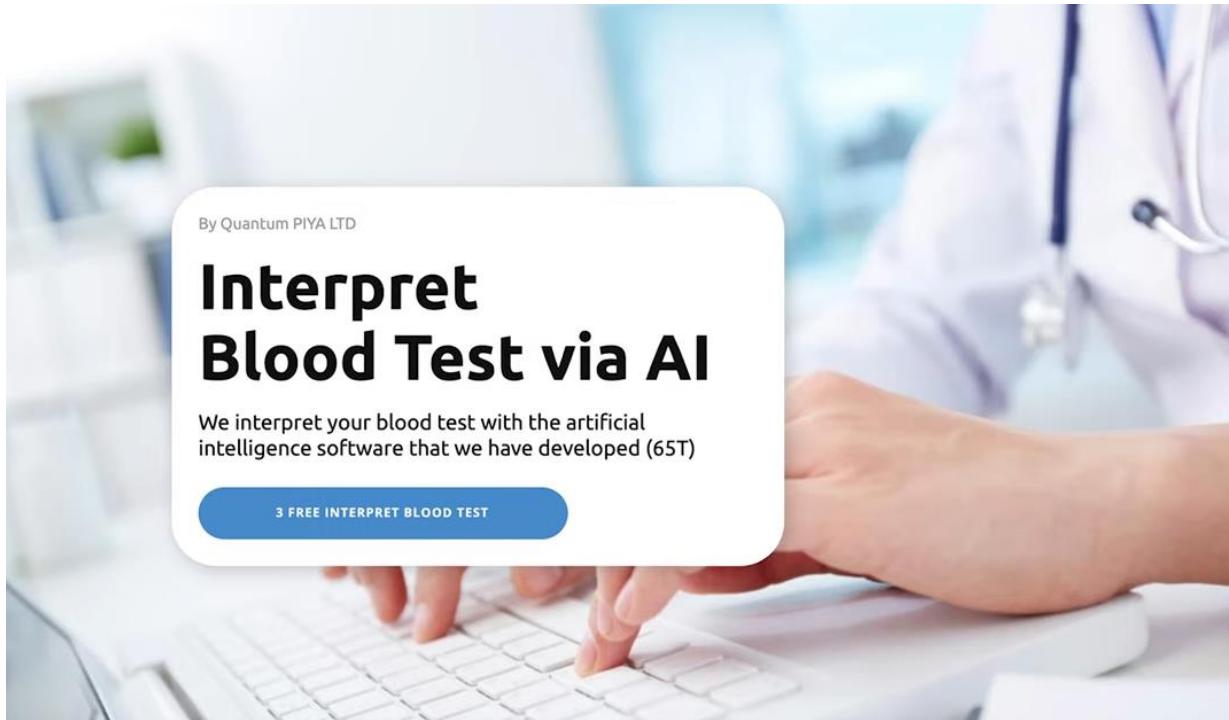
Meskó, B., Görög, M. A short guide for medical professionals in the era of artificial intelligence. *npj Digit. Med.* **3**, 126 (2020)

Janne Cadamuro, Federico Cabitza, Zeljko Debeljak, Sander De Bruyne, Glynis Frans,
Salomon Martin Perez, Habib Ozdemir, Alexander Tolios, Anna Carobene and Andrea Padoan*

Potentials and pitfalls of ChatGPT and natural-language artificial intelligence models for the understanding of laboratory medicine test results. An assessment by the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Working Group on Artificial Intelligence (WG-AI)

<https://doi.org/10.1515/cclm-2023-0355>
Received April 7, 2023; accepted April 12, 2023;
published online April 24, 2023

Results: ChatGPT recognized all laboratory tests, it could detect if they deviated from the RI and gave a test-by-test as well as an overall interpretation. The interpretations were rather



AI – stetoskop 21. stoljeća

Prosječni pacijent, 2050. godine:

- Sekvenciran genom
- Specificiran mikrobiom
- Način života odgovarajuće prilagođen gore navedenom
- Kontinuirani monitoring prijenosnim uređajima i laboratorijskim pretragama

Što će to značiti za našu struku?

Najveća predrasuda vezana za AI?

To pick the biggest one, it's that AI is a threat instead of a powerful technology like any other that is agnostic, and good or bad depending how we use it. It's a very harmful outlook, because we need to be more ambitious and more optimistic so we invest more, learn more, and get the benefits, not just suffer the slow-moving consequences of disruption and automation".

Gary Kasparov

Do
More
Great
Work.