UNIVERSITÉ DE GENÈVE
FACULTÉ DE MÉDECINE

Hôpitaux Universitaires Genève

Stroke, AI, Digitalization & Telemedicine

Controverse : Acute radiological stroke diagnosis assisted by AI improves patient outcome

Contra - position

Cerebrovascular Center
Annual Symposium

Jeremy Hofmeister
Unité de Neuroradiologie Interventionnelle, Hôpitaux Universitaires de Genève

Automated Segmentation of Cerebral Arteries on Three-Dimensional Rotational Angiography Using nnUNet v2: Prospective Validation with Quantitative Metrics and Expert Qualitative Assessment

Jeremy Hofmeister[1,2], Olivier Brina[1,2], Andrea Rosi[1],

European Radiology (2019) 29:4776–4782
https://doi.org/10.1007/s00330-019-6004-7

IMAGING INFORMATICS AND ARTIFICIAL INTELLIGENCE

Differentiating
computed tom

Review

How to Improve the Management of Acute Ischemic Stroke by Modern Technologies, Artificial Intelligence, and New Treatment Methods

Kamil Zeleňák [1,2,*], Antonín Krajina [3], Lukas Meyer [4], Jens Fiehler [4], ESMINT Artificial Intelligence and Robotics Ad hoc Committee [2], Daniel Behme [2,5], Deniz Bulja [2,6], Jildaz Caroff [2,7], Amar Ajay Chotai [2,8], Valerio Da Ros [2,9], Jean-Christophe Gentric [2,10], Jeremy Hofmeister [2,11], Omar Kass-Hout [2,12], Özcan Kocatürk [2,13], Jeremy Lynch [2,14], Ernesto Pearson [2,15] and Ivan Vukasinov

Hofmeister *et al.*
European Radiology Experimental (2024) 8:20
https://doi.org/10.1186/s41747-023-00416-y

European Radiology EXPERIMENTAL

ORIGINAL ARTICLE — Open Access

Validating the accuracy of deep learning

Stroke
Volume 51, Issue 8, August 2020; Pages 2488-2494
https://doi.org/10.1161/STROKEAHA.120.030334

American Heart Association.

CLINICAL AND POPULATION SCIENCES

Clot-Based Radiomics Predict a Mechanical Thrombectomy Strategy for Successful Recanalization in Acute Ischemic Stroke

Jeremy Hofmeister, MD, MSc, Gianmarco Bernava, MD, Andrea Rosi, MD, Maria Isabel Vargas, MD, Emmanuel Carrera, MD, Xavier Montet, MD, Simon Burgermeister, MD, Pierre-Alexandre Poletti, MD, Alexandra Platon, MD, Karl-Olof Lovblad, MD, and Paolo Machi, MD, PhD

Radiology: Artificial Intelligence

TECHNICAL DEVELOPMENT

Generative Adversarial Networks Improve the Reproducibility and Discriminative Power of Radiomic Features

Sandra Marcadent, MSc • Jeremy Hofmeister, MD* • Maria Giulia Preti, PhD • Steve P. Martin, MD • Dimitri Van De Ville, PhD • Xavier Montet, MD*

Radiology: Artificial Intelligence 2020; 2(3):e190035 • https://doi.org/10.1148/ryai.2020190035

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Neuroscience Informatics
journal homepage: www.elsevier.com/locate/neuri
ELSEVIER

Artificial Intelligence in Brain Informatics

Predictive value of clot imaging in acute ischemic stroke: A systematic review of artificial intelligence and conventional studies

Daniela Dumitriu LaGrange [a,*], Jeremy Hofmeister [b], Andrea Rosi [b], Maria Isabel Vargas [b,a], Isabel Wanke [c,d,e], Paolo Machi [b,a], Karl-Olof Lövblad [b,a]

Cerebrovascular Center
Annual Symposium

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Gianmarco B

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European Radiology E
https://doi.org/10.11

ORIGINAL

Validat

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IMAGING INFORMATICS AND ARTIFICIAL INTELLIGENCE

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How to Improve the Management of Acute Ischemic Stroke by Modern Technologies, Artificial Intelligence, and New Treatment Methods

2,15

TECHNICAL DEVELOPMENT

the
of Radiomic

P. Martin, MD •

8/ryai.2020190035

Me: Contra ?

Stroke

Volume 51, Issue 8, August 2020; Pages 248
https://doi.org/10.1161/STROKEAHA.120.030

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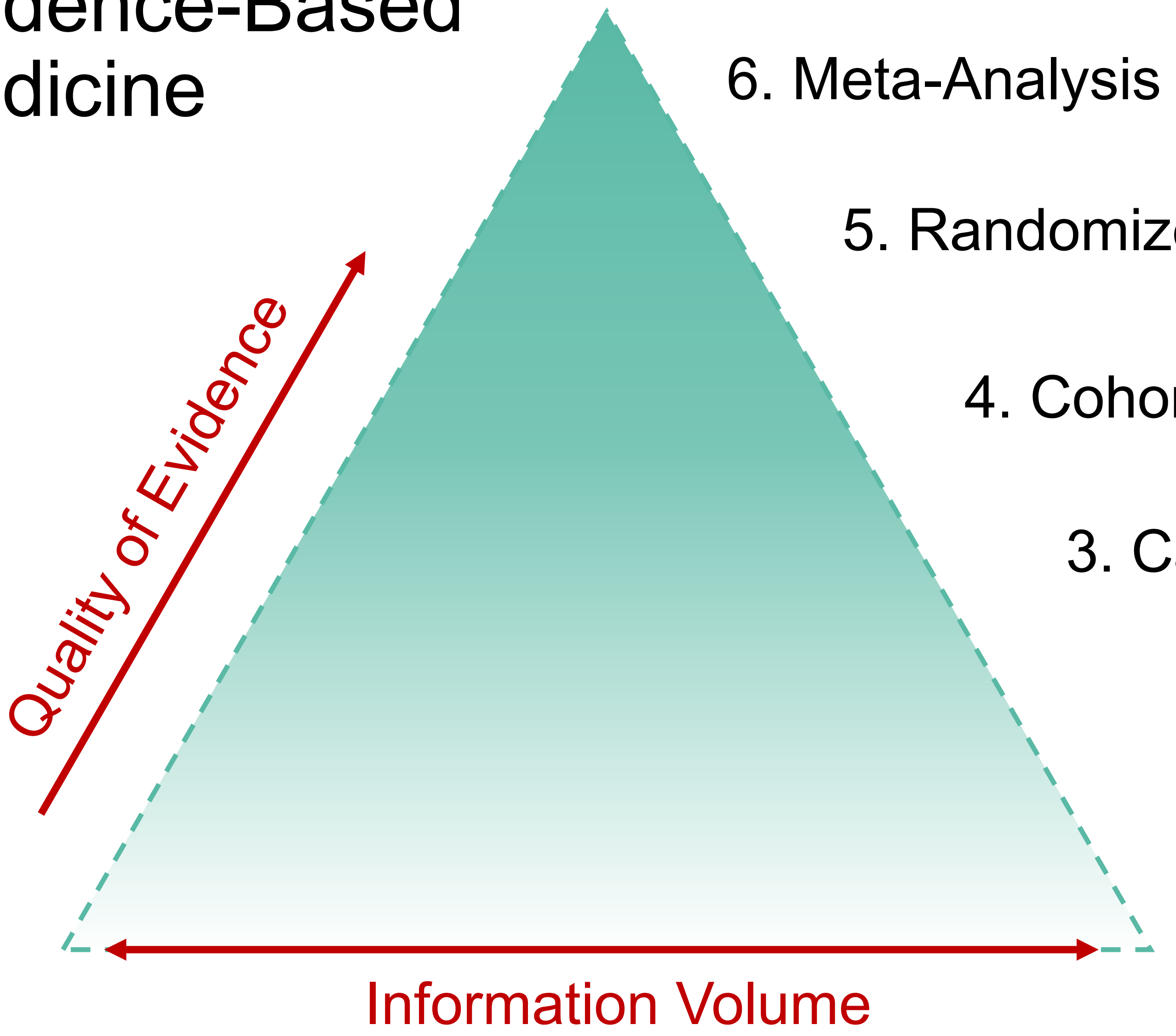
Does AI change the patient outcome?

1. **Where does the evidence actually stand?**
   What the literature measures, and what it does not

2. **Is it the algorithm, or the platform around it?**
   What was actually randomized

3. **What traps should we avoid?**
   Lessons we have already learned, elsewhere

Evidence-Based Medicine



6. Meta-Analysis (of RCT)
5. Randomized Controlled Trials
4. Cohort Studies
3. Case-Control Studies
2. Case Series
1. Expert Opinions

1

Where does the evidence actually stand?

What the literature measures, and what it does not

2

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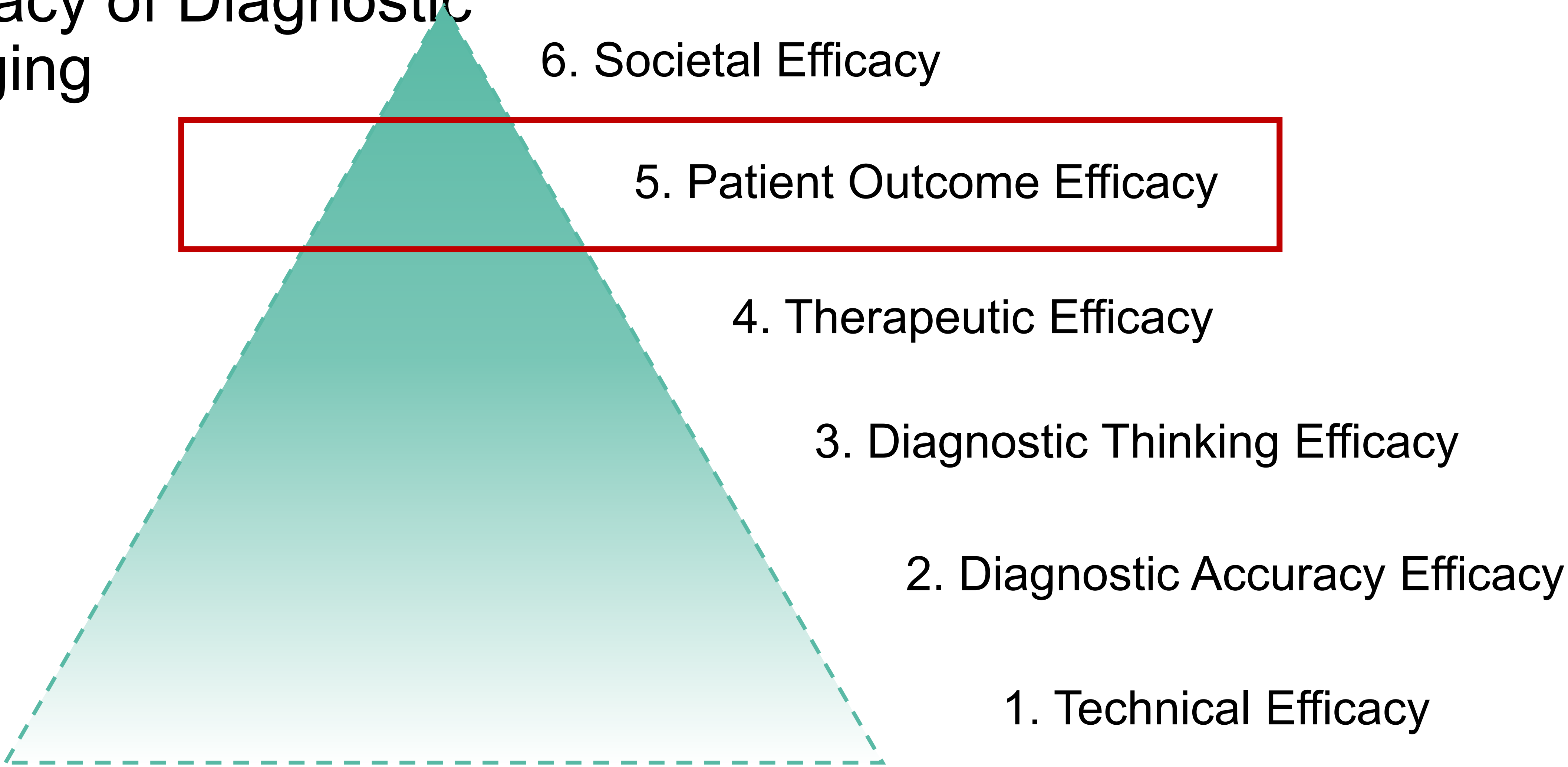
Efficacy of Diagnostic Imaging



Fryback & Thornbury (1991)

What the evidence base is made of

Sarhan 2025 *Transl Stroke Res*	12 studies · 15,595 patients **11 observational · 1 RCT**
Dantas 2025 *Neuroradiology*	9 studies · 1,270 patients **Same picture**
NIHR / NICE 2024 *Health Technol Assess*	204 pages · 25 databases **Independent assessment**

11 / 12

studies in the largest meta-analysis are observational

"The available evidence is not suitable to determine the clinical effectiveness of using AI-derived software to support the review of CT brain scans in acute stroke."

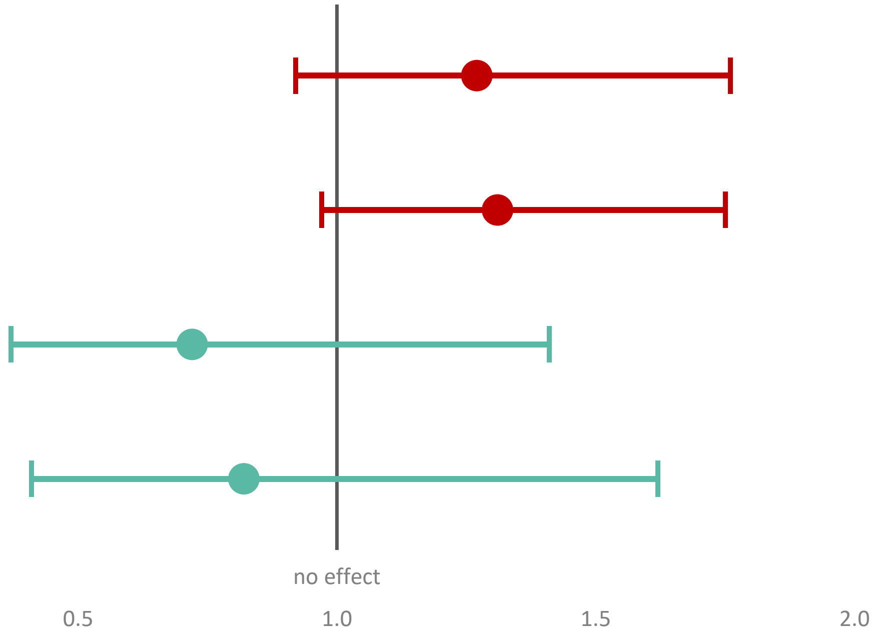
Before/after studies report only on test-positive patients. Nobody has ever counted the misses.

Sarhan, Transl Stroke Res 2025;16:2258-71 · Dantas, Neuroradiology 2025;67:2399-407 · Westwood, Health Technol Assess 2024;28(11)

What the top of the evidence pyramid says

Workflow: door-to-groin −20.6 min (−36.7 to −4.4), $p < 0.01$: the times really do improve.

mRS 0–2 at 90 days	*Dantas*	1.27 (0.92–1.76)	**p = 0.14**
mRS 0–2 at 90 days	*Sarhan*	1.31 (0.97–1.75)	**p = 0.08**
Mortality	*Sarhan*	0.72 (0.37–1.41)	p = 0.34
Symptomatic ICH	*Sarhan*	0.82 (0.41–1.62)	p = 0.56



Every stopwatch improves. But no patient does better.

Dantas, Neuroradiology 2025;67:2399-407 · Sarhan, Transl Stroke Res 2025;16:2258-71

The trial that would settle this is barely feasible

HERMES: each hour of delay to reperfusion costs 5.2% absolute functional independence.

11 min

the randomized trial

≈ 1.0% absolute

39,000

patients per arm

20 min

the meta-analysis

≈ 1.8% absolute

12,000

patients per arm

For comparison

1,287

patients in all five
HERMES trials combined

Between 20 and 60 times HERMES. The trial isn't missing — it's barely feasible.

Saver, JAMA 2016;316:1279-88 · 80% power, α = 0.05 two-sided, 45% baseline functional independence

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Lessons we have already learned, elsewhere

What did we actually randomize?

Martinez-Gutierrez et al., JAMA Neurology 2023 — the only randomized trial in this field

THE INTERVENTION ARM

AI occlusion detection on CT angiography + **Secure mobile messaging real-time alerts to every phone**

Two components. One arm.

ENDPOINTS

Primary

Door-to-groin time (−11 min)

90-day mRS

Exploratory analysis

THE CONTROL ARM THAT DOES NOT EXIST

A protocolized group alert, without the algorithm.

Not in this trial. Not in any of the twelve. Not anywhere in this literature.

Martinez-Gutierrez, JAMA Neurol 2023;80:1182-90 · funding and personal fees from Viz.ai declared

The pro-AI authors agree with me

“

Viz.ai is best understood as a broader clinical workflow platform... improvements in door-to-intervention times should be attributed not only to the AI-based detection algorithm but also to the broader efficiencies introduced by modern communication technology.

— Sarhan et al., Translational Stroke Research 2025

the same meta-analysis from the previous slide

We may have spent ten years measuring the effect of a stroke alert system...

Where the benefit actually lives

Nagaratnam et al., Lancet Digital Health 2025 — 452,952 patients · all 107 English stroke hospitals · 5 years

Thrombectomy rate 2.3% → 4.6% · door-in-door-out −64 min.

Primary stroke centers

OR 2.34

95% CI 1.78–3.10

no on-site neuroradiology

Comprehensive stroke centers

OR 1.28

95% CI 1.03–1.58

rooms like ours

The benefit is a function of the absence of a (interventional) neuroradiologist, not the presence of AI. That is an argument about access and geography. It is a good argument. The motion is about diagnosis.

In-hospital mortality: 10.5% with AI · 10.5% without.

Nagaratnam, Lancet Digit Health 2025;7:100927 · four authors are Brainomix employees with share options

1

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Forty-two versus seven

Andersson et al., Radiology: Artificial Intelligence 2026 — 3,031 prospective emergency CTAs, 10 hospitals

42

occlusions found by the AI,
missed by the radiologist

47

occlusions found by the radiologist,
missed by the AI

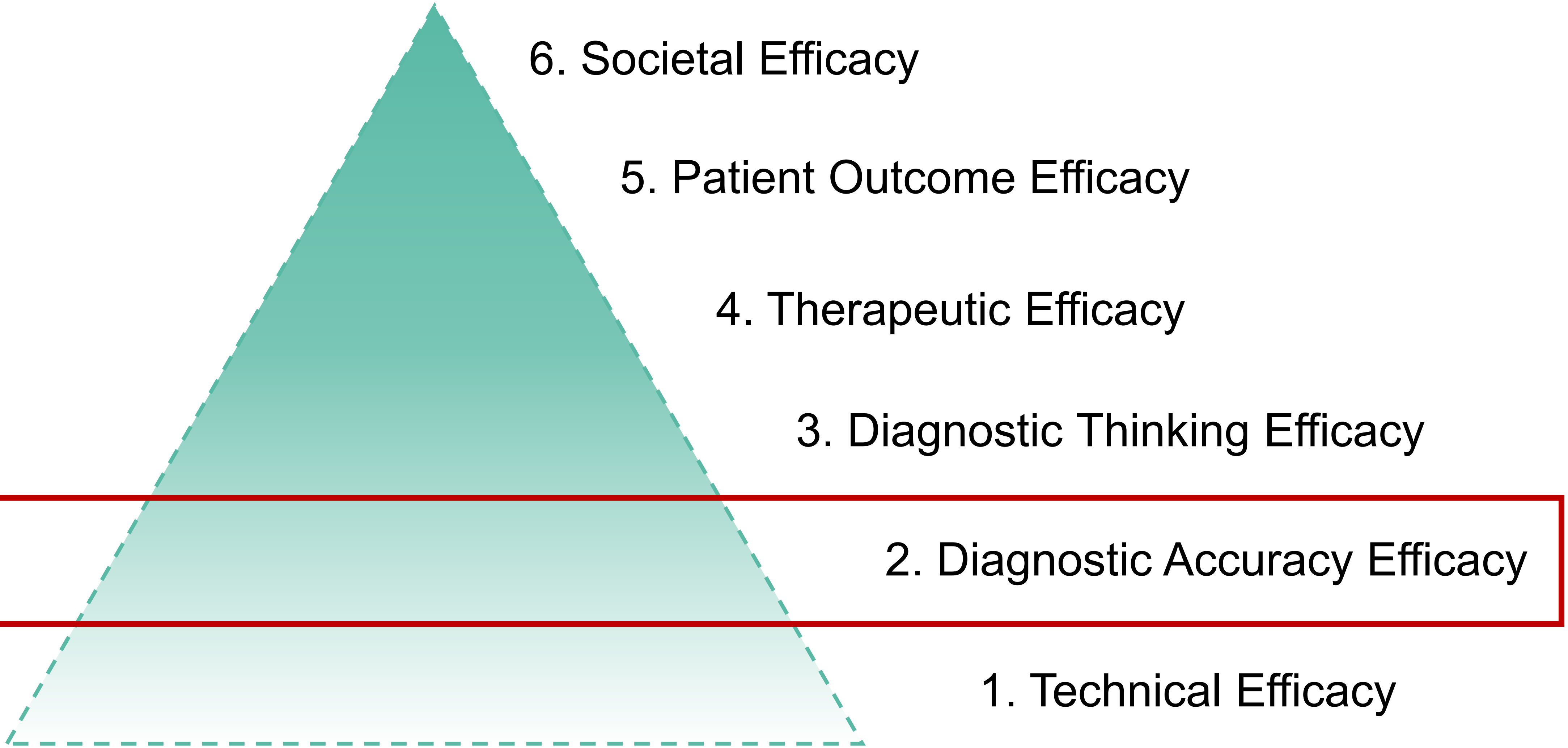
We are not replacing error with performance. We are trading one set of errors for another.

Sensitivity: AI 81.7% vs. report 81.2% (p = 0.91)

FDA clearance 91.3% → real world 81.7%

No usable AI output in 7.5% of exams (1 in 13)

Andersson, Radiol Artif Intell 2026;8(3):e250749



Fryback & Thornbury (1991)

We have done this before

Computer-aided detection in screening mammography

1998
FDA approval

2002
CMS reimbursement

2012
83% of US screening mammograms
> $400 million per year

2015
625,625 mammograms:
no benefit on any metric

ROC area 0.84 with CAD vs. 0.88 without

Within-radiologist sensitivity: OR 0.53 (0.29–0.97)

Performance was worse with the tool than without it.

THE MECHANISM (Taplin 2006)

Visible lesions NOT marked by CAD were significantly less likely to be called abnormal.

In Stroke patients, if the algorithm doesn't flag the MeVO (≥M2), you are less likely to see it. And commercial LVO tools might miss up to 50% of MCA-MeVO occlusions.

Lehman, JAMA Intern Med 2015;175:1828-37 · Taplin, AJR 2006;187:1475-82 · Matsoukas, J Neurointerv Surg 2023;15:52-6

Acute radiological stroke diagnosis assisted by AI improves patient outcome

1. Where does the evidence actually stand?

2. Is it the algorithm, or the platform around it?

3. What traps should we avoid?

Contra does not mean never.

I build some of these tools. I think they will matter… But maybe not at patient-outcome efficacy.

WHAT WOULD CHANGE MY MIND

Design	**Cluster randomized, stepped-wedge**
Control arm	**Protocolized group notification, without the AI algorithm**
Primary endpoint	**90-day modified Rankin Scale**

We demanded this standard of thrombolysis and thrombectomy.
There is no reason to waive it for software.

Merci

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