Endoscopic match

Intelligenza artificiale per la colonscopia: serve davvero?

PRO

Andrea Buda

Outline

- Why do we need AI in endoscopy?

- Why AI should be worthwile in colonoscopy?

- What RCT has told us?

Why do we need AI in Endoscopy ?

- ✓ To reduce practice variation and improve quality in reporting

- ✓ To prevent avoidable medical errors

- ✓ Assist gastroenterologists by offering artificial support

- ✓ Assist in real time to discover the unnoticeable

- ✓ Increase confidence in examination outcome and patient's quality life

Better outcome for the patient!

AI in colonoscopy

- Detection (CADe)
- Characterization (CADx)
- Inflammatory scoring (IBD)
- Quality of bowel prep
- Report drafting/analysis
- CIR calculation
- Other...

Detection of neoplastic lesions

✓ High variability among endoscopists

Zorzi M, Gut 2017; 66: 1233-1240

✓ Inverse correlation with CRC incidence and death

Corley DA, N Engl J Med 2014; 370:1298-1306

✓ Increasing adenoma detection reduces CRC risk

Kaminski M et al. Gastroenterology 2017; 153: 98-105

AI major roles in colonoscopy practice

✓ To overcome *human factors* related to recognition (competence, fatigue, distraction)

✓ To reduce variability across endoscopists

CADe in colonoscopy: why?

- Available and regulatory approved

- Easy to use (intuitive - short training)

- Effective in increasing polyp detection

AI Systems for colonoscopy

AI systems	Product	Manufacturer	Year of regulatory approval	Place of regulatory approval
CADe/CADx	EndoBRAIN	Cybernet Corp.	2018 - 2020	Japan
CADe	GiGenius	Medtronic Corp.	2019 - 2020	Europe - US
CADe	DISCOVERY	Pentax Corp.	2020	Europe
CADe/CADx	CAD EYE	Fujifillm Corp.	2020	Europe - Japan
CADe	ENDO-AID	Olympus Corp.	2020	Europe

CADe= Computer Aided Detection
CADx= Comupter Aided Diagnosis

Computed-Aided Detection - CADe
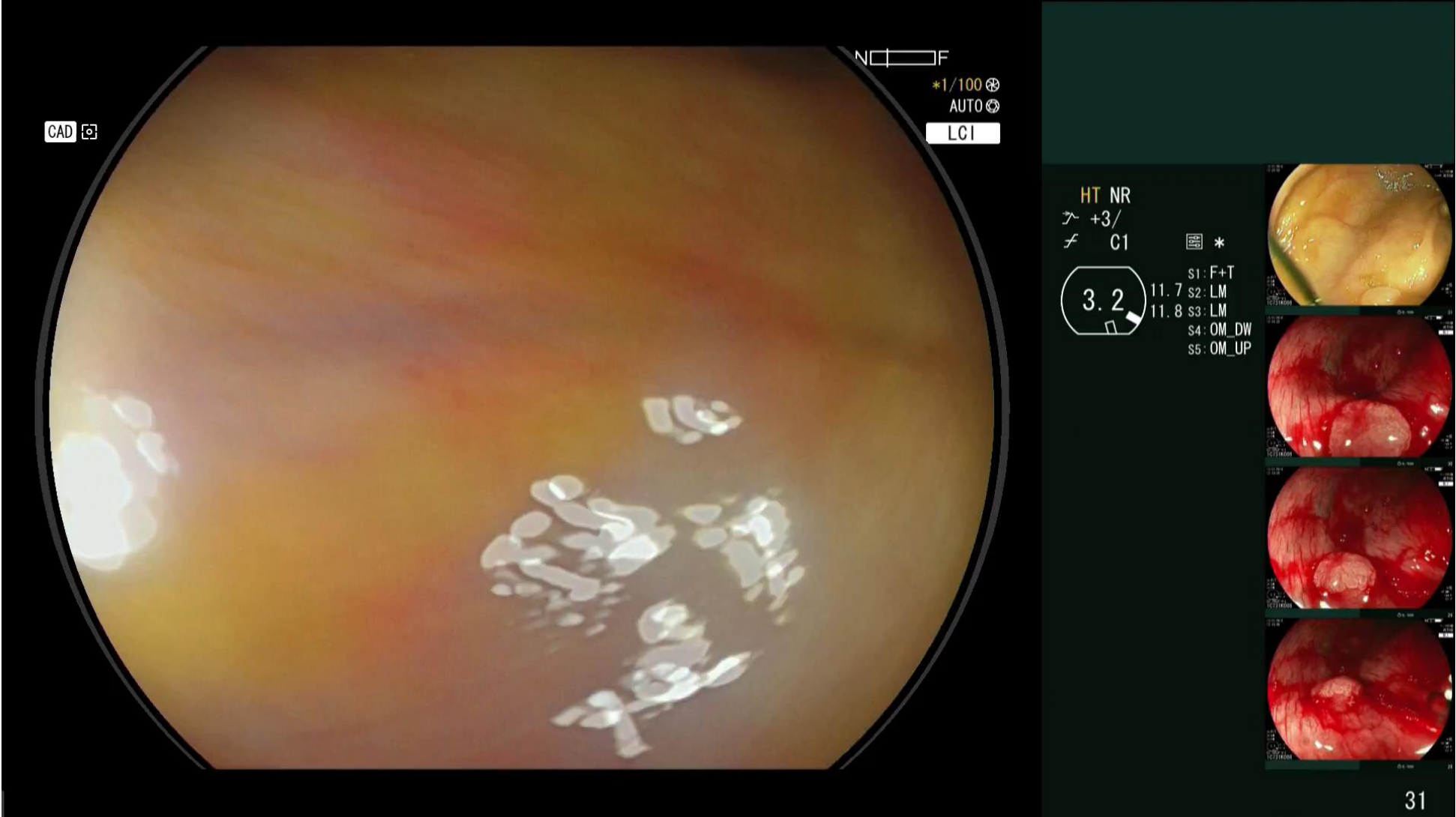
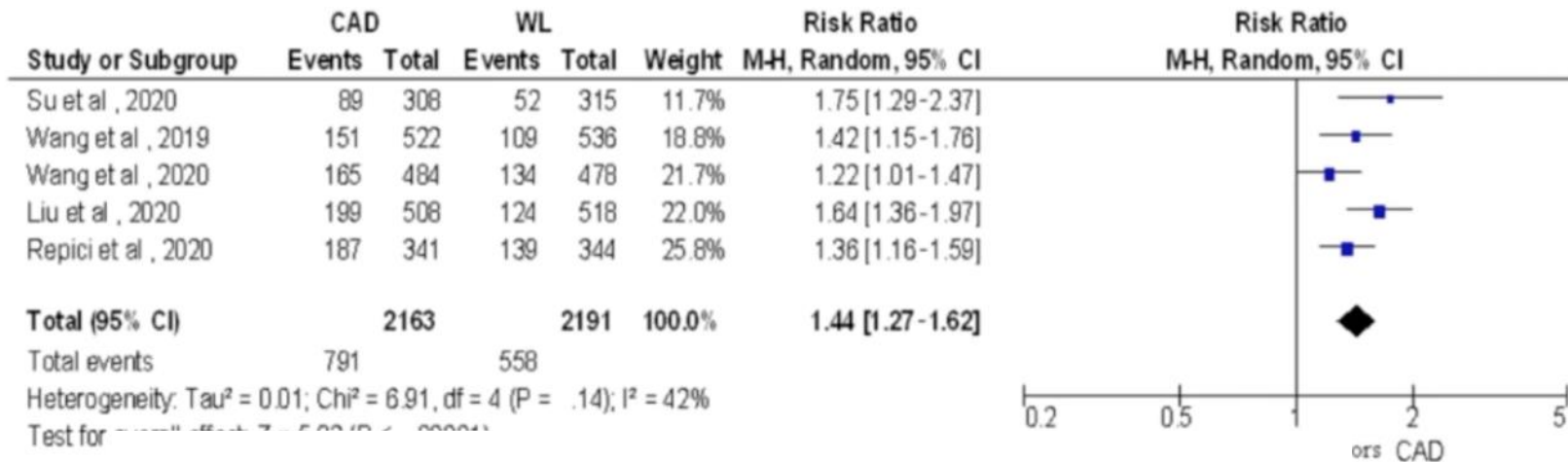# Effective in increasing polyp detection

CADe increases ADR

Author, journal, year	N. of papers	Results (95%CI)
Hassan C, GIE 2021	5	**ADR** RR: 1.44 (1.27-1.62)
Barua I, Endoscopy 2021	5	**ADR** RR: 1.52 (1.31-1.77)
Li J, Eur J GH 2021	5	**ADR** RR: 1.75 (1.52-2.01)
Zhang Y, J Laparoendosc Adv Surg Tech A, 2021	7	**ADR** OR: 1.72 (1.52-1.95)
Xu Y, PlosOne 2021	7	**PDR** AUC: 0.98 (0.96-0.99)
Ashat M, Endosc Int Open 2021	6	**ADR** OR: 1.76 (1.55-2.00)
Deliwala SS, Int J Colorect Dis 2021	6	**ADR** OR: 1.77 (1.57-2.08)
Nazarin S, J Med Int Res 2021	8	**ADR** OR: 1.53 (1.32-1.77)

Limitations: Mostly experts endoscopists, limited number of patients, patient heterogeneity, increase in ≤5mm polyps

Performance of artificial intelligence in colonoscopy for adenoma and polyp detection: a systematic review and meta-analysis

Cesare Hassan, MD, PhD, Marco,[1,*] Marco Spadaccini, MD,[2,3,*] Andrea Iannone, MD, PhD,[4]
Roberta Maselli, MD, PhD,[2] Manol Jovani, MD,[5,6] Viveksandeep Thoguluva Chandrasekar, MD,[7]
Giulio Antonelli, MD,[1] Honggang Yu, MD,[8] Miguel Areia, MD, PhD,[9] Mario Dinis-Ribeiro, MD,[10]
Pradeep Bhandari, MD,[11] Prateek Sharma, MD, PhD,[7] Douglas K. Rex, MD,[12] Thomas Rösch, MD, PhD,[13]
Michael Wallace, MD, PhD,[14] Alessandro Repici, MD[2,3]

Study or Subgroup	CAD Events	Total	WL Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Su et al , 2020	89	308	52	315	11.7%	1.75 [1.29-2.37]
Wang et al , 2019	151	522	109	536	18.8%	1.42 [1.15-1.76]
Wang et al , 2020	165	484	134	478	21.7%	1.22 [1.01-1.47]
Liu et al , 2020	199	508	124	518	22.0%	1.64 [1.36-1.97]
Repici et al , 2020	187	341	139	344	25.8%	1.36 [1.16-1.59]
Total (95% CI)		2163		2191	100.0%	1.44 [1.27-1.62]
Total events	791		558			

Heterogeneity: Tau² = 0.01; Chi² = 6.91, df = 4 (P = .14); I² = 42%
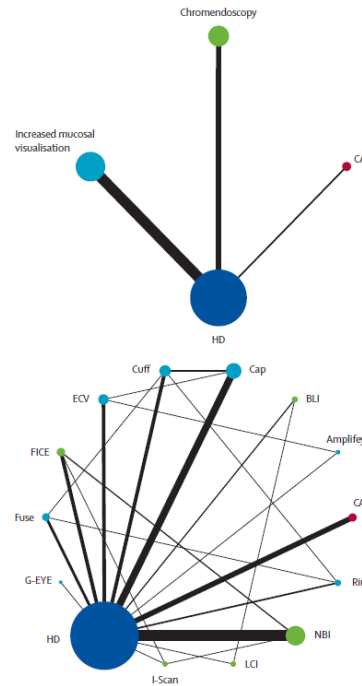Test for ~~~~

Pooled data from 5 RCTs: 36.6% ADR *versus* 25.2% ADR in favor CADe

Very consistent data although different technologies!

Effective in increasing polyp detection

CADe is superior to advanced imaging and auxiliary tools

- ✓ 50 RCTs (34.445 pts)
- ✓ 18 chromoendoscopy
- ✓ 26 increased mucosal visualization
- ✓ 6 CADe

	Comparator	Confidence in evidence	Network estimate effect size* (95% CI)
Adenoma detection rate			
Computer-aided detection	HD white-light endoscopy	High	1·78 (1·44 to 2·18)
Computer-aided detection	Chromoendoscopy	Moderate	1·45 (1·14 to 1·85)
Computer-aided detection	Increased mucosal visualisation	Low	1·54 (1·22 to 1·94)

Spadaccini et al. Lancet Gastro Hepatol 2022

Comparison of Artificial Intelligence With Other Interventions to Improve Adenoma Detection Rate for Colonoscopy

A Network Meta-analysis

Muhammad Aziz, MD,* Hossein Haghbin, MD, MPH,† Wasef Sayeh, MD,‡
Halah Alfatlawi, MD,‡ Manesh K. Gangwani, MD,‡
Amir H. Sohail, MD, MSc,§ Tamer Zahdeh, MD,‖ Simcha Weissman, MD,‖
Faisal Kamal, MD,¶ Wade Lee-Smith, MLS,# Ali Nawras, MD,*
Prateek Sharma, MD,** and Aasma Shaukat, MD, MPH††
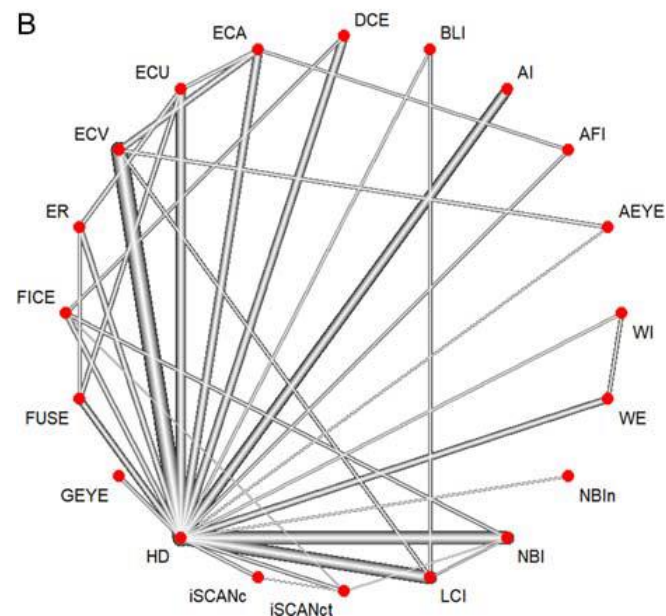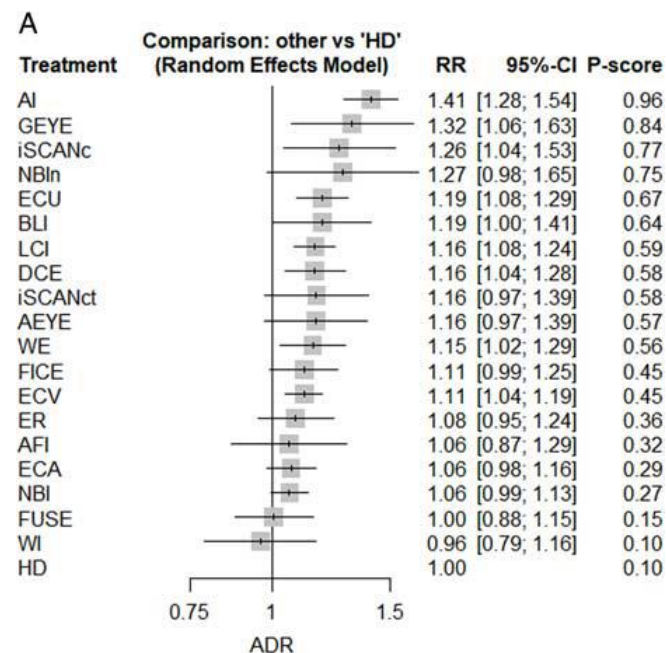
CADe for neoplasia detection: *open issues*

- False positive (procedure time)
- False negative
- Validation by experts, real life data limited
- Effect mainly due to detection of small/ diminutive adenomas

Computer-aided detection-assisted colonoscopy: classification and relevance of false positives ⓒⓂⒺ

Cesare Hassan, MD,[1,]* Matteo Badalamenti, MD,[2,]* Roberta Maselli, MD, PhD,[2] Loredana Correale,[2] Andrea Iannone, MD,[3] Franco Radaelli, MD,[4] Emanuele Rondonotti, MD,[4] Elisa Ferrara, MD,[2] Marco Spadaccini, MD,[2,5] Asma Alkandari, MD,[6] Alessandro Fugazza, MD,[2] Andrea Anderloni, PhD,[2] Piera Alessia Galtieri, MD,[2] Gaia Pellegatta, MD,[2] Silvia Carrara, MD,[2] Milena Di Leo, MD,[2] Vincenzo Craviotto, MD,[2,5] Laura Lamonaca, MD,[2,5] Roberto Lorenzetti, MD,[1] Alida Andrealli, MD,[4] Giulio Antonelli, MD,[1] Michael Wallace, MD,[7] Prateek Sharma, MD,[8] Thomas Rösch, MD,[9] Alessandro Repici, MD[2,5]

✓ False positive (procedure time)
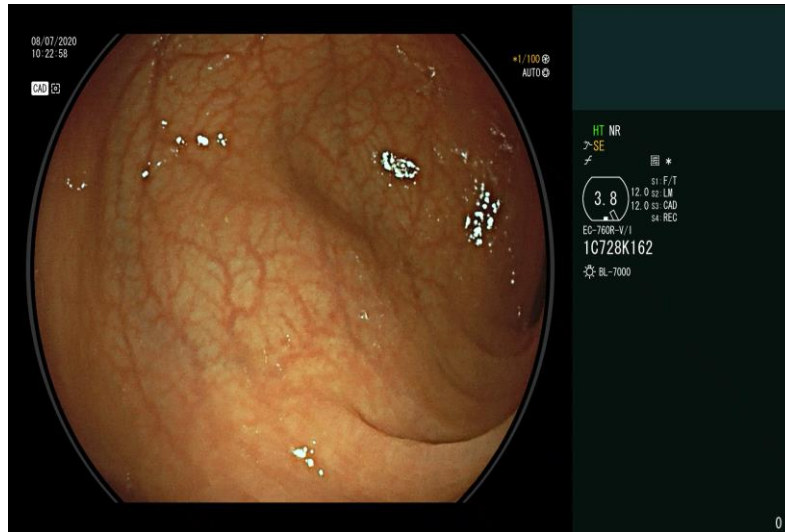
Post-hoc analysis 40 videos AID_1:
- ✓ Mean FP per colonoscopy: 27.3
- ✓ 5.7% (1.6) of all FPs require additional exploration (4.8±6.2 sec.)
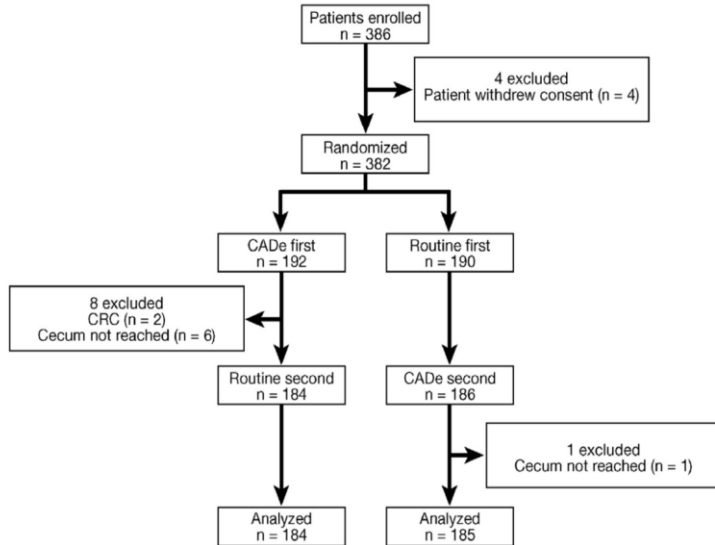- ✓ < 10 sec/colonoscopy (+1% of WT)

CADe for neoplasia detection: *open issues*

✓ False negative

CLINICAL—ALIMENTARY TRACT

Lower Adenoma Miss Rate of Computer-Aided Detection-Assisted Colonoscopy vs Routine White-Light Colonoscopy in a Prospective Tandem Study

Pu Wang,[1] Peixi Liu,[1] Jeremy R. Glissen Brown,[2] Tyler M. Berzin,[2] Guanyu Zhou,[1] Shan Lei,[1] Xiaogang Liu,[1] Liangping Li,[1] and Xun Xiao[1]

[1]Department of Gastroenterology, Sichuan Academy of Medical Sciences & Sichuan Provincial People's Hospital, Chengdu, China; and [2]Center for Advanced Endoscopy, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, Massachusetts

Adenoma Miss Rate

Variable	Routine-CADe group (n = 185)	CADe-routine group (n = 184)
Adenoma		
Detected at first pass	72	124
Detected at second pass	48	20
Miss rate, %	40.00 (31.23–48.77)	13.89 (8.24–19.54)

p<0.001

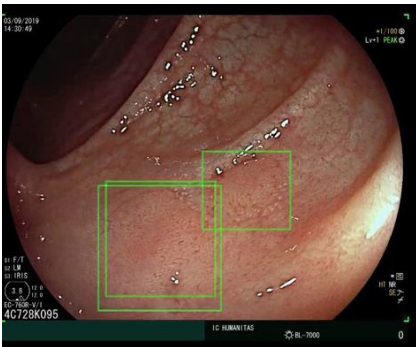CADe reduces by 3-folds the miss rate of adenomas by endoscopists using WL
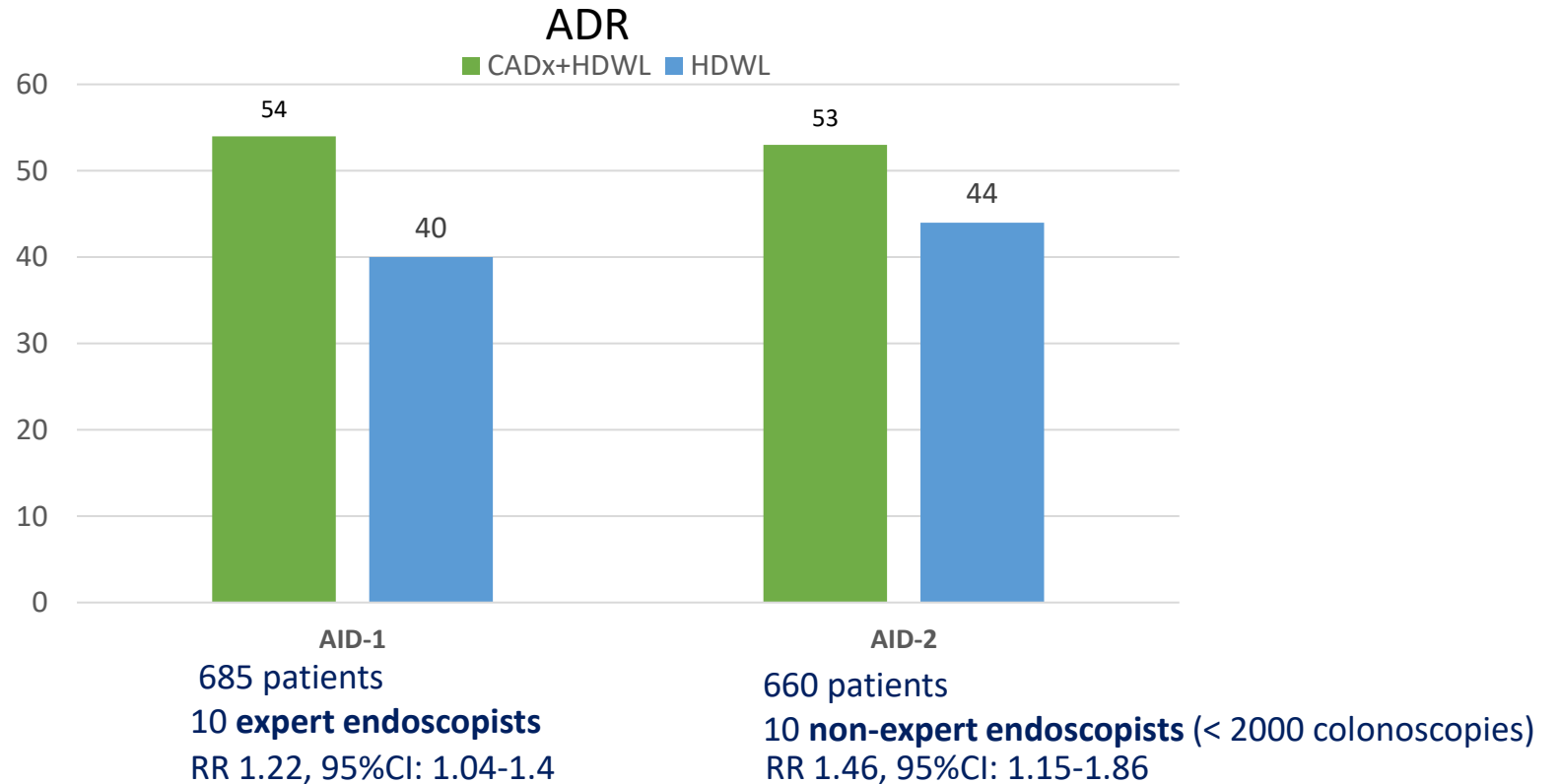
Effective in increasing polyp detection

CADe is effective regardless endoscopist expertise

Alessandro Repici,[1,2] Marco Spadaccini [1,2] Giulio Antonelli [3,4]
Loredana Correale,[2] Roberta Maselli,[1,2] Piera Alessia Galtieri,[2] Gaia Pellegatta,[2]
Antonio Capogreco,[1,2] Sebastian Manuel Milluzzo,[5] Gianluca Lollo,[6] Dhanai Di Paolo,[7]
Matteo Badalamenti,[2] Elisa Ferrara,[2] Alessandro Fugazza [2] Silvia Carrara,[2]
Andrea Anderloni,[2] Emanuele Rondonotti [7] Arnaldo Amato [7]
Andrea De Gottardi,[6] Cristiano Spada,[5] Franco Radaelli [7] Victor Savevski,[8]
Michael B Wallace,[9] Prateek Sharma,[10,11] Thomas Rösch [12] Cesare Hassan [3]

ADR

Legend: CADx+HDWL (green), HDWL (blue)

	AID-1	AID-2
CADx+HDWL	54	53
HDWL	40	44

AID-1
685 patients
10 **expert endoscopists**
RR 1.22, 95%CI: 1.04-1.4

AID-2
660 patients
10 **non-expert endoscopists** (< 2000 colonoscopies)
RR 1.46, 95%CI: 1.15-1.86

Summary

- AI increases ADR and reduces miss rates of adenomas with a negligible increase of WT for both expert and non-expert endoscopists

- Optimal colonoscopy technique remains of paramount importance when using AI (false negative)

- *Over reliance/deskilling* may be a concern

- Early integration of AI may represent a reasonable measure of quality assurance for all the stakeholdres involved in screening programs
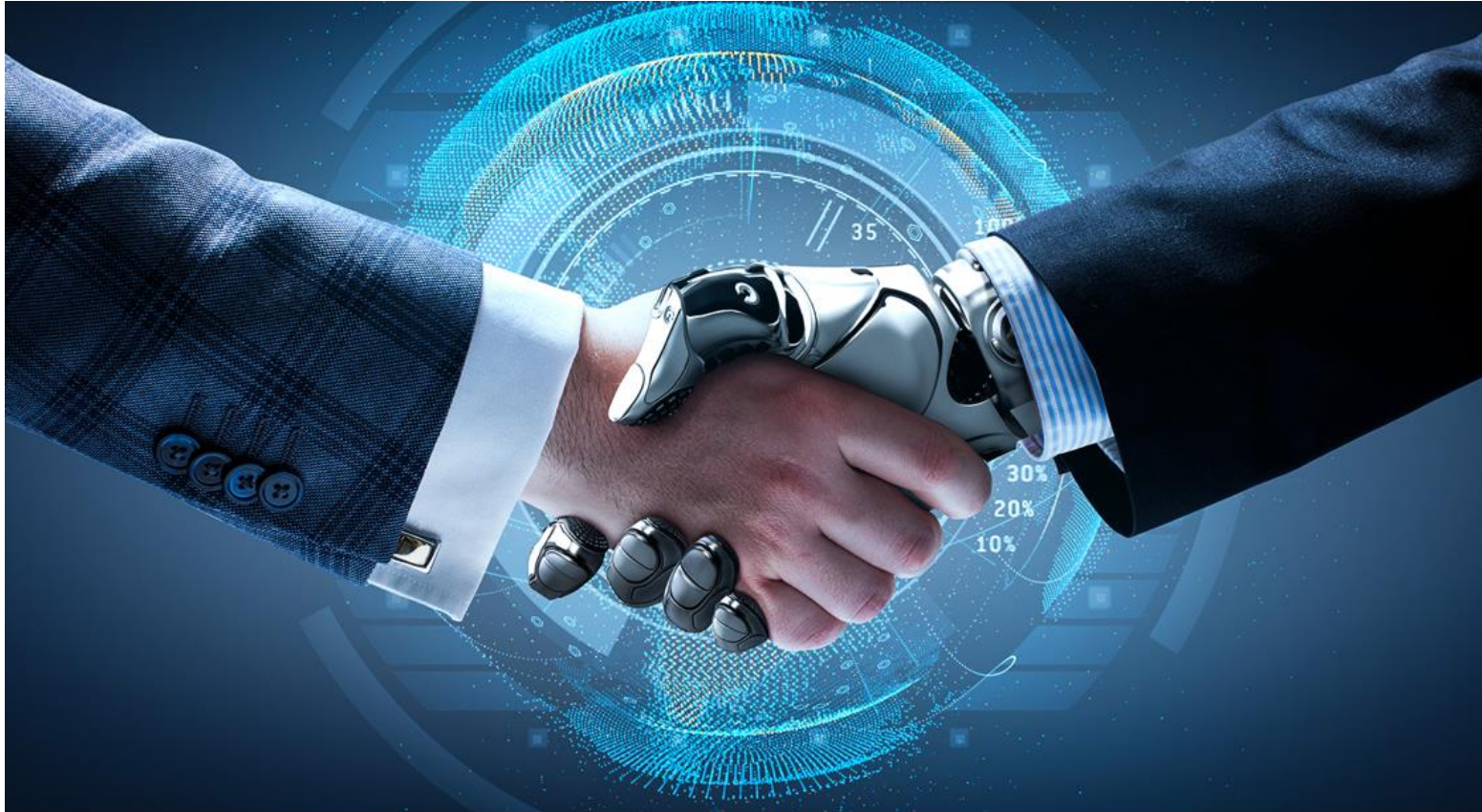
Physician is still important and medicine is still the art of the past and future!