WEO

The voice of world endoscopy

CADe, CADx - how good is it and how good should it be?

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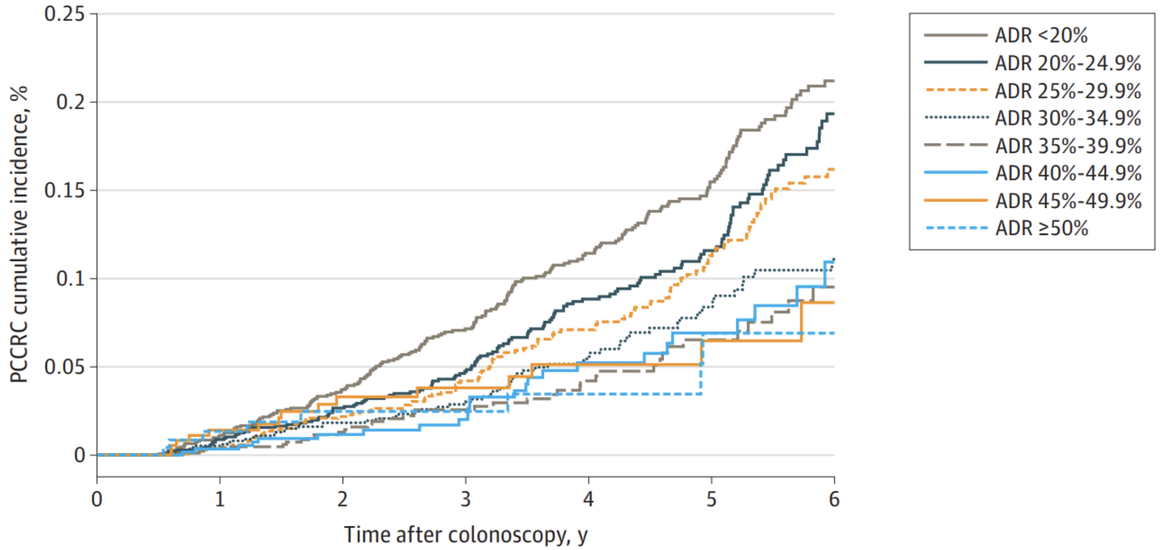
Conflicts of interest

- None

CADe - What‘s the point?

- ↑ ADR associated with ↓ risk of CRC
- CADe would detect more adenomas
- CRC rates would decrease

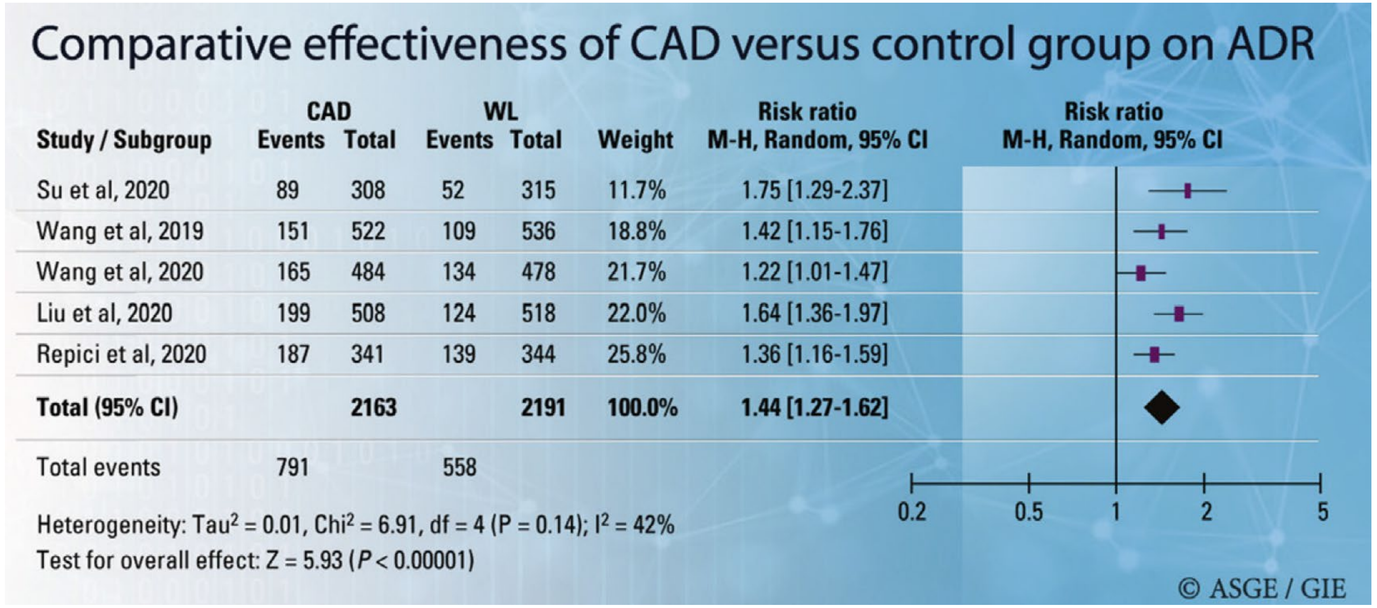
Figure 1. Postcolonoscopy Colorectal Cancer Cumulative Incidence Stratified by Physician Adenoma Detection Rate Group



Schottinger et al. JAMA 2022

CADe – Just how good is it really?

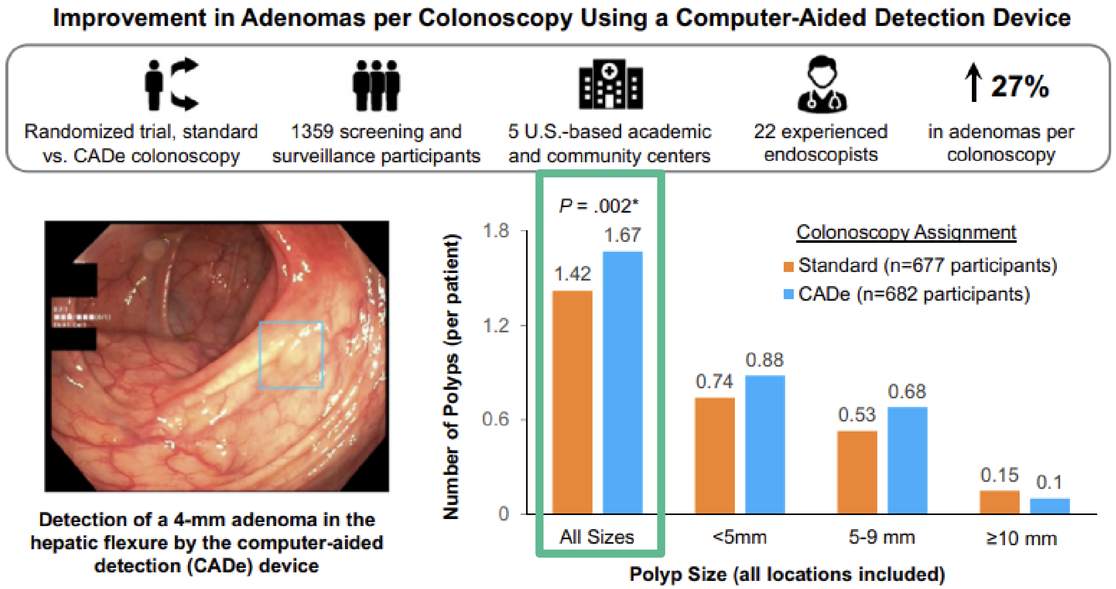
- Meta-analysis.
- Increase of ADR RR 1.44



Hassan et al. GIE 2021

CADe – Just how good is it really?

- RCT. Increase in APC (1.42 vs 1.67)
- Experts. ADR of 25% and minimum of 1000 colonoscopy procedures.



Gastroenterology

Shaukat et al. Gastro 2022

CADe – Just how good is it really?

Gastroenterology 2022;163:295–304

ARTIFICIAL INTELLIGENCE

Impact of Artificial Intelligence on Miss Rate of Colorectal Neoplasia

Michael B. Wallace,[1,2] Prateek Sharma,[3] Pradeep Bhandari,[4] James East,[5] Giulio Antonelli,[6,7,8] Roberto Lorenzetti,[6] Micheal Vieth,[9] Ilaria Speranza,[10] Marco Spadaccini,[6] Madhav Desai,[4] Frank J. Lukens,[1] Genci Babameto,[11] Daisy Batista,[11] Davinder Singh,[11] William Palmer,[1] Francisco Ramirez,[12] Rebecca Palmer,[5] Tisha Lunsford,[12] Kevin Ruff,[12] Elizabeth Bird-Liebermann,[5] Victor Ciofoaia,[11] Sophie Arndtz,[4] David Cangemi,[1] Kirsty Puddick,[4] Gregory Derfus,[13] Amitpal S. Johal,[14] Mohammed Barawi,[15] Luigi Longo,[16] Luigi Moro,[16] Alessandro Repici,[17,18] and Cesare Hassan[17,18]

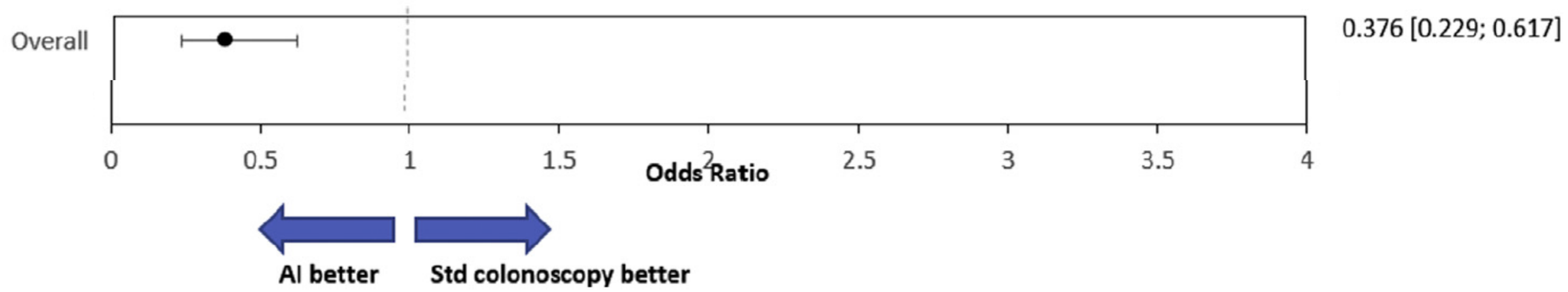
Wallace et al. Gastro 2022

CADe – Just how good is it really?

- Tandem study randomized AI first vs standard colonoscopy first

Table 2. AMR Overall and by Subgroup: FAS Population

	AI first (n = 116)	Standard colonoscopy first (n = 114)	P value[a]	OR [95% CI]
Overall n/N' (%)	38/246 (15.45)	80/247 (32.39)	<.001	0.38 [0.25–0.59]



OR [95% CI]:

0.376 [0.229; 0.617]

Wallace et al. Gastro 2022

CADe – Just how good is it really?

- Time over time, we see significant ADR increases
- amongst many RCTs,
- many practice settings,
- many experience levels,
- in single center or multicentered studies.
- Should now be standard of care?

CADe – Just how good does it need to be?

- What is the contribution of 1-5mm adenomas towards CRC rates?
- Does it matter if CADe detects more?
- ADR is a proxy for colonoscopy quality, adding CADe does not change withdrawal technique (withdrawal time, looking behind folds, suctioning pools liquid, meticulous examination, cecal/rectal retroflexion).
- If you work on detecting the smallest polyps through meticulous examination, you will not miss the more significant lesions. Role of CADe in this?

CADe – Just how good does it need to be?

- Should improve AADR.
- Should improve 5-9mm and ≥10mm polyp detection.
- Should improve proximal serrated lesion detection rates.
- Ultimately should reduce CRC rates.
- Because these systems could be costly to implement.

CADe – Just how good is it really?

TABLE 2. Adenoma detection subgrouped according to size, location, and morphology

	Adenoma <5 mm			Adenoma 6-9 mm			Adenoma ≥10 mm		
Reference	**Control**	**CAD**	***P* value**	**Control**	**CAD**	***P* value**	**Control**	**CAD**	***P* value**
Wang et al[11]	102 (63.8)	185 (70.6)	<.05	50 (31.6)	61 (23.3)	ns	8 (5.0)	16 (6.1)	ns
Wang et al[21]	128 (71)	211 (75)	<.05	46 (25)	60 (21)	ns	7 (4)	10 (4)	ns
Repici et al[10]	164 (74.5)	234 (73.1)	<.05	28 (12.7)	55 (17.2)	<.05	28 (12.7)	31 (9.7)	ns
Liu et al[23]	89 (62.7)	166 (66.4)	<.05	43 (30.3)	63 (25.2)	ns	10 (7.0)	21 (8.4)	ns
Su et al[22]	37 (66.1)	72 (63.7)	<.05	\	\	\	\	\	\

Values are n (%).

CAD, Computer-aided diagnosis; *ns*, not statistically significant; \, not available.

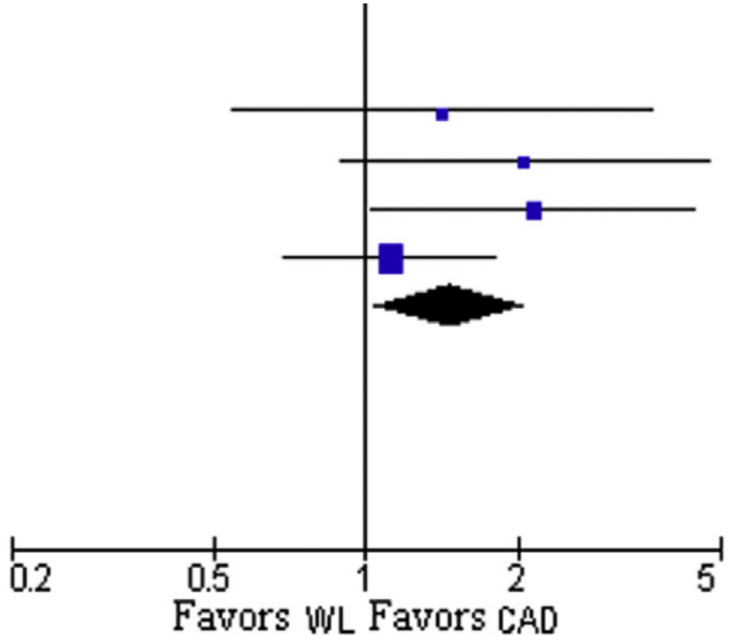
Hassan et al. GIE 2021

CADe – Just how good is it really?

1.3.3 ≥10 mm						
Wang et al , 2020	10	484	7	478	12.8%	1.41 [0.54 - 3.68]
Wang et al , 2019	16	522	8	536	16.7%	2.05 [0.89 - 4.76]
Liu et al , 2020	21	508	10	518	21.3%	2.14 [1.02 - 4.50]
Repici et al , 2020	31	341	28	344	49.2%	1.12 [0.69 - 1.82]
Subtotal (95% CI)		1855		1876	100.0%	1.46 [1.04 - 2.06]
Total events	78		53			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.82$, df = 3 (P = .42); $I^2 = 0\%$

Test for overall effect: Z = 2.18 (P = .03)



Improvement in SDR 4% (c) vs 6% (cad) p<0.01

No improvement in AADR 5% (c) vs 9% (cad) p=0.33

Hassan et al. GIE 2021

CADe – Just how good is it really?

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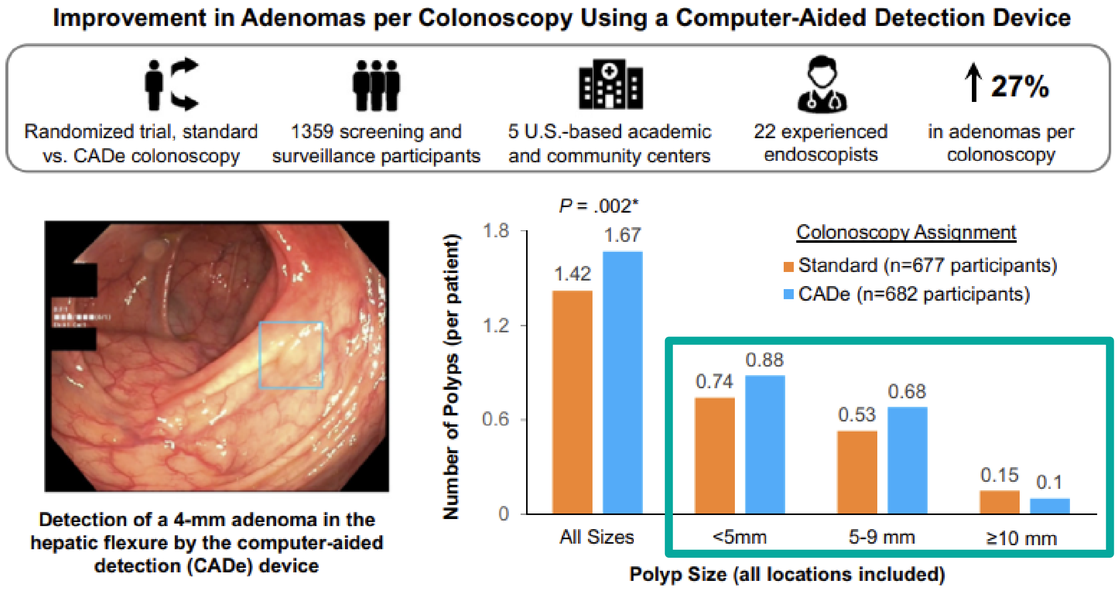

Decrease in SSL detection 16% vs 12.6% (p=0.09)
Increase mainly driven by <5 and 5-9mm detection

No mention of AADR

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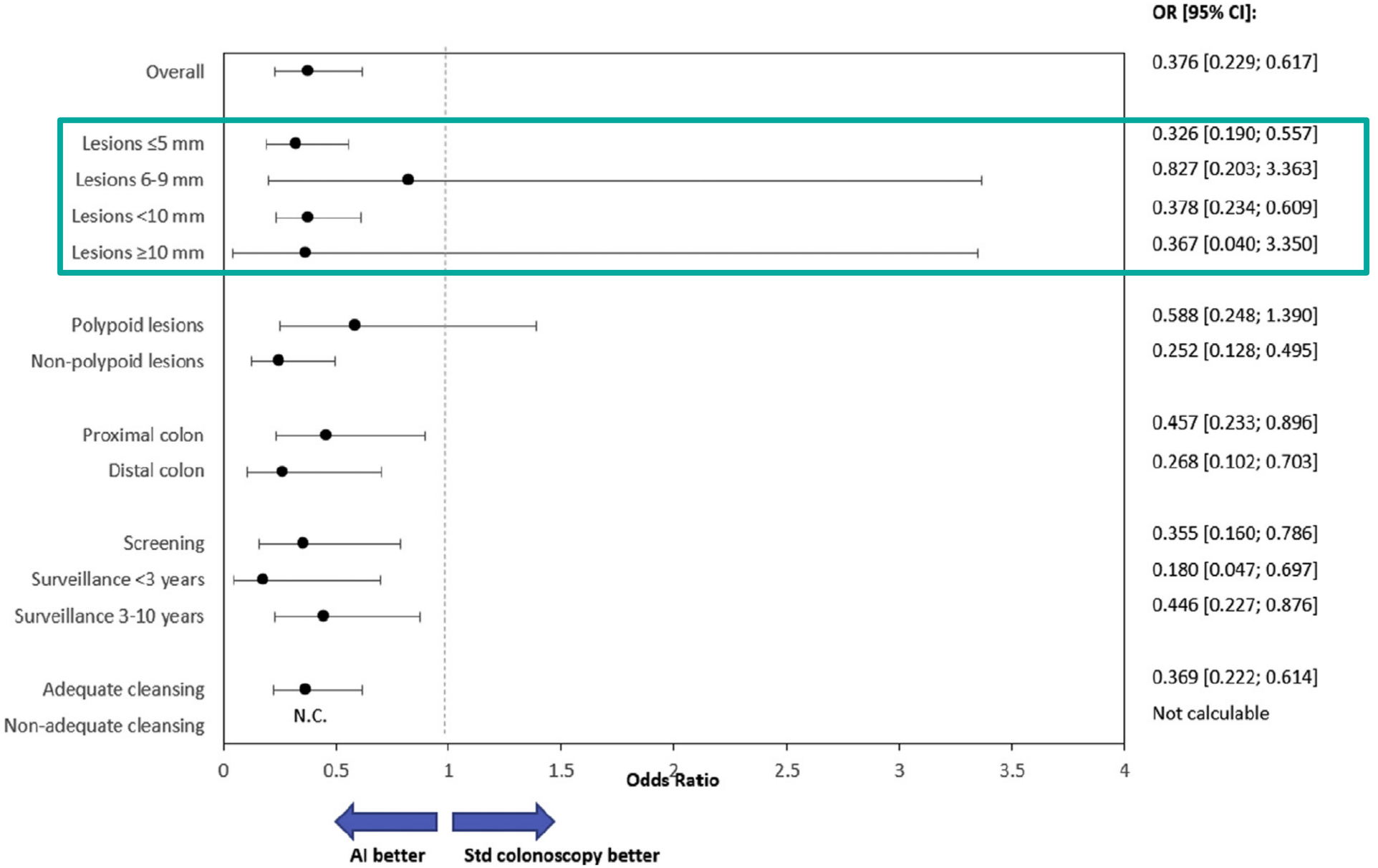


Wallace et al. Gastro 2022

CADe – Just how good is it really?

- 30 endoscopists prospective propensity score matched
- ADR improvement, no improvement in SDR or AADR.

Impact of the clinical use of artificial intelligence–assisted neoplasia detection for colonoscopy: a large-scale prospective, propensity score–matched study (with video)

Misaki Ishiyama, MD,[1] Shin-ei Kudo, MD, PhD,[1] Masashi Misawa, MD, PhD,[1] Yuichi Mori, MD, PhD,[1,2] Yasuhara Maeda, MD, PhD,[1] Katsuro Ichimasa, MD, PhD,[1] Toyoki Kudo, MD, PhD,[1] Takemasa Hayashi, MD, PhD,[1] Kunihiko Wakamura, MD, PhD,[1] Hideyuki Miyachi, MD, PhD,[1] Fumio Ishida, PhD,[1] Hayato Itoh, PhD,[3] Masahiro Oda, PhD,[3,4] Kensaku Mori, PhD[3]

Ishiyama et al. GIE 2022

CADe – Cost effectiveness

Cost-effectiveness of artificial intelligence for screening colonoscopy: a modelling study

Miguel Areia, Yuichi Mori*, Loredana Correale, Alessandro Repici, Michael Bretthauer, Prateek Sharma, Filipe Taveira, Marco Spadaccini, Giulio Antonelli, Alanna Ebigbo, Shin-ei Kudo, Julia Arribas, Ishita Barua, Michal F Kaminski, Helmut Messmann, Douglas K Rex, Mário Dinis-Ribeiro*, Cesare Hassan**

Used 1.44RR ADR from Hassan et al. meta-analysis
Assume a 3.6% relative reduction in CRC mortality
CADe resulted in 57$ savings per individual = 290MM/y USD

Cost-effectiveness of Artificial Intelligence-Aided Colonoscopy for Adenoma Detection in Colon Cancer Screening

Alan Barkun, Hamid Sadri, Daniel von Renteln – in review

Used a Canadian FIT cohort
1.46 IRR Adenoma detection from Repici Gastro 2020 RCT
CADe resulted in 14$ savings per colonoscopy

CADx - What‘s the point?

- Perform optical diagnosis.
- Implement Resect and discard strategies.
- Implement diagnose and leave strategies.
- Save costs associated with pathology.
- Provide same day surveillance intervals.
- Allow widespread implementation by shifting legal burden.
- Eventually guide polypectomy practice (EMR, ESD).

CADx – How good is it? In vivo data

Artificial Intelligence Allows Leaving-In-Situ Colorectal Polyps

Cesare Hassan,[1,2] Giuseppina Balsamo,[3] Roberto Lorenzetti,[4] Angelo Zullo,[4] and Giulio Antonelli[4,5,6]

- GI Genius, Medtronic, USA
- 494 diminutive polyps with real-time CADx
- 96/97% agreement with ESGE/USMSTF surveillance intervals
- 97% NPV for rectosigmoid adenomas
- 82% ss, 93% sp
- No real difference when compared with Endoscopist-based diagnosis

Hassan et al. CGH 2022

CADx – How good is it? In vivo data

In vivo computer-aided diagnosis of colorectal polyps using white light endoscopy

OPEN ACCESS

Authors
Ana García-Rodríguez[1], Yael Tudela[2], Henry Córdova[1,3,4], Sabela Carballal[1,3,4], Ingrid Ordás[1,3,4], Leticia Moreira[1,3,4], Eva Vaquero[1,3,4], Oswaldo Ortiz[1], Liseth Rivero[1,3,4], F. Javier Sánchez[2], Miriam Cuatrecasas[3,4,5], Maria Pellisé[1,3,4], Jorge Bernal[2], Glòria Fernández-Esparrach[1,3,4]

- ATENEA
- 52 diminutive polyps with real-time CADx
- 73.3% NPV
- 88.2% ss, 61.1% sp
- No real difference when compared with Endoscopist-based diagnosis

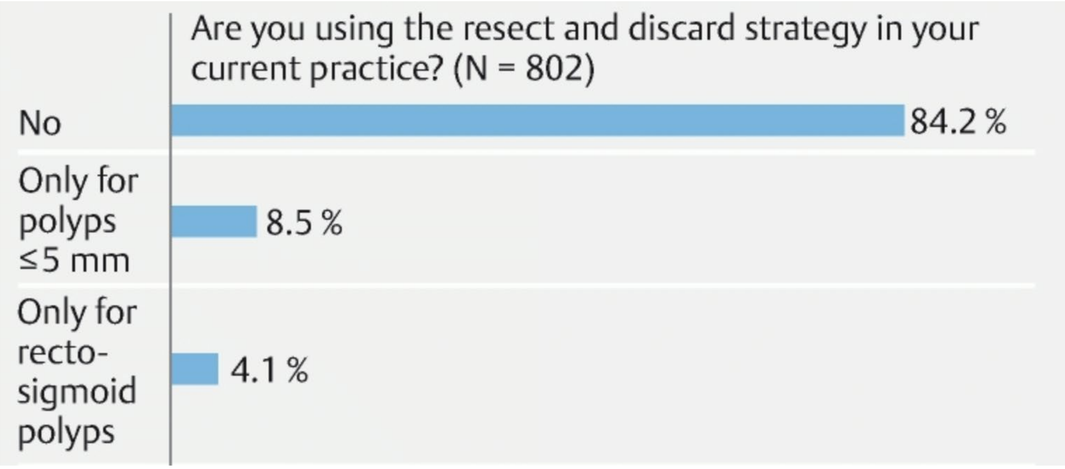
Garcia-Rodriguez et al. End Int Open 2022

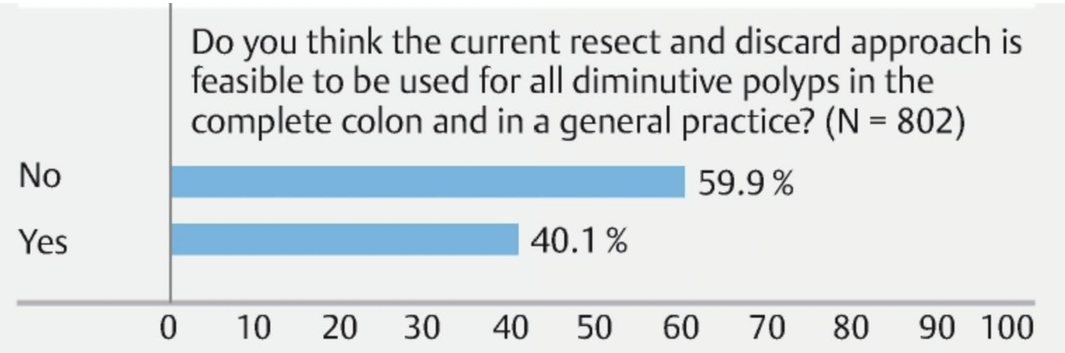
CADx – How good should it be?

Strategy	Definition	ASGE PIVI (2015)	ESGE position statement (2022)
Resect and discard	Do not send 1-5mm polyps to pathology	90% agreement with pathology based surveillance intervals	80% ss 80% sp High confidence Dx
Diagnose and leave	Do not resect 1-5mm rectosigmoid HPs	90% NPV for adenomas High confidence Dx	90% ss 80% sp High confidence Dx

ASGE Technology Committee. GIE 2015
Houwen et al. Endoscopy 2022

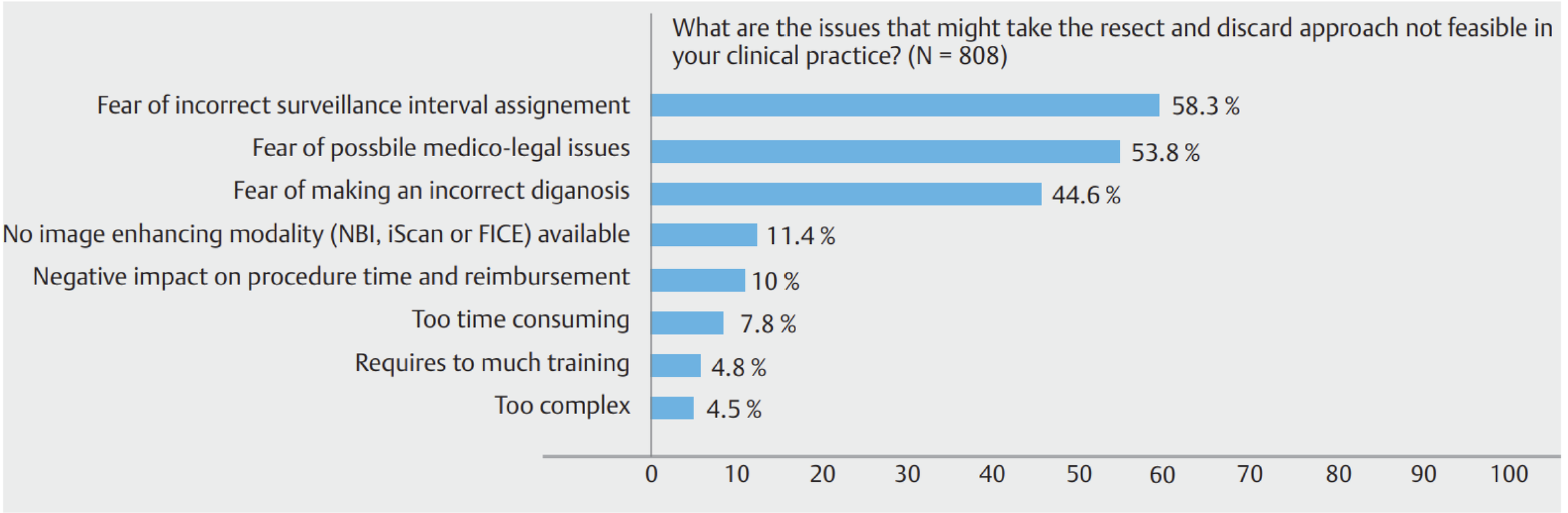
CADx – Is it enough?





Willems and Djinbachian et al. Endoscopy 2020

CADx – Is it enough?



Willems and Djinbachian et al. Endoscopy 2020

CADx – How good should it be?

- Fear of incorrect diagnosis is the main barrier to implementation.
- What are endoscopists willing to accept?
- AI has similar efficacy to endoscopists so far, so not a gamechanger yet
- Shift of responsibility towards the machine?
- Incorrect diagnosis using CADx akin to a negative FIT? Not the endoscopists‘ fault?

CADx – How good should it be?

- CADx should be equal to or superior to endoscopists.
- Endoscopists need backing from societies (ASGE/ESGE).
- CADx systems need to be able to diagnose SSLs.
- CADx systems need to be able to diagnose VA/TVA/HGD.

Conclusion

- CADe/CADx still have issues that need improvement.
- Likely future will involve CADe/CADx/CAQ combination packages.
- Ensure adequate technique, detect more polyps, resect and discard or diagnose and leave using CADe to decrease costs.
- Impact on CRC incidence and mortality still needs to be assessed.
- Very exciting new research avenues ahead!

Thank you

WEO

World Endoscopy Organization