

Supplementary Online Content

Liu J, Zhou R, Liu C, et al. Automatic quality control system and adenoma detection rates during routine colonoscopy: a randomized clinical trial. *JAMA Netw Open*. 2025;8(1):e2457241. doi:10.1001/jamanetworkopen.2024.57241

eFigure 1. The Appearance of AQCS

eFigure 2. Subgroup Analysis of the Adenoma Detection Rate by Intention-to-Treat Analysis

eTable 1. The Distribution of Colonoscopists' Performance (Lower- or Medium-Level Detector) at Each Center

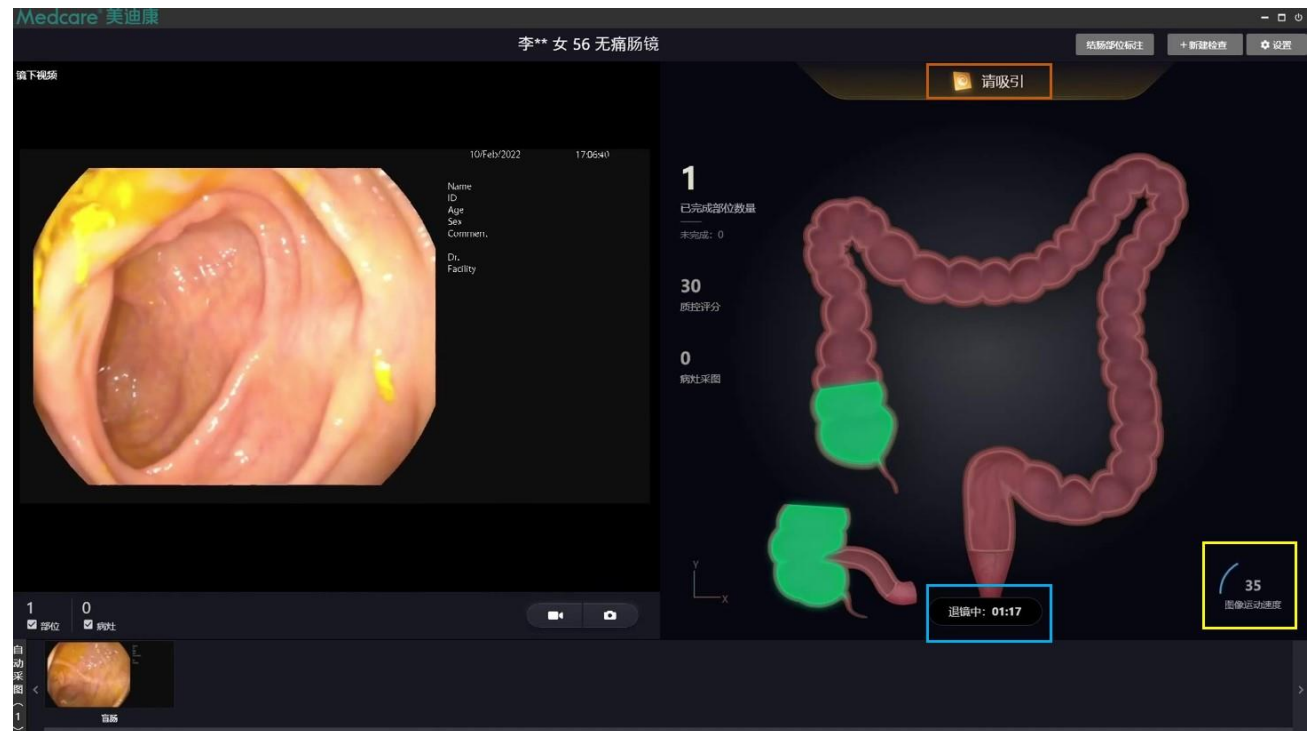
eTable 2. Other Findings and Outcomes in AQCS-Assisted and SC Groups

eTable 3. (Incident) Rate Ratios (IRR) and 95% Confidence Intervals for the Multilevel Negative Binomial Regression Model

eTable 4. Subgroup Analysis of Surveillance Recommendation by Colonoscopists' Performance and Hospital Characteristics, Comparing AQCS-Assisted Group With SC Group

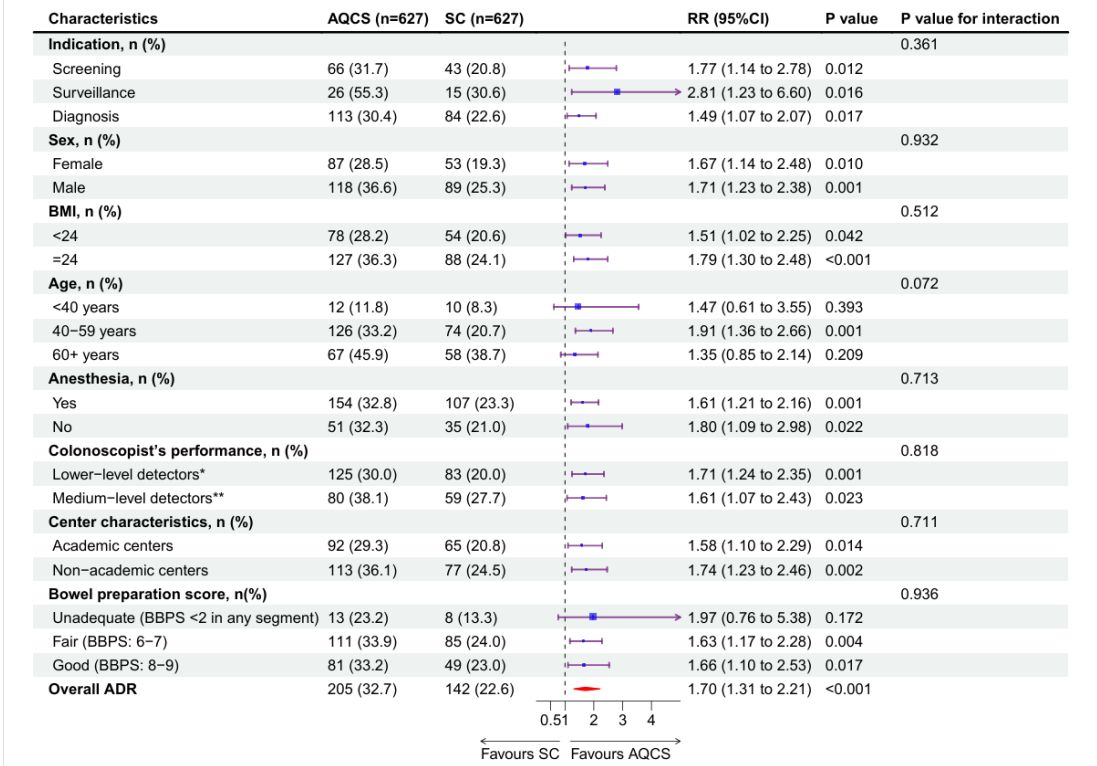
This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. The appearance of AQCS.



Alongside the original videos, four additional visual and audio notices were provided to endoscopists in real-time: (1) timer on a second high-definition monitor (hollow blue box); (2) prompts for controlling withdrawal speed and reexamining certain segments when unsteady or fuzzy frames identified continuously by AQCS (hollow yellow box); (3) prompts for cleaning mucosa or suctioning liquid pools when suboptimal cleansing (BBPS score <2) was recognised (hollow orange box) and (4) tracking box on the monitor indicating lesions location (eVideo).

eFigure 2. Subgroup analysis of the adenoma detection rate by intention-to-treat analysis.



AQCS, automatic quality control system; SC, standard colonoscopy; RR, relative risk; CI, confidence interval; BMI, body mass index; BBPS, Boston bowel preparation score; ADR, adenoma detection rate.
 *Lower-level detectors were ten colonoscopists with a mean basal ADR of less than 25%. **Medium-level detectors were five colonoscopists with a mean basal ADR of 25%–35%.

eTable 1. The distribution of colonoscopists' performance (lower- or medium-level detector) at each center.

	Lower-level detector (n=10)	Medium-level detector (n=5)
Center A	3	0
Center B	2	0
Center C	2	0
Center D	0	2
Center E	1	2
Center F	2	1

* Lower-level detectors (as reference) were ten colonoscopists with a mean basal ADR of less than 25%.

** Medium-level detectors were five colonoscopists with a mean basal ADR of 25–35%.

eTable 2. Other findings and outcomes in AQCS-assisted and SC groups

	AQCS-assisted group (n=627)	SC group (n=627)	RR (95%CI)	P value
Polyp detection rate	283 (45.1)	230 (36.7)	1.34 (1.05-1.70)	0.02
Polyps per colonoscopy	1.39 (2.69)	0.96 (2.19)	1.23 (1.01-1.51)	0.04
Advanced ADR	45 (7.2)	29 (4.6)	1.42 (0.85-2.37)	0.18
Advanced ADR of lower-level detectors*	23/417 (5.5)	11/414 (2.7)	1.53 (0.69-3.37)	0.29
Advanced ADR of medium-level detectors**	22/210 (10.5)	18/213 (8.5)	1.22 (0.61-2.42)	0.57
Advanced ADR of academic hospitals	11/314 (3.5)	8/313 (2.6)	0.76 (0.25-2.36)	0.64
Advanced ADR of non-academic hospitals	34/313 (10.9)	21/314 (6.7)	1.60 (0.88-2.91)	0.13
Advanced adenomas per colonoscopy	0.11 (0.51)	0.07 (0.41)	1.38 (0.81-2.35)	0.23

Values are n (%), mean (SD), or n/n (%). The RRs were computed from mixed-effects logistic or negative binomial regressions, including a random intercept at the colonoscopist level.

AQCS, automatic quality control system; SC, standard colonoscopy; ADR, adenoma detection rate.

* Lower-level detectors (as reference) were ten colonoscopists with a mean basal ADR of less than 25%.

** Medium-level detectors were five colonoscopists with a mean basal ADR of 25–35%.

eTable 3. (Incident) Rate ratios (IRR) and 95% confidence intervals for the multilevel negative binomial regression model. ICC (intraclass correlation coefficient) for null multilevel model

	APC for entire colon			APC for flat or sessile lesions			APC for proximal colonic lesions			APC for lesions < 10mm		
Variables	IRR	95% CI	<i>P</i> value	IRR	95% CI	<i>P</i> value	IRR	95% CI	<i>P</i> value	IRR	95% CI	<i>P</i> value
Study arm-AQCS	1·50	1·17-1·91	0·001	1·49	1·15-1·93	0·002	1·56	1·14-2·14	0·006	1·46	1·13-1·88	0·004
Indication												
Surveillance colonoscopy (screening colonoscopy as reference)	1·40	0·89-2·20	0·14	1·49	0·94-2·36	0·09	1·08	0·60-1·92	0·80	1·53	1·13-1·88	0·07
Diagnostic colonoscopy (screening colonoscopy as reference)	1·10	0·84-1·45	0·47	1·11	0·84-1·47	0·46	0·95	0·68-1·34	0·79	1·10	0·97-2·41	0·51
Smoking history	1·15	0·84-1·56	0·38	1·04	0·75-1·43	0·82	0·93	0·62-1·38	0·71	1·03	0·83-1·45	0·86
Age (years)	1·05	1·04-1·06	<0·001	1·05	1·03-1·06	<0·001	1·05	1·03-1·06	<0·001	1·05	1·03-1·06	<0·001
Male	1·77	1·32-2·36	<0·001	1·78	1·32-2·40	<0·001	1·87	1·29-2·70	<0·001	1·80	1·34-2·42	<0·001
Withdrawal time without intervention, min	1·50	1·33-1·68	<0·001	1·55	1·37-1·75	<0·001	1·61	1·38-1·87	<0·001	1·53	1·35-1·73	<0·001
Qualified BBPS	1·69	1·09-2·63	0·02	1·67	1·04-2·66	0·03	1·38	0·79-2·41	0·25	1·70	1·08-2·70	0·02

Colonoscopist’s performance—medium-level detectors**	1·00	0·76-1·31	0·999	0·84	0·63-1·11	0·22	0·86	0·61-1·22	0·41	0·93	0·70-1·22	0·59
Random part	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Between colonoscopist standard deviation (null model)	0·42	0·25-0·69		0·41	0·24-0·69		0·45	0·25-0·76		0·44	0·26-0·73	
ICC	0·15			0·15			0·17			0·16		
	APC for advanced adenoma			APC for non-advanced adenoma			APC for non-neoplastic polyp*					
Variables	IRR	95% CI	<i>P</i> value	IRR	95% CI	<i>P</i> value	IRR	95% CI	<i>P</i> value			
Study arm-AQCS	1·38	0·81-2·35	0·23	1·48	1·15-1·91	0·003	1·01	0·76-1·35	0·94			
Indication												
Surveillance colonoscopy (screening colonoscopy as reference)	0·86	0·30-2·46	0·78	1·45	0·92-2·29	0·11	1·33	0·78-2·26	0·29			
Diagnostic colonoscopy (screening colonoscopy as reference)	1·29	0·67-2·48	0·44	1·06	0·80-1·39	0·69	0·86	0·61-1·21	0·40			
Smoking history	1·78	0·90-3·53	0·01	1·08	0·78-1·48	0·65	1·06	0·73-1·55	0·75			

Age (years)	1·07	1·04-1·10	<0·001	1·05	1·03-1·06	<0·001	1·02	1·01-1·03	<0·001
Male	1·96	0·99-3·86	0·05	1·74	1·30-2·34	<0·001	1·20	0·86-1·67	0·29
Withdrawal time without intervention, min	1·39	1·11-1·74	0·004	1·54	1·36-1·73	<0·001	1·45	1·17-1·80	<0·001
Qualified BBPS	0·89	0·41-1·96	0·78	2·00	1·24-3·24	0·005	1·18	0·72-1·93	0·51
Colonoscopist's performance—medium-level detectors**	2·58	1·25-5·32	0·01	0·87	0·66-1·15	0·31	0·83	0·31-2·24	0·71
Random part	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
Between colonoscopist standard deviation (null model)	0·94	0·54-1·65		0·45	0·26-0·73		0·67	0·43-1·09	
ICC	0·47			0·17			0·31		

APC, adenomas per colonoscopy; IRR, incident rate ratios; CI, confidence interval; AQCS, automatic quality control system; BBPS, Boston Bowel Preparation Scale; ICC, intraclass correlation coefficient. *Polyps with histology showing hyperplastic, inflammatory lesions, normal mucosa and others. ** Medium-level detectors were five colonoscopists with a mean basal ADR of 25–35%. Lower-level detectors (as reference) were ten colonoscopists with a mean basal ADR of less than 25%.

eTable 4. Subgroup analysis of surveillance recommendation by colonoscopists' performance and hospital characteristics, comparing AQCS–assisted group with SC group

	USMSTF (1 or 3-year interval)		ESGE (3-year interval)		JGES (1 or 3-year interval)	
	RR	95% CI	RR	95% CI	RR	95% CI
All	1·51	0·94-2·42	1·63	1·00-2·65	1·59	1·04-2·43
Colonoscopist's performance						
Lower-level detectors (basal ADR <25%)	1·67	0·84-3·32	1·89	0·92-3·89	1·98	1·08-3·64
Medium-level detectors (basal ADR 25-35%)	1·22	0·62-2·38	1·30	0·66-2·56	1·13	0·61-2·10
Hospital characteristics						
Academic hospitals	0·77	0·31-1·95	0·93	0·35-2·46	1·06	0·48-2·37
Non-academic hospitals	1·72	0·96-3·09	1·81	0·99-3·27	1·57	0·92-2·68

The RRs were computed from mixed-effects logistic or negative binomial regressions, including a random intercept at the colonoscopist level.

AQCS, automatic quality control system; SC, standard colonoscopy; USMSTF, US Multi-Society Task Force on Colorectal Cancer; ESGE, European Society of Gastrointestinal Endoscopy; JGES, Japan Gastroenterological Endoscopy Society; RR, relative risk; CI, confidence interval; ADR, adenoma detection rate.