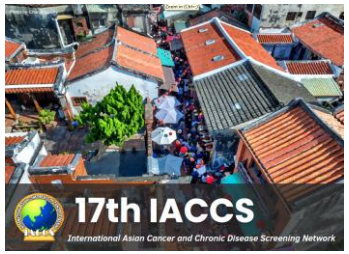

17th IACCS: International Asian Cancer and Chronic Disease Screening Network

Providing Multiple Options for CRC Screening Programs: Is It a Breakthrough for Improving Screening Participation?

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17th IACCS: International Asian Cancer and Chronic Disease Screening Network

COI Disclosure

Takahisa Matsuda

I have financial relationships to disclose.

Speaker honorarium: Olympus, Fujifilm, EA Pharma, Eiken Chemical Co., Ltd.

Outline

1. Why CRC screening matters
2. Screening strategies around the world
3. Does offering choice improve participation?
4. Insights from Japan and Taiwan
5. Future direction and key messages

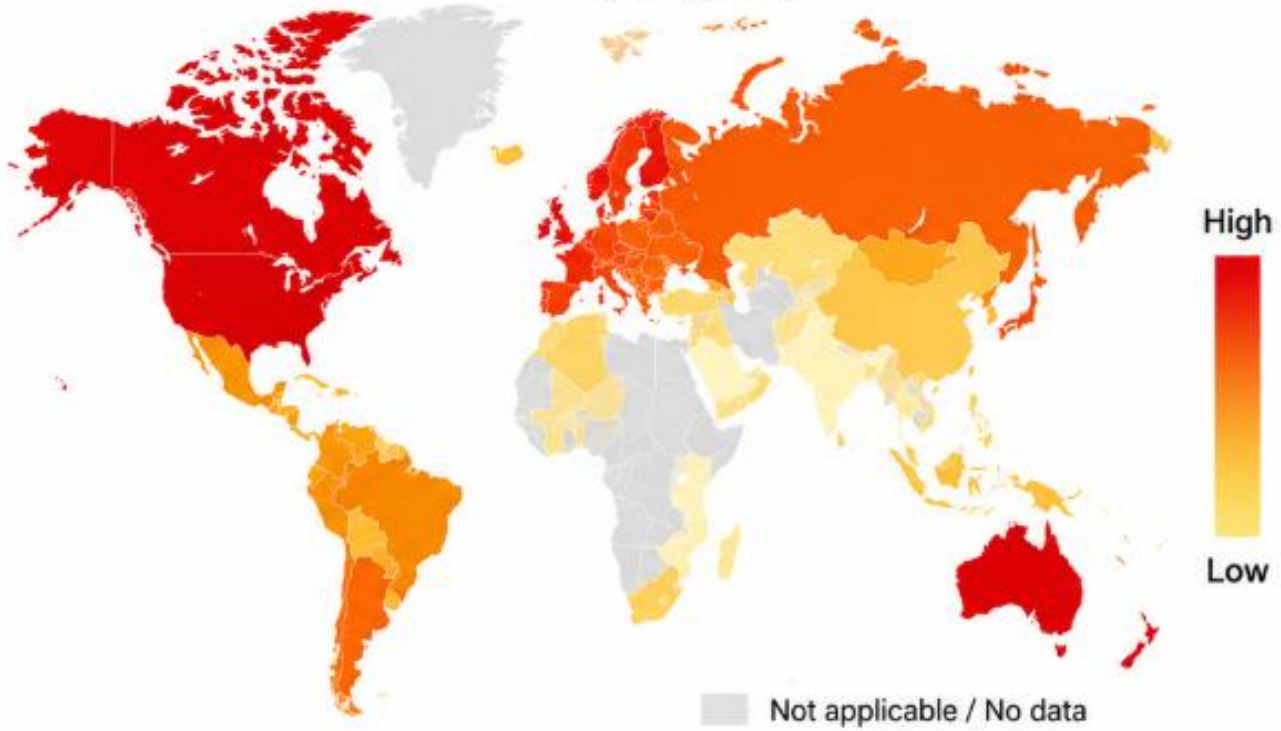
Why CRC Screening Matters

The global burden of colorectal cancer (2022)

1.93 million
New cases

904,000
Deaths

One of the few cancers that can be **prevented through screening**



Screening can prevent both cancer incidence and mortality by detecting precancerous lesions and early-stage cancers.

Bray F, et al. CA Cancer J Clin. 2024;74(3):229-263.
Sung H, et al. CA Cancer J Clin. 2021;71(3);209-249.

The Biggest Challenge is Participation

Screening efficacy depends on participation

Screening test	Efficacy for detecting CRC (cancer or advanced adenoma)	Participation in general population (typical range)
Colonoscopy First screening method (colonoscopy-first strategies)	**Highest** ★ ★ ★ ★ ★ *Gold standard*	**Lower** **~10–25%** (most programs)
FIT Fecal immunochemical test (FIT-based strategies)	**Moderate** ★ ★ ★ ☆ ☆ *Less sensitive than colonoscopy but effective for population screening*	**Higher** **~30–70%** (organized programs)

Examples of colonoscopy-first countries

Germany

10-year cumulative use of screening colonoscopy:

11–26%

(2002–2011 birth cohorts)

Poland

PICCOLINO randomized trial (colonoscopy-only arm):

17.5%

(invitation group)

(2011–2012)

Japan (2022)

~40–45%

Overall colorectal cancer screening participation rate (age 40–69)

Key message

Even highly effective tests cannot reduce mortality *if people do not participate and complete follow-up.*

The key to reducing colorectal cancer mortality is to increase participation and ensure high-quality diagnostic colonoscopy after a positive FIT.

Sources

1. Hornschuch M, et al. *Trends in participation in colorectal cancer screening by screening colonoscopy in Germany: a registry database analysis. Eur J Cancer Prev.* 2022;31:497–504.
2. Pilonis ND, et al. Effect of colonoscopy vs FIT-based screening on colorectal cancer incidence: the PICCOLINO randomized clinical trial. *Gastroenterology.* 2021;160:1097–1105.
3. European Commission/IARC. *European Colorectal Cancer Screening Report.* Luxemourg: Publications Office of the European Union; 2022.
4. Ministry of Health, Labour and Welfare, Japan. *Report on the Promotion of Cancer Control Programs in Japan, 2022.*

CRC, colorectal cancer; FIT, fecal immunochemical test; RCT, randomized controlled trial.

Current Global Screening Strategies

Different countries, different strategies

Country	Primary screening strategy (as of 2024–2025)	Key features
Japan	**FIT** (Fecal immunochemical test)	• National organized program • Target age: **40 years and older** (no upper age limit)
Taiwan	**National organized biennial FIT program** (Fecal immunochemical test)	• National program since 2014 • Target age: 50–74 years (expanded to 45–74 from 2025)
United States	**Multiple options** FIT, FIT–DNA (sDNA–FIT), colonoscopy, CT colonography, flexible sigmoidoscopy	• Individuals can choose from recommended screening options (USPSTF 2021)
Germany	**FIT or Colonoscopy** (Both are offered as first-line screening options)	• Statutory health insurance covers either FIT or colonoscopy • Target age: 50–75 years
Netherlands	**National organized biennial FIT program** (Fecal immunochemical test)	• Biennial FIT invitation program since 2014 • Target age: 55–75 years

Points to consider

Healthcare resources
Availability of endoscopy, laboratories, workforce, and budget

Healthcare system
Organization of care, referral pathways, and data systems

Organized vs. opportunistic
Organized programs achieve higher participation and better outcomes

Patient acceptability
Test burden, invasiveness, convenience, and cultural preferences

There is no single best test or strategy for all countries.
The optimal strategy depends on local resources, systems, and participation.

References

1. Ministry of Health, Labour and Welfare, Japan. 2022.
2. Taiwan Ministry of Health and Welfare. *Taiwan Colorectal Cancer Screening Program*. 2024.
3. US Preventive Services Task Force. Colorectal Cancer: Screening. JAMA. 2021;325(19):1965-1977.
4. Senore C, et al. Best Pract Res Clin Gastroenterol. 2023;36:101080.
5. Arndt V, et al. European screening guidelines for colorectal cancer. *Endoscopy*. 2022;54:1147-1163.
6. Dutch National Institute for Public Health and the Environment (RIVM). *Nationaal Bevolkingsonderzoek Darmkanker*. 2024.

FIT, fecal immunochemical test; sDNA-FIT, stool DNA test with FIT; CT, computed tomography.

Why Multiple Options Became a U.S. Strategy

USPSTF emphasizes patient preference and shared decision-making

USPSTF Recommendation (2021)

Recommended screening options

FIT

Stool-based test every year

[タイトルなし]

FIT-DNA

Stool-based DNA test every 1–3 years

Colonoscopy

Every 10 years

CT Colonography

Every 5 years

Flexible Sigmoidoscopy

Every 5 years

Multiple evidence-based options are acceptable

Why offer multiple options?

- Different patient preferences
- Shared decision-making
- Reduction of screening barriers
- Goal: increase participation

Important consideration

United States

- Predominantly opportunistic screening
- Individual choice is emphasized
- Healthcare systems and resources differ

May not directly apply to organized population-based programs

Key message: Choice is recommended in some healthcare systems, but its value depends on the screening context.

Reference: USPSTF. Screening for Colorectal Cancer. JAMA. 2021;325(19):1965-1977.

Why Participation Matters More than Test Efficacy

Colonoscopy-only strategy: limitations

Limitations of colonoscopy-only screening

Bowel preparation
Burdensome laxative preparation may discourage participation

Invasiveness
Requires sedation and an invasive procedure with small but real risks

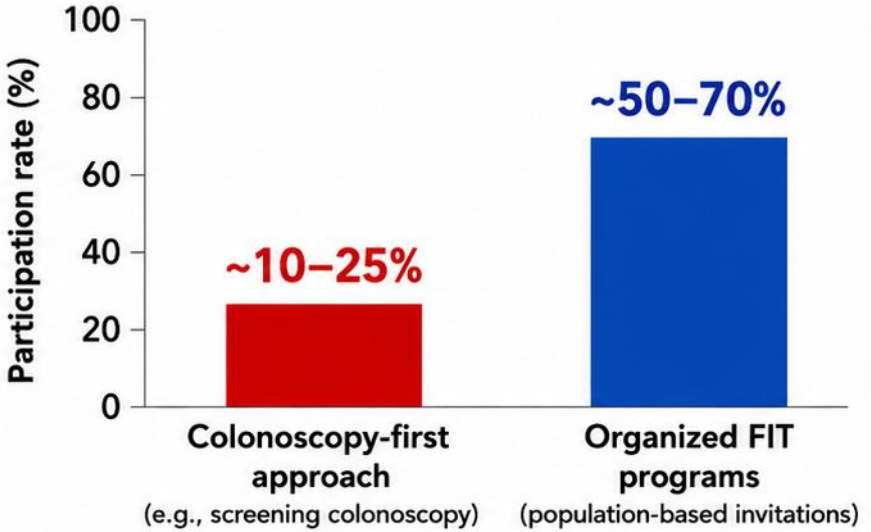
Fear / discomfort
Anxiety about pain, complications, or the procedure itself

Cost
Higher cost compared with stool-based tests; less cost-effective at the population level

Time / inconvenience
Time off work, need for transportation and accompanying person

Typical participation rates in population screening

(Not head-to-head trials; real-world program data)



Organized programs using FIT typically achieve much higher participation than colonoscopy-first approaches.

Examples include programs in multiple European countries, Asia, and elsewhere.*

Message: Colonoscopy is highly effective for detecting and preventing colorectal cancer, but **participation is often limited** when it is the only option.

A population strategy must be acceptable, accessible, and sustainable. High participation is essential to achieve the full potential of screening.

References

1. Brenner H, et al. *Lancet*. 2014;383:1490–1502.
2. Hol L, et al. *Gut*. 2013;62:960–967.
3. European Commission. European Cancer Information System (ECIS). 2022.
4. Lansdorp-Vogelaar I, et al. *Int J Cancer*. 2011;128:2472–2484.
5. von Karsa L, et al. *European Colorectal Cancer Screening Guidelines. Endoscopy*. 2013;45:51–59.
6. Meester RGS, et al. *Gastrointest Endosc*. 2015;82:448–455.

* Examples include Germany, Poland, the Netherlands, Taiwan, Japan, and other population-based screening programs.

The "Choice" Hypothesis

Would offering multiple options improve participation?

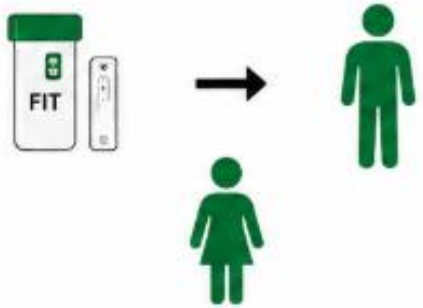
Different strategies may influence participation in different ways.

1. Colonoscopy only

Limited acceptability

- Invasive procedure
- Bowel preparation burden
- Fear, discomfort, time, cost

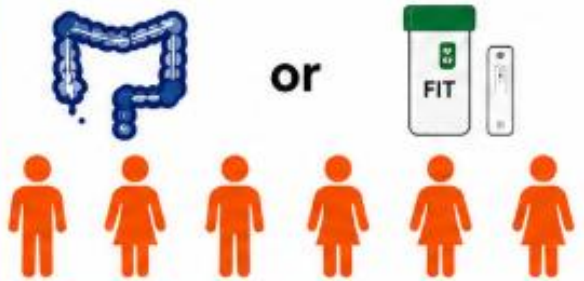
2. FIT only



Less invasive, more acceptable

- Simple, non-invasive stool test
- Lower burden and cost
- May lead to higher participation

3. Choice strategy (FIT or Colonoscopy)



Hypothesis: participation may increase

- Individuals choose the option they prefer
- Reduces barriers for some
- May engage more people overall

Possible mechanisms behind improved participation with choice

Patient preference
People are more likely to choose a test they find acceptable.

Reduced barriers
Offering options can overcome individual barriers.

Greater accessibility
Different options fit different needs and life situations.

Shared decision-making
Empowers individuals and may increase engagement.

This is a hypothesis. Randomized trials and real-world data are needed to determine its true impact.

Landmark RCT: Inadomi Trial

Adherence to CRC screening: a randomized clinical trial of competing strategies

Study design

Randomized controlled trial

Participants aged 50–75 years

Enrolled participants:

n = 997

(April 2005 – July 2008)

U.S. primary care practices

12-month completion of any recommended screening test

Strategy (randomized)	Completion rate (12 months)
Colonoscopy recommendation (n = 331)	38.2% (127 / 331)
FOBT recommendation (n = 333)	67.2% (224 / 333)
Choice (colonoscopy or FOBT) (n = 333)	68.8% (229 / 333)

Message

Colonoscopy recommendation alone resulted in the **lowest** completion rate.

FOBT recommendation and **Choice** (FOBT or colonoscopy) achieved substantially **higher participation.**

Important nuance: This study used **guaiac FOBT** rather than **FIT**. Therefore, it should be interpreted as evidence supporting the "choice hypothesis," **not** as direct evidence for **FIT-based** screening programs.

FOBT (guaiac) ✓ | FIT ✗

Inadomi JM, et al. Adherence to colorectal cancer screening: a randomized clinical trial of competing strategies. *Arch Intern Med.* 2012;172(8):575–582.

More Recent Evidence: PICCOLINO Study

Randomized trial comparing CRC screening strategies

1. Colonoscopy only

Invitation to colonoscopy as the only screening option

2. Sequential strategy

FIT first; colonoscopy offered if FIT positive

3. Active choice

Participants can choose between colonoscopy or FIT

Results (Invitation-based RCT)

	1. Colonoscopy only (n = 3,320)	2. Sequential strategy (n = 3,321)	3. Active choice (n = 3,319)
Participation (completed any recommended test)	17.5% (581 / 3,320)	25.8% (856 / 3,321)	26.5% (879 / 3,319)
Advanced neoplasia detection rate* (per-protocol population)	1.1% (37 / 3,320)	1.0% (34 / 3,321)	1.0% (34 / 3,319)
Comparison of advanced neoplasia detection rate (vs. colonoscopy only)	–	Adjusted OR 0.93 (95% CI 0.60–1.42) $p = 0.75$	Adjusted OR 0.91 (95% CI 0.60–1.40) $p = 0.66$

Key take-home messages

- Participation improved (Active choice ≥ Sequential strategy > Colonoscopy only)
- However, advanced neoplasia detection rate was not significantly higher with active choice or sequential strategy compared with colonoscopy only.

Increasing participation does not automatically translate into higher diagnostic yield.

Message: Offering a choice or using a sequential strategy can increase participation, but does not necessarily lead to higher detection of advanced neoplasia.

* Advanced neoplasia: colorectal cancer or advanced adenoma (≥ 10 mm, or with villous features or high-grade dysplasia).

Pilonis ND, Segnan N, Piciocchi A, et al. Comparing colorectal cancer screening strategies: a randomized trial. *Gastroenterology*. 2021;160(4):1097-1105.

Implementation Matters

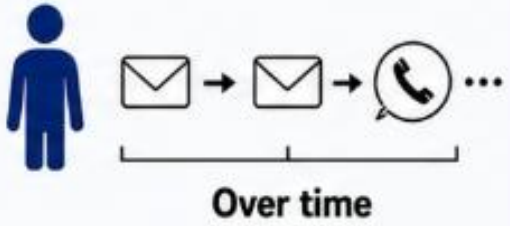
STUDY DESIGN

1 Active Choice

Participants are asked to choose between colonoscopy or FIT at the invitation.

2 Sequential Outreach

Participants receive multiple reminders and additional outreach over time.

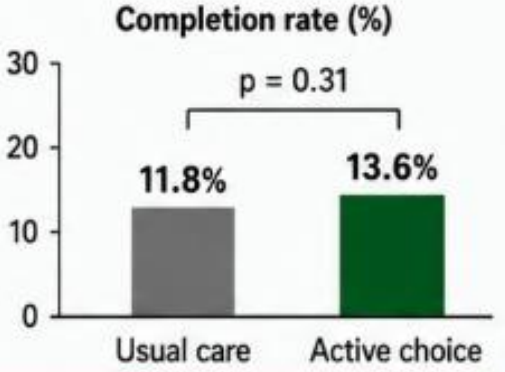


RESULTS

No major increase in overall completion

13.6% vs. 11.8%

p = 0.31



Screening behavior changed

- More participants selected colonoscopy
- More participants completed the test
- Different choices were made

KEY MESSAGE:
How options are offered may be as important as the options themselves.

Mehta SJ, et al. *JAMA Netw Open.* 2019;2:e1910305. doi:10.1001/jamanetworkopen.2019.10305.

Organized Screening Programs

Simplicity may be the key

Organized programs achieve high participation and population impact through simplicity, scalability, and efficient logistics.

Why simplicity matters

1. Simplicity

Easy-to-understand messages and simple procedures increase participation.

2. Scalability

Simple programs can be expanded and sustained at the population level.

3. Efficient logistics

Streamlined processes reduce costs and ensure program sustainability.

Population-based FIT program flow (example)

Invitation

Targeted individuals receive an invitation by mail.

Home-based FIT

Individuals complete the FIT at home and return it by mail.

Results

Participants receive their results with clear explanations.

Follow-up

Positive FIT results are followed by colonoscopy.

These simple, organized steps lead to higher participation and greater impact on colorectal cancer mortality.

Key message: **Simplicity, scalability, and efficient logistics are essential for successful organized screening programs.**

Senore C, et al. Organized colorectal cancer screening programs: evidence, implementation, and future perspectives. *Best Pract Res Clin Gastroenterol.* 2023;57-58:101834.

Taiwan: A Successful Organized Screening Program

Organization, participation, and quality drive outcomes

Organized population-based screening can substantially reduce CRC mortality.

Why Taiwan succeeded

1. Population-based invitation
- Nationwide screening program
- Clearly defined target population

2. High participation
- Repeated invitations
- Simple screening process

3. Strong follow-up system
- Positive FIT → colonoscopy
- Program monitoring

4. Long-term commitment
- Sustained for more than a decade

Impact on colorectal cancer mortality

~35%
Reduction in CRC mortality

Evidence from nationwide FIT screening

Chiu HM, et al. Cancer. 2015;121:3541-3548.

Chiu HM, et al. Gut. 2021;70:112-119.

How the program works

Population-based invitation → FIT screening → Follow-up colonoscopy → Mortality reduction

Taiwan demonstrates how an organized screening program can achieve substantial population benefit.

Key message

Successful screening is not only about the test.
It is about organization, participation, and follow-up.

References: Chiu HM, et al. Cancer. 2015;121:3541-3548. | Chiu HM, et al. Gut. 2021;70:112-119.

Japan's Challenge:

Toward an Integrated and Organized Screening System

Multiple screening opportunities exist, but data are NOT fully integrated— a solvable challenge.

Municipal FIT
(Population-based)

FIT (2-day, annually)
– Primary for screening

Workplace Health Program
(Occupational Health Check-ups)

FIT or Colonoscopy
(Opportunistic)

Private Hospitals / Care Health Plan

Variety of tests
(Opportunistic)

Municipal Database

Company / Health Insurance Database

In-house Database

Data are partially linked, but not yet centralized.
Comprehensive linkage across all opportunities is the next step.

Current Consequences

Limited Data Linkage
Due to separate systems (insurance, local government, private sector).

Lack of Coordinated Pathway
Difficult to track the full pathway from screening to treatment.

Incomplete Outcome Evaluation
Hard to evaluate the true impact on mortality.

Quality Improvement Difficult
Limited ability to provide feedback and improve quality across settings.

Not Yet a Fully Organized System
Japan has a solid foundation, but important challenges remain.

Our Path Forward

Strengthen Data Linkage
Advance data linkage across insurance, municipalities, and healthcare providers.

Build a Coordinated Pathway
Ensure smooth follow-up from screening to diagnosis and treatment.

Improve Outcome Evaluation
Use linked data to evaluate and maximize the impact on mortality.

Promote Quality Improvement
Provide feedback and support to improve quality across all settings.

Toward a Fully Organized System
Build an integrated system that delivers better outcomes for all.

Key Message: Japan has diverse screening opportunities and a strong foundation.
The next step is integration and organization to maximize the impact on CRC mortality.

National Cancer Registry
(Available since 2016)

The future is in our hands. *With collaboration and commitment, Japan can build a world-class screening system.*

The Balance Between Choice and Simplicity

Organized Screening vs Opportunistic Screening

More options may not always improve population outcomes.

Organized screening (population-based)		Opportunistic screening (individual-based)
Simplicity Simple messages and procedures drive higher participation.	Approach	**Flexibility** Multiple options allow personalized choices.
Equity Equal access for all, regardless of background.	Value	**Personalization** Tailored to individual values and preferences.
Cost-effective Lower cost per person and sustainable at scale.	Impact	**Preference-oriented** Aligns with individual preferences and priorities.

Key message: The right balance is essential.
Simplicity is key for organized programs, while choice may be valuable in individual care.

Effective screening programs must match the strategy to the goal and the healthcare system.

Quality Determines the True Impact of Screening

Organized screening requires both participation and quality

To reduce colorectal cancer, screening must detect and remove precancerous lesions.

Participation + Quality = Maximum Impact

High participation

More people get screened.

High quality

More adenomas detected and removed.

Quality Improves Outcomes

ADR ↑

Adenoma Detection Rate

PCCRC ↓

Post-Colonoscopy Colorectal Cancer

CRC Mortality ↓

Colorectal Cancer Mortality

Evidence

- Higher ADR → Lower interval CRC (*Kaminski et al. N Engl J Med.* 2010)
- Every 1% increase in ADR → 3% lower risk of PCCRC and lower CRC mortality (*Corley et al. N Engl J Med.* 2014)

Quality maximizes the benefit of participation. | **High-quality screening saves more lives.**

Key message: Getting more people screened is essential, but ensuring high-quality colonoscopy is what saves lives.

References: Kaminski MF, et al. *N Engl J Med.* 2010;362:1795-1803. | Corley DA, et al. *N Engl J Med.* 2014;370:1298-1306.

Future Direction

Precision CRC screening: the right test for the right person at the right time

Advances in technology and science enable more accurate, efficient, and personalized colorectal cancer screening.

Key drivers of precision screening

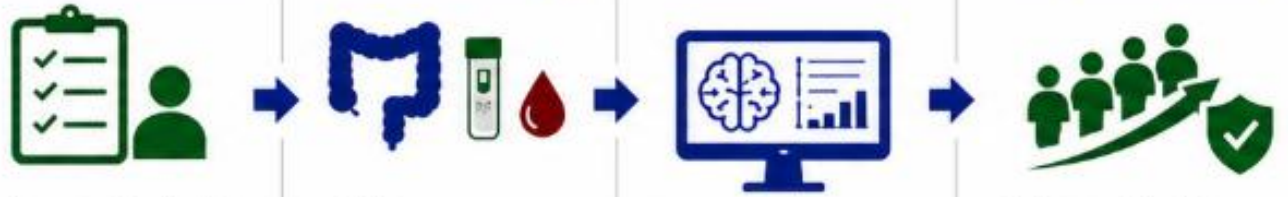
Risk stratification
Identify individuals at higher risk to tailor screening intensity and timing.

Artificial intelligence
AI tools improve detection, prediction, and decision support.

Biomarkers
Blood, stool, and molecular markers enhance risk assessment and early detection.

Personalized screening
Matching the best test and interval to each individual's risk and preferences.

Toward personalized CRC screening



1. Risk assessment	2. Tailored strategy	3. Advanced tools	4. Optimal outcomes
• Age, sex, family history • Lifestyle factors • Genetic risk	• Colonoscopy • FIT • Blood / stool tests • Other modalities	• AI-assisted colonoscopy • Risk prediction models • Decision support systems	• Higher participation • Earlier detection • Better outcomes • Efficient use of resources

From one-size-fits-all to right-size-fits-individual.
Precision screening will improve outcomes and sustainability.

Key message: The future of CRC screening lies in precision—using the right tools to deliver the right care to the right people.

Examples of emerging approaches

AI-assisted colonoscopy

Risk-based screening

Mailed FIT programs

Data-driven risk prediction

Key Messages

Effective CRC screening depends on participation, strategy, and sustainability.

1 **Participation is the key determinant of screening success.**	Even highly effective tests cannot reduce mortality if people do not participate.
2 **Offering multiple options may improve participation.**	Studies show that choice strategies increase participation compared with a single recommended test.
3 **However, simplicity is crucial for organized programs.**	Simple, scalable programs are more effective at the population level.
4 **Organized screening should prioritize equity, accessibility, and sustainability.**	Population-based programs ensure equal access and deliver the greatest public health impact.
5 **Future screening should be risk-based and personalized.**	Advances in risk stratification, AI, and biomarkers will help deliver the right test to the right person at the right time.
6 **Balancing choice and simplicity is key to the success of CRC screening.**	We must adapt strategies to healthcare systems, resources, and population needs.

Providing multiple options may help some individuals,
but organized screening programs require simplicity, equity, and sustainability.

Summary

- ✓ Participation is the foundation of successful CRC screening.
- ✓ Offering multiple options may improve participation.
- ✓ However, simplicity is essential for organized population-based programs.
- ✓ High-quality diagnostic colonoscopy is critical for reducing CRC mortality.
- ✓ The goal is not simply more choice, but the right balance of participation, quality, and organization.
- ✓ Successful screening programs require organization, quality, and sustainability.


Thank you for your kind attention
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