

Session Ten

**Panel**  
**Early-Age Onset**  
**Colorectal Cancer: What's**  
**Experienced, What's**  
**Known, and What's Next?**



**11:15 AM to 12:30 PM**

# Panel

## Early-Age Onset Colorectal Cancer: What's Experienced, What's Known, and What's Next?



**Moderator**  
**Allison Rosen**  
MS



**Suzy Reyes**



**Scott Kopetz**  
MD, PhD, FACP



**Cassandra Fritz MD,**  
MPHS

# Azucena (Suzy) Reyes

**Suzy Reyes**

Early-Age Onset Colorectal Cancer Survivor

# Azucena (Suzy) Reyes

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Cancer Survivor















Chemotherapy

#2

November

30, 2015



CHEMOTHERAPY

# 3 🤪

12/14/2015 💉



CHEMOTHERAPY

#4





CHEMOTHERAPY

#5



1/11/16





**CHEMO**



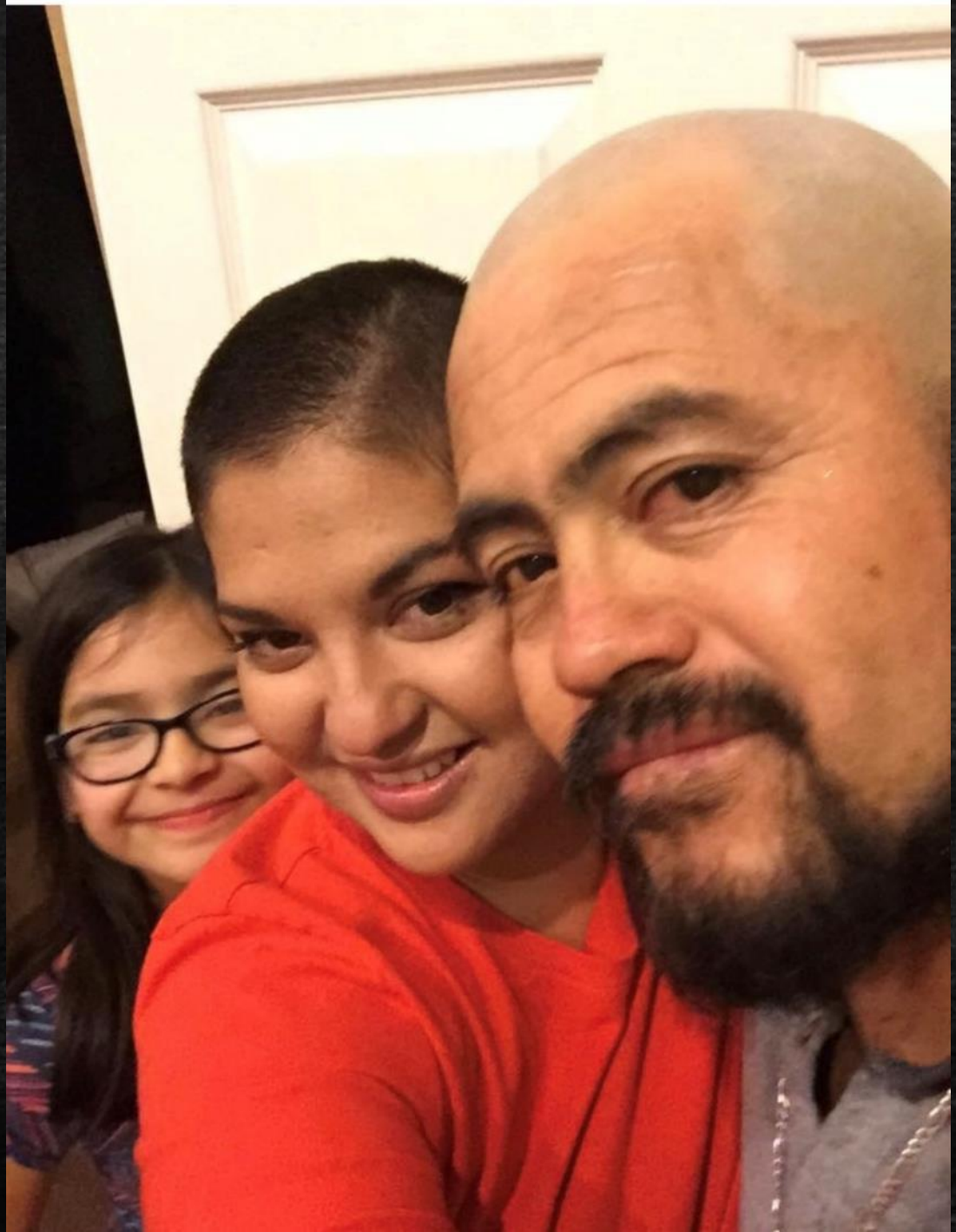
**#6 1/25/16**

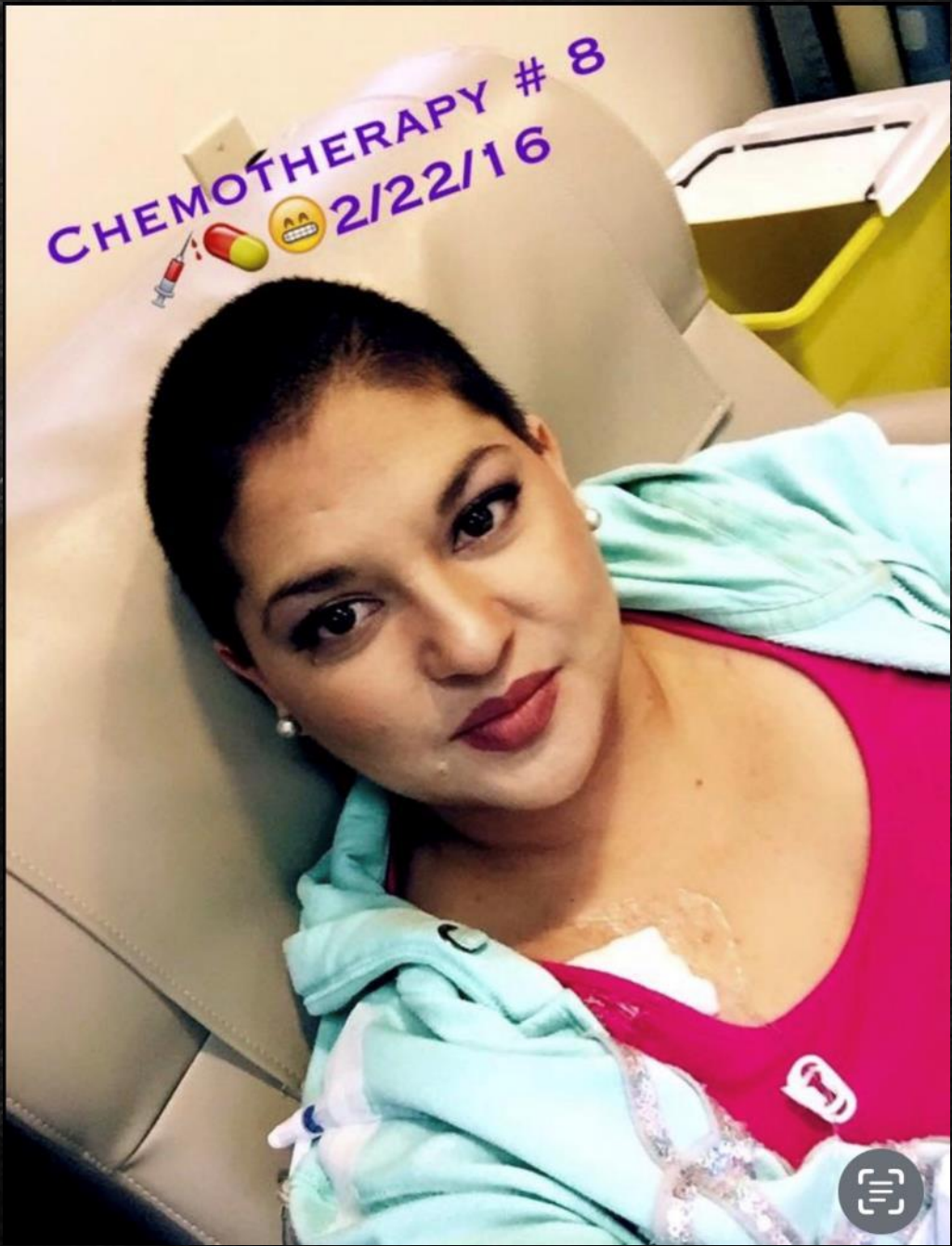






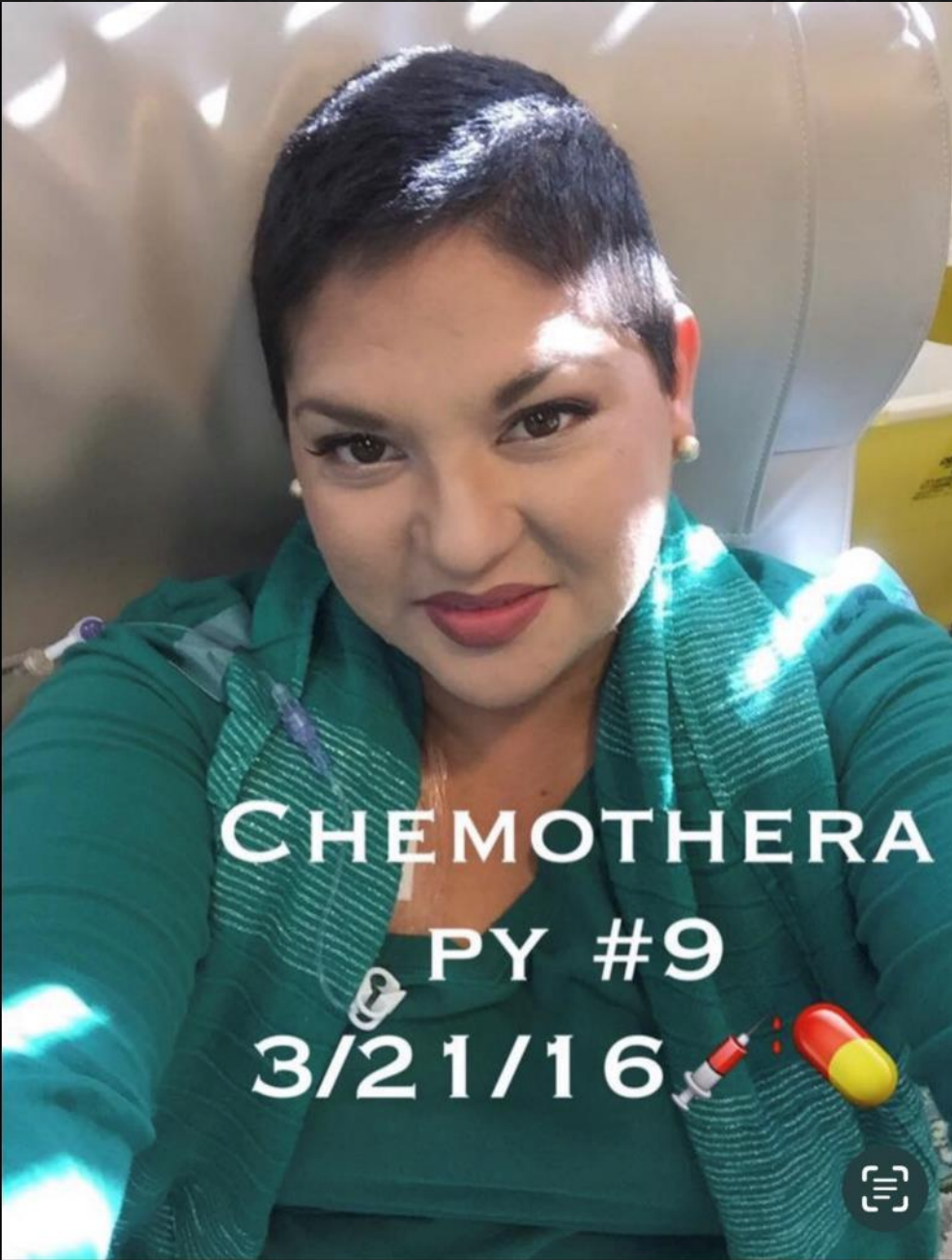






CHEMOTHERAPY # 8  
2/22/16





CHEMOTHERA

PY #9

3/21/16





CHEMOTHERAPY

#11

4/19/16





**FINAL CHEMO**  
Ring the Bell...



...then  
**RUN LIKE HELL**

**FINAL CHEMO RING THE**



**THEN RUN LIKE**

**HELL !!!**

**4/3/16**

























# Thank You

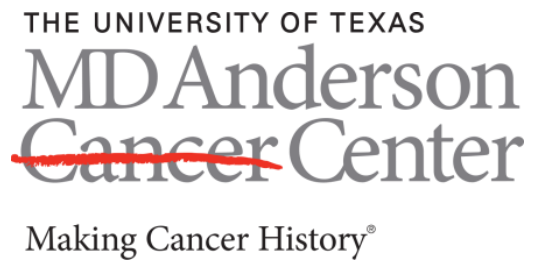
[nccrt.org](http://nccrt.org) @NCCRTnews #80inEveryCommunity

# Overview of Early-Onset Colorectal Cancer

**Scott Kopetz, MD, PhD, FACP**

Deputy Chair for Translational Research and Professor  
Department of Gastrointestinal (GI) Medical Oncology, Division of Cancer Medicine  
The University of Texas MD Anderson Cancer Center





# Overview of Early-Onset Colorectal Cancer

Scott Kopetz, MD, PhD

Department of Gastrointestinal Medical Oncology  
MD Anderson Cancer Center

# Topics

01

## **EPIDEMIOLOGY**

The epidemiology of EOCRC globally and in the United States.

02

## **EXPOSOME**

Exposures or risk factors potentially contributing to the rising risk of EOCRC.

03

## **GENETICS & EPIGENETICS**

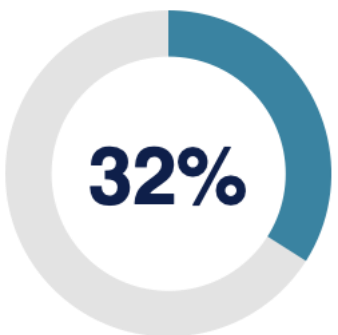
Molecular aspects of EOCRC.

# US Incidence



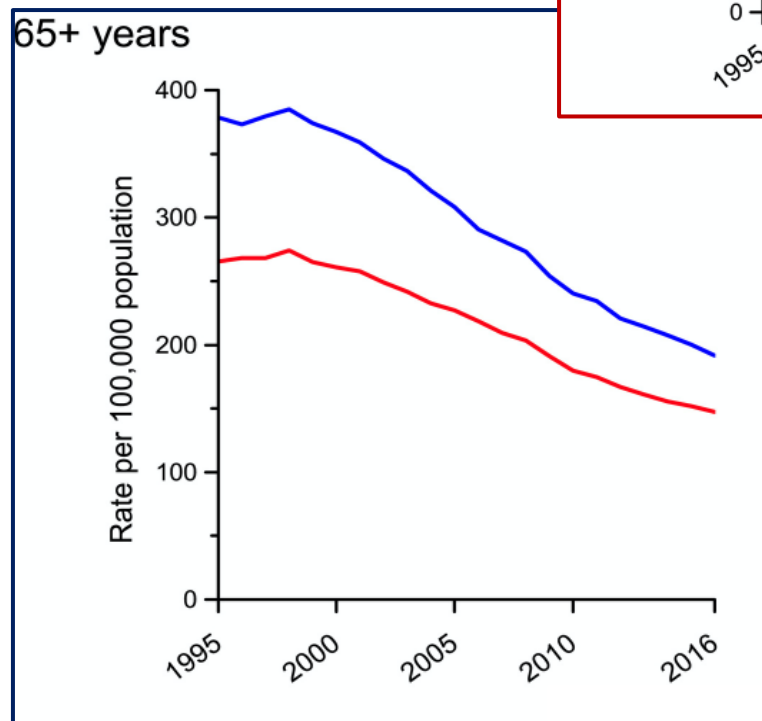
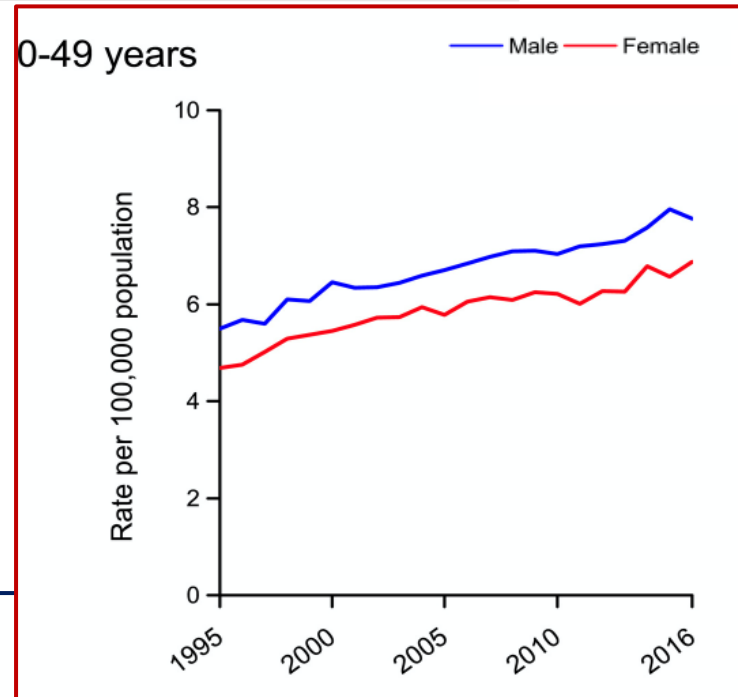
## Incidence of EOCRC

Incidence rate of EOCRC **raised** by more than 50% in both genders since 1994.



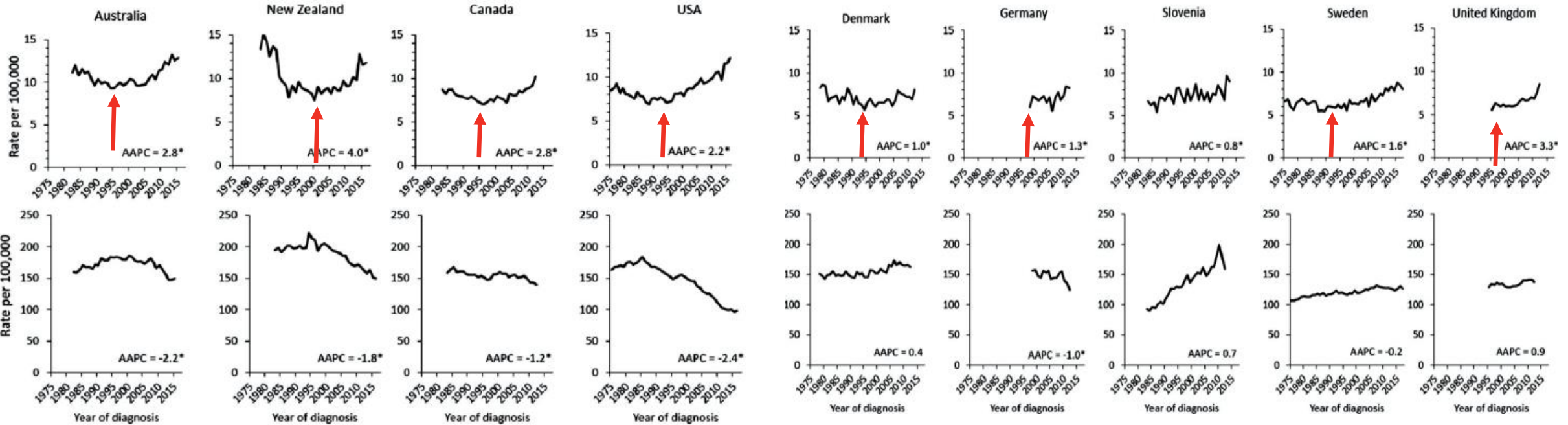
## Incidence of LOCRC

Incidence rate of LOCRC **declined** by around 34% in both genders since 2000.



# Global Prevalence: Europe, North America & Oceania

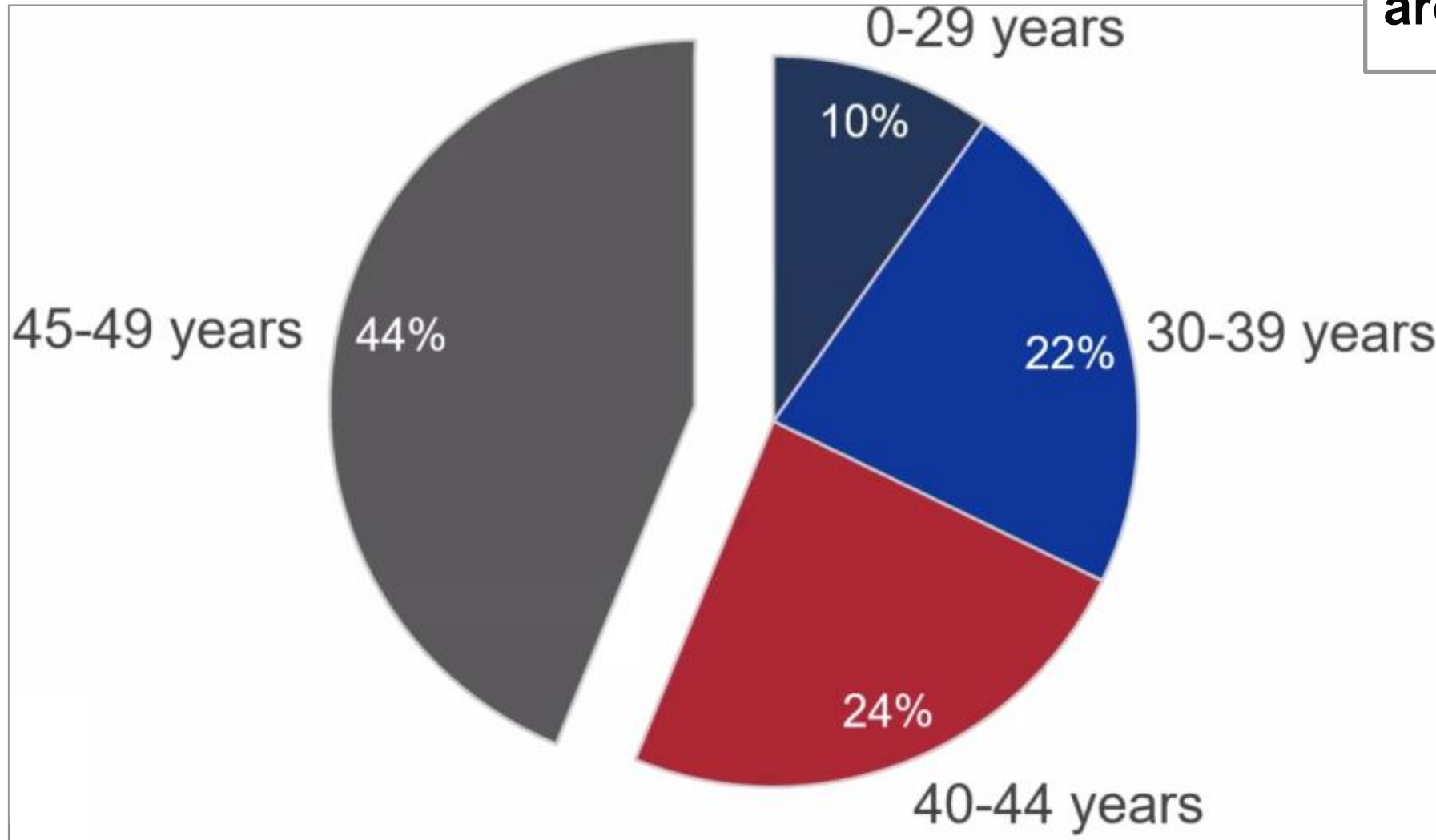
20-49 years



EOCRC incidence **increased** in 19 countries. **Nine** of which had stable or **declining** trends in older adults.

Average annual per cent change (AAPC) in colorectal cancer incidence by age during the most recent 10 years of available data.

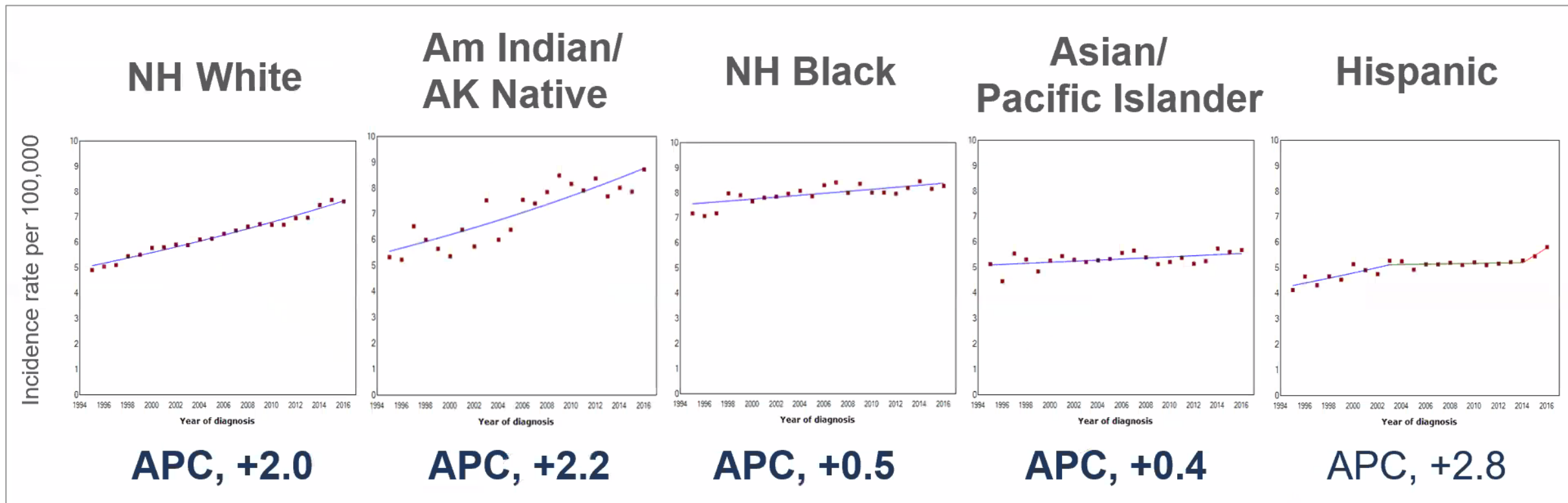
# EOCRC Age Distribution



**44%** of EOCRC cases are **45-49** years old

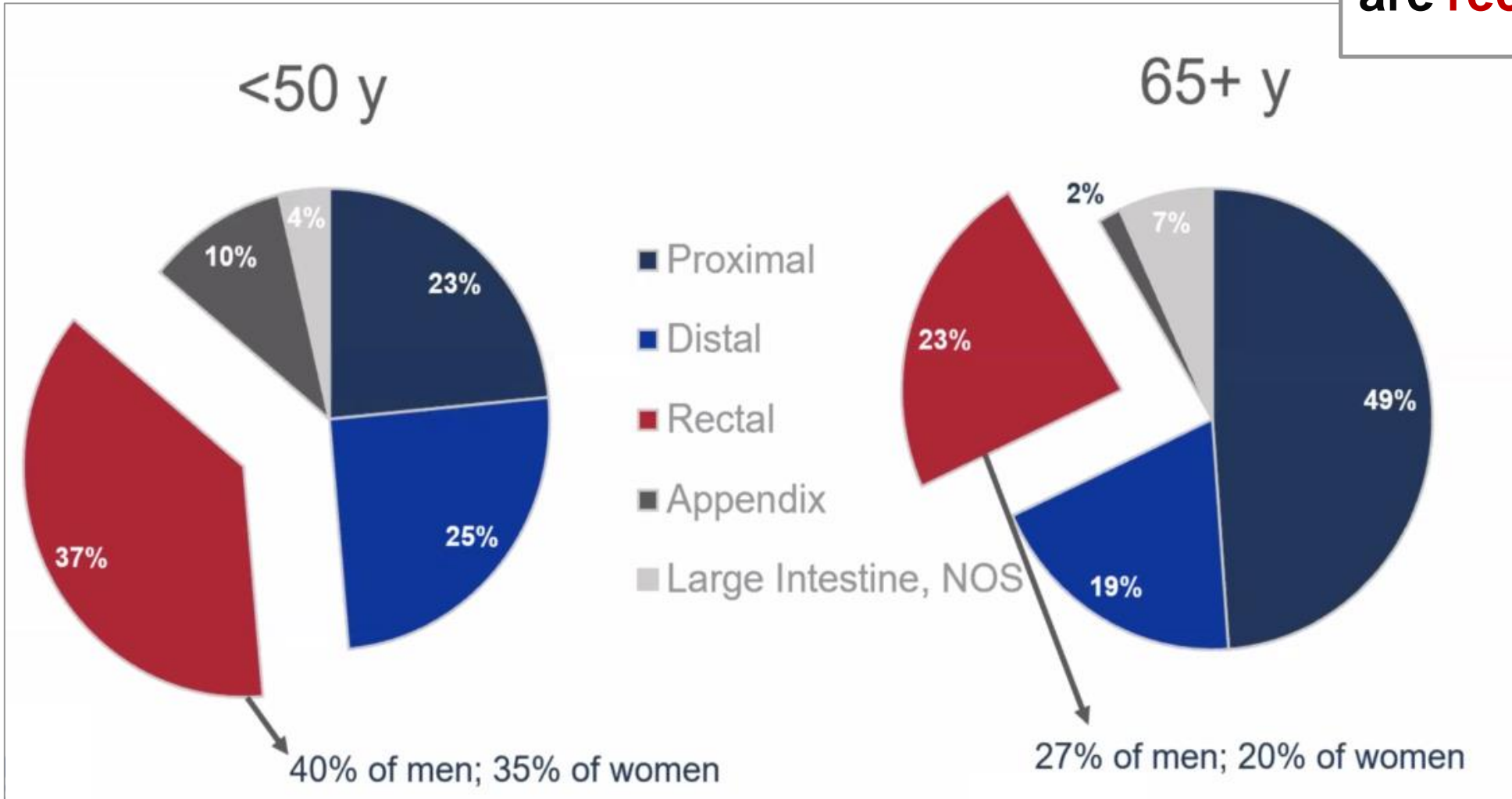
# EOCRC by Race/Ethnicity

Annual per cent change (APC)  
 Bold =  $p < 0.05$

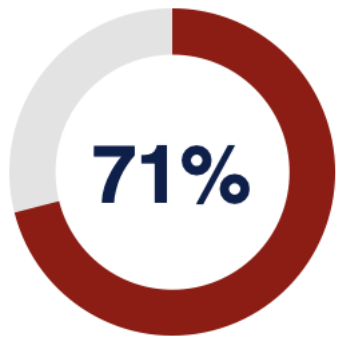


# EOCRC Subsite

**40%** of EOCRC cases are **rectal** cancer

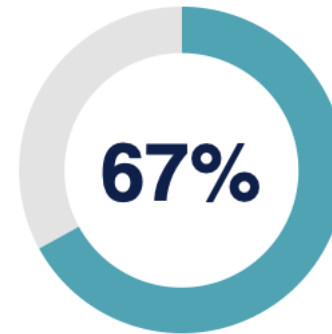


# EOCRC Clinical Diagnosis



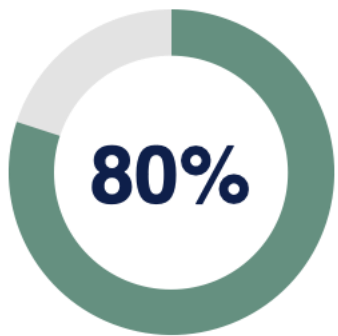
## Stage

Diagnosed at **stage III or IV.**



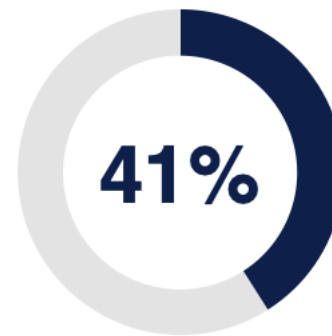
## Diagnosis Time

Visited **two physician** at least before they get the diagnosis.



## Family

Around 80% with young children



## Diagnosis Period

Waited **six months** at least when they experienced symptoms before talking to a doctor



# AGENDA

01

## EPIDEMIOLOGY

The epidemiology of EOCRC globally and in the United States.

02

## EXPOSOME

Exposures or risk factors potentially contributing to the rising risk of EOCRC.

03

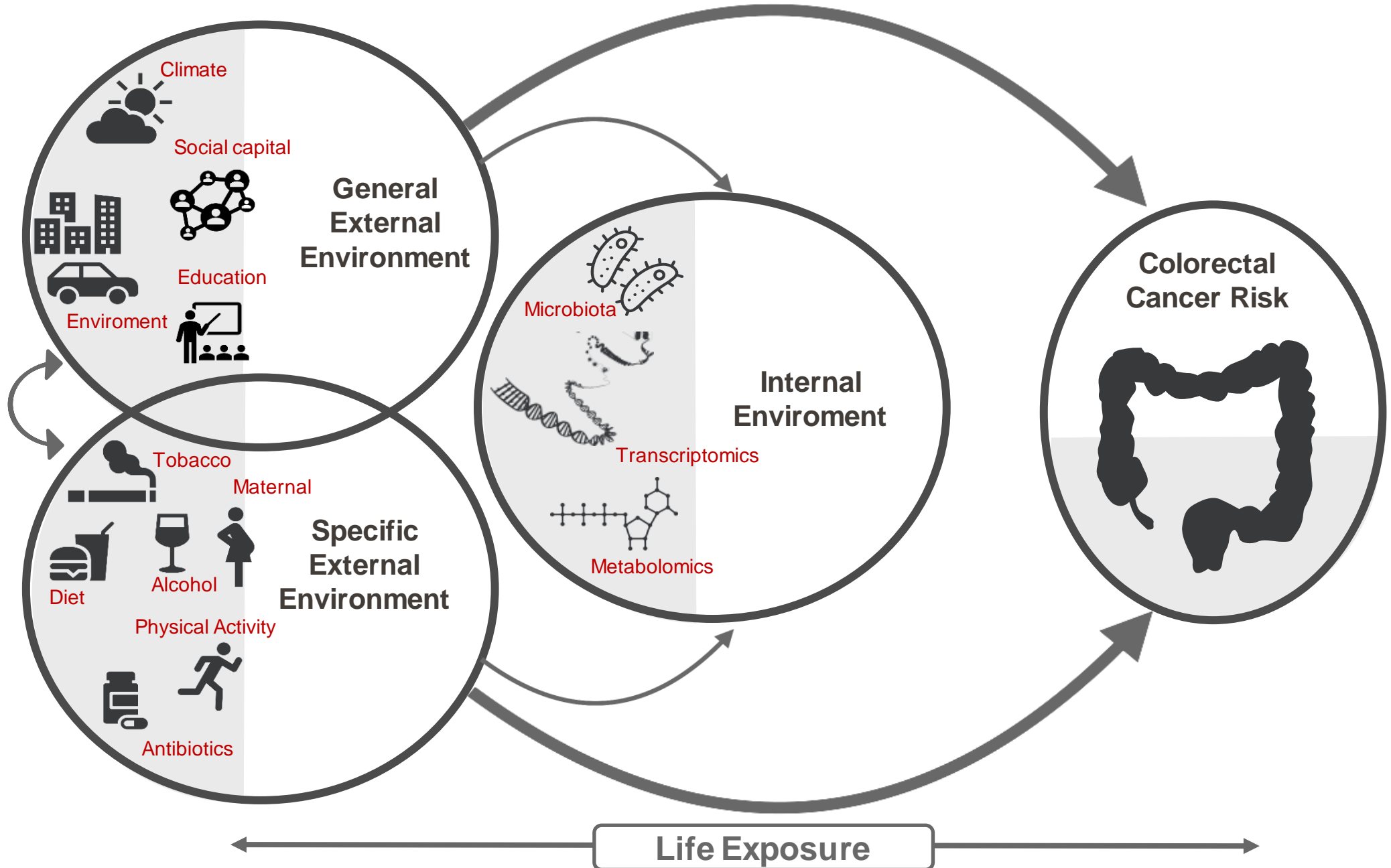
## GENETICS & EPIGENETICS

Molecular aspects of EOCRC.

04

## CONCLUSION

Remarks and recommendations

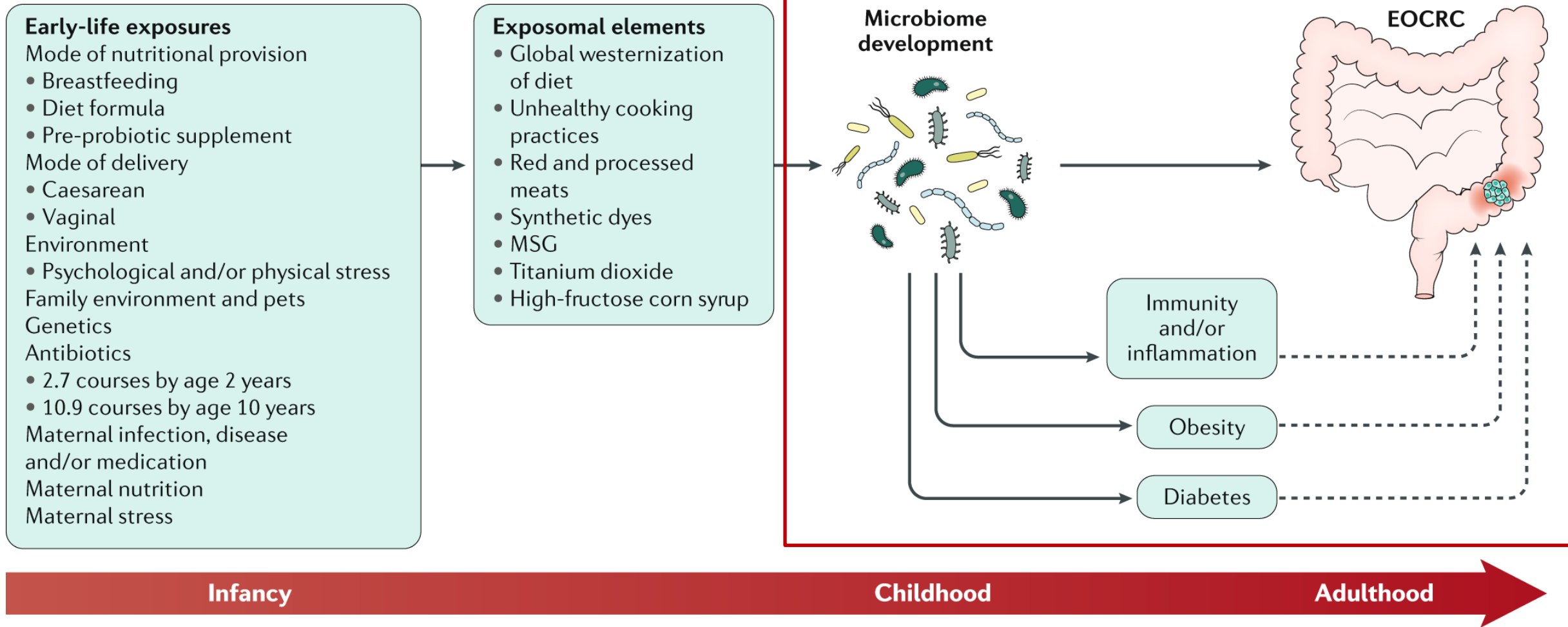


# Specific External Environment

Etiological factors	Level of evidence	Unit increase	RR (95% CI)	Temporal trend
Obesity	++	5 kg/m <sup>2</sup> in BMI	1.05 (1.03–1.07)	↑
Western dietary pattern	++	Highest vs lowest	1.12 (1.01–1.24)	Poorest in 2000s then stable
Processed meat	++	50 g per day	1.16 (1.08–1.26)	↔
Alcohol (as ethanol)	++	10 g per day	1.07 (1.05–1.09)	Peak in 1980s then ↓
Red meat	+	100 g per day	1.12 (1.00–1.25)	Peak in 1970s then ↓
Diabetes	+	Yes vs no	1.30 (1.20–1.40)	↑
Smoking	+	Current vs never	1.15 (1.00–1.32)	↓
Total physical activity	--	5 MET- hours per week	0.97 (0.94–0.99)	↔
Aspirin	--	75–1200 mg per day	0.76 (0.63–0.94)	↑
Total fiber	-	10 g per day	0.93 (0.87–1.00)	↑
Whole grain	-	90 g per day	0.83 (0.79–0.89)	↑
Total calcium	-	300 mg per day	0.92 (0.89–0.95)	↑

Keum *et al*, Nature Reviews Gastro, 2019; Daniel *et al*, Public Health Nutr, 2011; Menke *et al*, JAMA, 2015; Larson *et al*, JNCI, 2005; Albertson *et al*, Nutr J., 2016; Labarthe *et al*, Circulation 1996; Gahche *et al*, NCHS Data Brief, 2011

# Microbiome



# Molecular Features: MD Anderson + AACR GENIE + Foundation Medicine

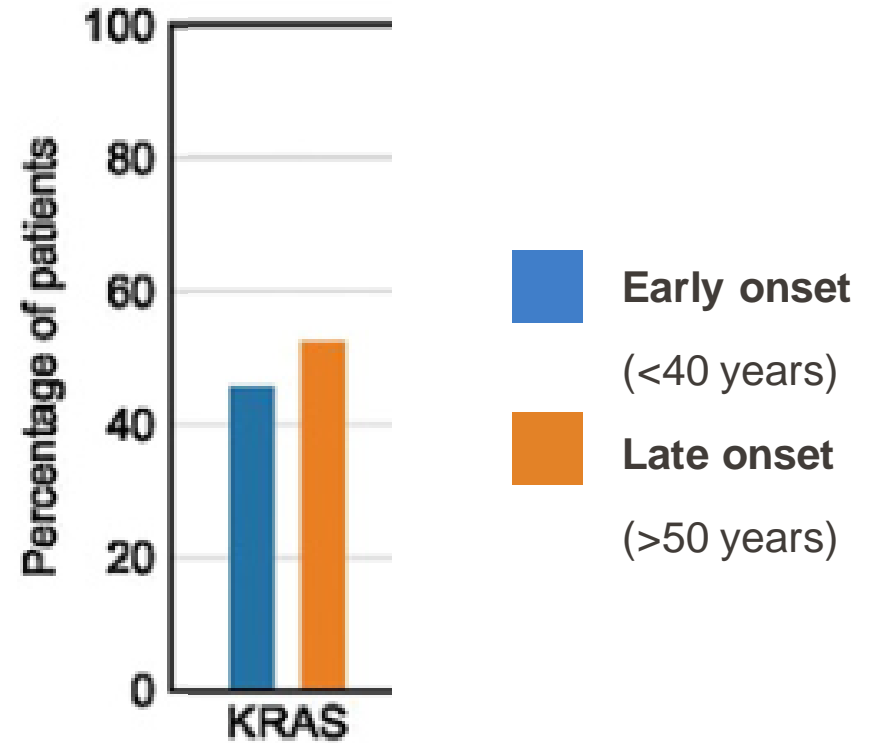
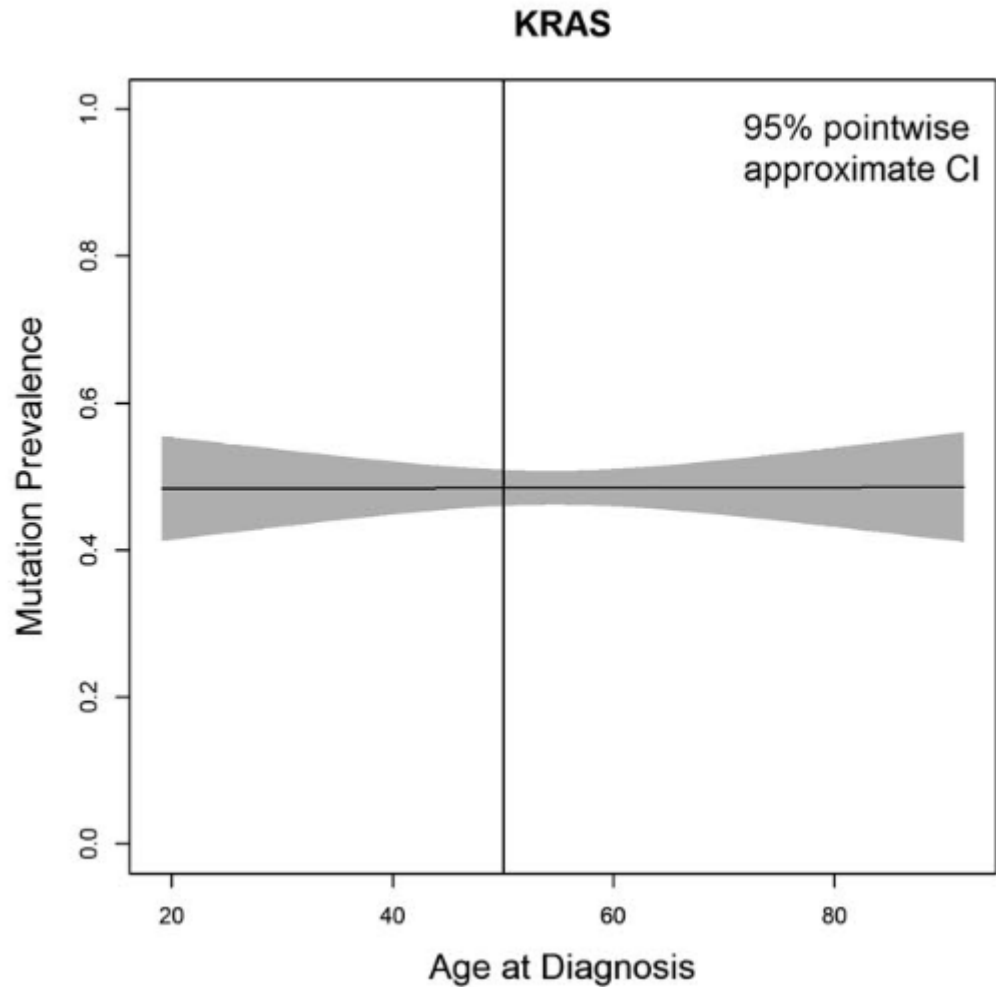
	MDACC Molecular Cohort	MDACC Tumor Registry Cohort	AACR Project GENIE Cohort	CMS Cohort
Patient Information	<ul style="list-style-type: none"> <li>N=1877</li> <li>Seen at MDACC from January 1, 2012 to September 1, 2016</li> </ul>	<ul style="list-style-type: none"> <li>N=32507</li> <li>Seen at MDACC from January 1, 1980 to present</li> </ul>	<ul style="list-style-type: none"> <li>N=1868</li> <li>Excluded patients from MDACC to prevent duplication of data</li> </ul>	<ul style="list-style-type: none"> <li>Total N=626</li> <li>N=448 from TCGA</li> <li>N=178 from MDACC</li> </ul>
Clinical Data	<ul style="list-style-type: none"> <li>Baseline clinical and pathologic characteristics</li> </ul>	<ul style="list-style-type: none"> <li>Baseline clinical and pathologic characteristics</li> </ul>	<ul style="list-style-type: none"> <li>Limited clinical and pathologic characteristics</li> </ul>	<ul style="list-style-type: none"> <li>Limited clinical and pathologic characteristics</li> </ul>
Molecular Data	<ul style="list-style-type: none"> <li>Mutational data available from 46- or 50-gene CLIA next-generation sequencing panel</li> </ul>	<ul style="list-style-type: none"> <li>Unavailable</li> </ul>	<ul style="list-style-type: none"> <li>Mutation data available from AACR Project GENIE database, which includes a mixture of next-generation sequencing platforms</li> </ul>	<ul style="list-style-type: none"> <li>RNA expression data.</li> <li>For TCGA patients, data were publicly available.</li> <li>For MDACC patients, data were obtained with Affymetrix RNA expression arrays.</li> </ul>
Cancer Stage(s)	<ul style="list-style-type: none"> <li>Stage IV</li> </ul>	<ul style="list-style-type: none"> <li>Stages I-IV</li> </ul>	<ul style="list-style-type: none"> <li>Majority stage IV</li> </ul>	<ul style="list-style-type: none"> <li>Stages I-IV</li> </ul>
Additional Data	<ul style="list-style-type: none"> <li>Comorbid predisposing condition information available for patients &lt; 50 years</li> </ul>			<ul style="list-style-type: none"> <li>Classification by CMS subtype</li> </ul>

## Foundation Medicine

18,218 total patients

- 1,420 patients under the age of 40
- 3,248 between 40 and 49
- 13,550 age 50 and older

# No significant difference in *KRAS*, *NRAS* mutations

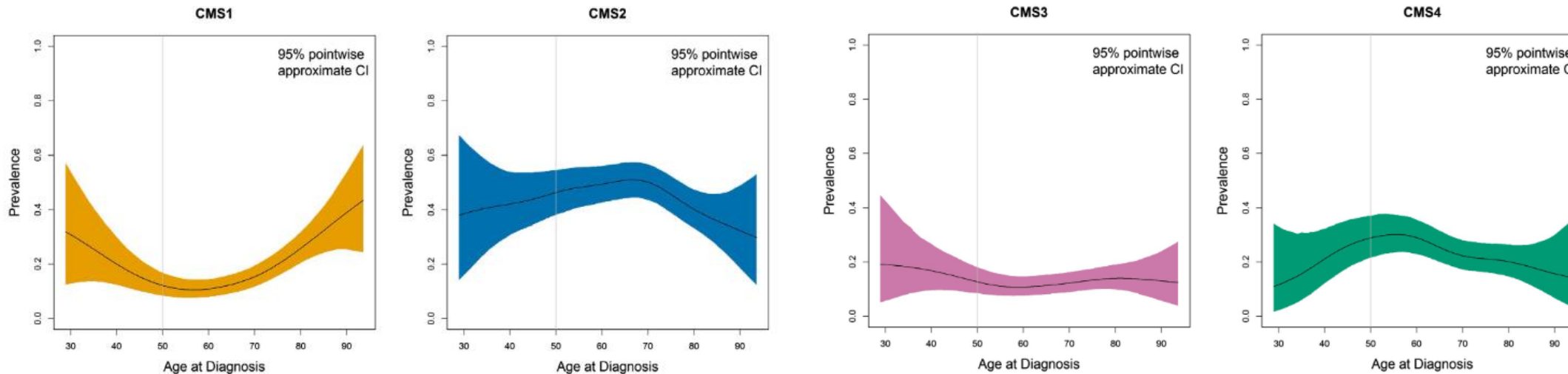


# Foundation One molecular testing

**Table 1.** Significant alterations and alterations in genes of interest between cohorts using false discovery rate (FDR) in MSS colorectal cancer (CRC) and MSI-H colorectal cancer

<b>Alteration rates in the MSS cohort</b>			
<b>Gene</b>	<b>Rate observed in under 40 group (%)</b>	<b>Rate observed in 50 and over group (%)</b>	<b>FDR</b>
<i>TP53</i>	82.3	76.7	1.56E–05
<i>APC</i>	65.8	79.7	4.84E–26
<i>KRAS</i>	45.6	52.4	1.56E–05
<i>PIK3CA</i>	14.1	17.5	0.002959601
<i>CTNNB1</i>	4	2.7	0.013488987
<i>BRAF</i>	5.2	7.7	0.002067048
<i>FAM123B</i>	2	6.8	1.35E–12
<i>NRAS</i>	3.7	4.6	0.171847712

# Consensus Molecular Subtypes Differences: Higher CMS1



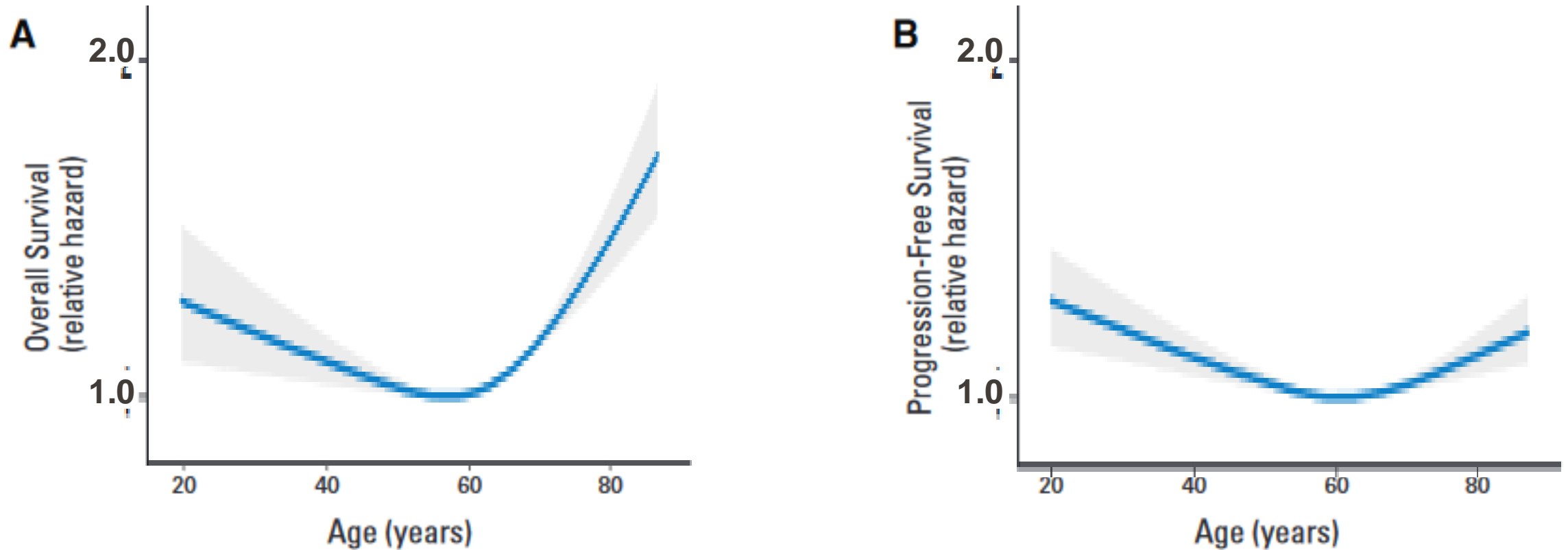
**TABLE 1.** Baseline Characteristics of the MDACC Molecular Cohort Classified by Age

Characteristic	Age						<i>P</i>
	18-29 y	30-39 y	40-49 y	50-59 y	60-69 y	≥70 y	
Patients, No. (%)	46 (2)	177 (9)	411 (22)	605 (32)	454 (24)	184 (10)	
MSI-H (n = 1525, 81% known), No. (%)	3 (7)	12 (8)	23 (3)	11 (2)	13 (4)	6 (4)	.038

High CMS1 despite low rates of MSI-H



# Overall survival and progression-free survival from diagnosis of mCRC is worse for EOCRC patients



20,003 patients from 24 first line studies of mCRC (ARCAD database)

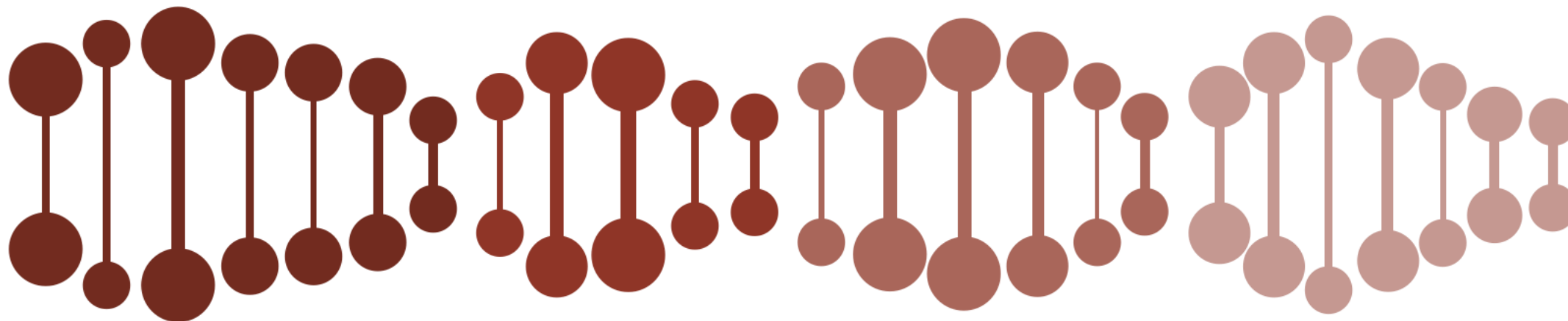
# Are we overtreating Young Adults with Colon Cancer?

More intense treatments with unmatched survival gains

**Table 2. Likelihood of Receiving Postoperative Systemic Chemotherapy and Multiagent Regimens for Young Adults (Ages 18-49 Years at Diagnosis) vs Older Adults (Ages 65-75 Years at Diagnosis) With Colon Cancers<sup>a</sup>**

Patients Who Received Chemotherapy	Any Chemotherapy, No. (%)	Odds Ratio for Receiving Chemotherapy (95% CI)	Multiagent Regimens, No. (%)	Odds Ratio for Receiving Multiagent Regimen (95% CI)
<b>Stage I</b>				
Ages 65-75 y (n = 8991)	162 (1.8)	1 [Reference]	52 (43.0)	1 [Reference]
Ages 18-49 y (n = 1926)	109 (5.7)	2.88 (2.21-3.77)	43 (48.3)	1.38 (0.71-2.68)
<b>Stage II Overall</b>				
Ages 65-75 y (n = 11 011)	2748 (25.0)	1 [Reference]	773 (41.7)	1 [Reference]
Ages 18-49 y (n = 3083)	1732 (56.2)	3.93 (3.58-4.31)	670 (54.9)	1.71 (1.48-1.97)
<b>Stage II Low Risk</b>				
Ages 65-75 y (n = 4822)	923 (19.1)	1 [Reference]	313 (39.6)	1 [Reference]
Ages 18-49 y (n = 1636)	826 (50.5)	4.22 (3.70-4.81)	388 (52.5)	1.67 (1.34-2.09)

# What We Need to Do?



**01**

## **Etiology**

unknown to the majority  
of ~ 80%

**02**

## **Risk Factor**

No known major risk  
factor

**03**

## **Mechanism**

No known differences in  
driver mechanisms

**04**

## **Evolution**

Unknown in EOCRC



**Multi-omics**

# Conclusion

- Early onset CRC is associated with unique clinical features and presentation
- Epidemiology suggests that this is not limited to US population, and that the impacts are across a diverse racial/ethnic groups.
- This rising incidence is in contrast to the gains being made in CRC prevention of screening age population
- Multiple etiologies have been proposed, but not yet clearly defined
- Molecular features are modestly different at the transcriptomic and mutational level, but do not provide clear clues yet
- Outcomes with treatment also vary, and yet overtreatment is a risk. Alignment of the treatments with the disease biology is needed



# Thank You

[nccrt.org](http://nccrt.org) @NCCRTnews #80inEveryCommunity

# Early-Onset Colorectal Cancer: Earlier Detection & Pathways to Prevention

**Cassandra Fritz, MD, MPHS**

Assistant Professor of Medicine

Division of Gastroenterology

Washington University School of Medicine in St. Louis

# Early-Onset Colorectal Cancer: Earlier Detection & Pathways to Prevention

**Cassandra D.L Fritz, MD, MPHS**  
**Assistant Professor of Medicine**  
**Washington University in St. Louis**

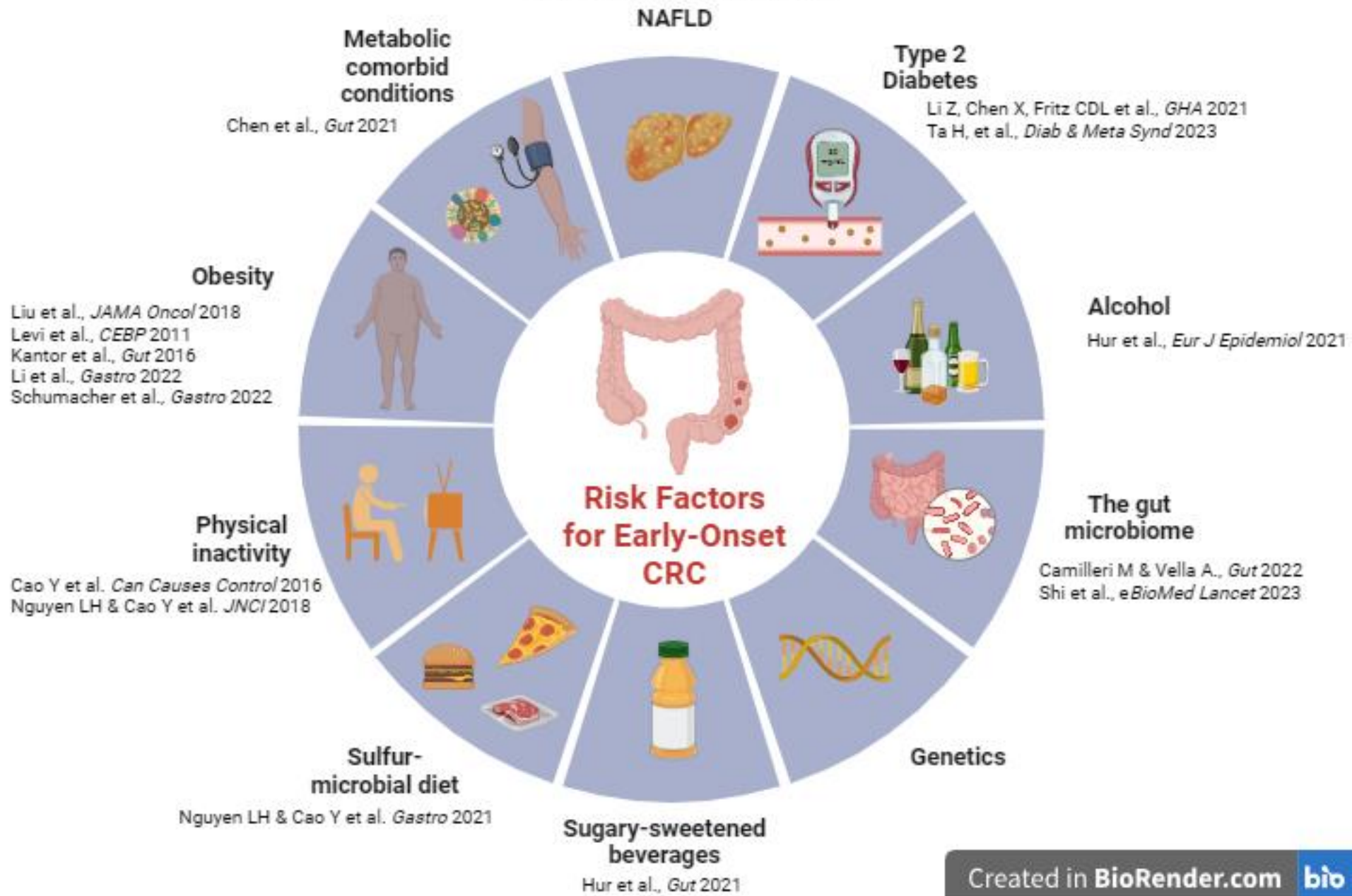
Department of Medicine  
Division of Gastroenterology

No Financial Disclosures

# Outline

- Pathway to detection of early-onset colorectal cancer
- Signs and symptoms & Diagnostic intervals
- Opportunities for improvement
- Primary prevention

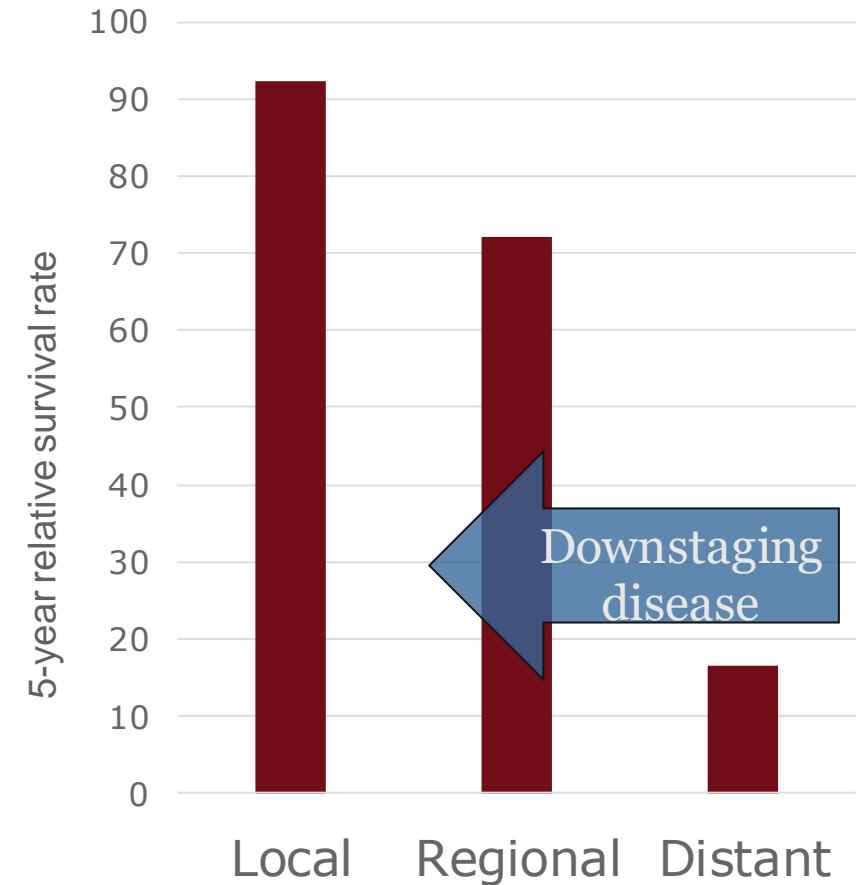
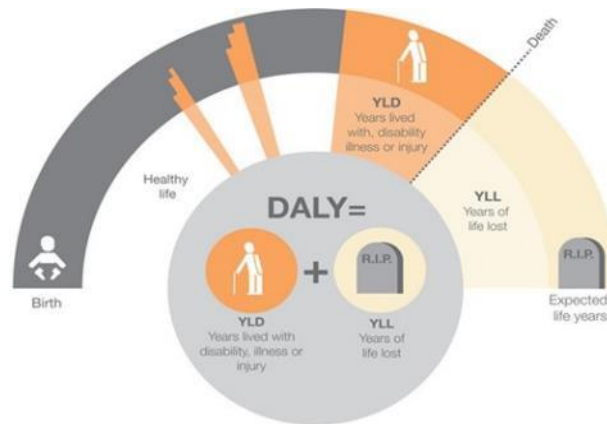




Created in **BioRender.com**

# 5-year Relative Survival of Early-onset Colorectal Cancer (20-49 years of age) by Stage at Diagnosis SEER 13, 1992-2013

- Morbidity and mortality are significant
- High mortality with later-stage disease
- Early-onset CRC is in the top 5 ranking cancers associated with high disability-adjusted life years (DALYs)

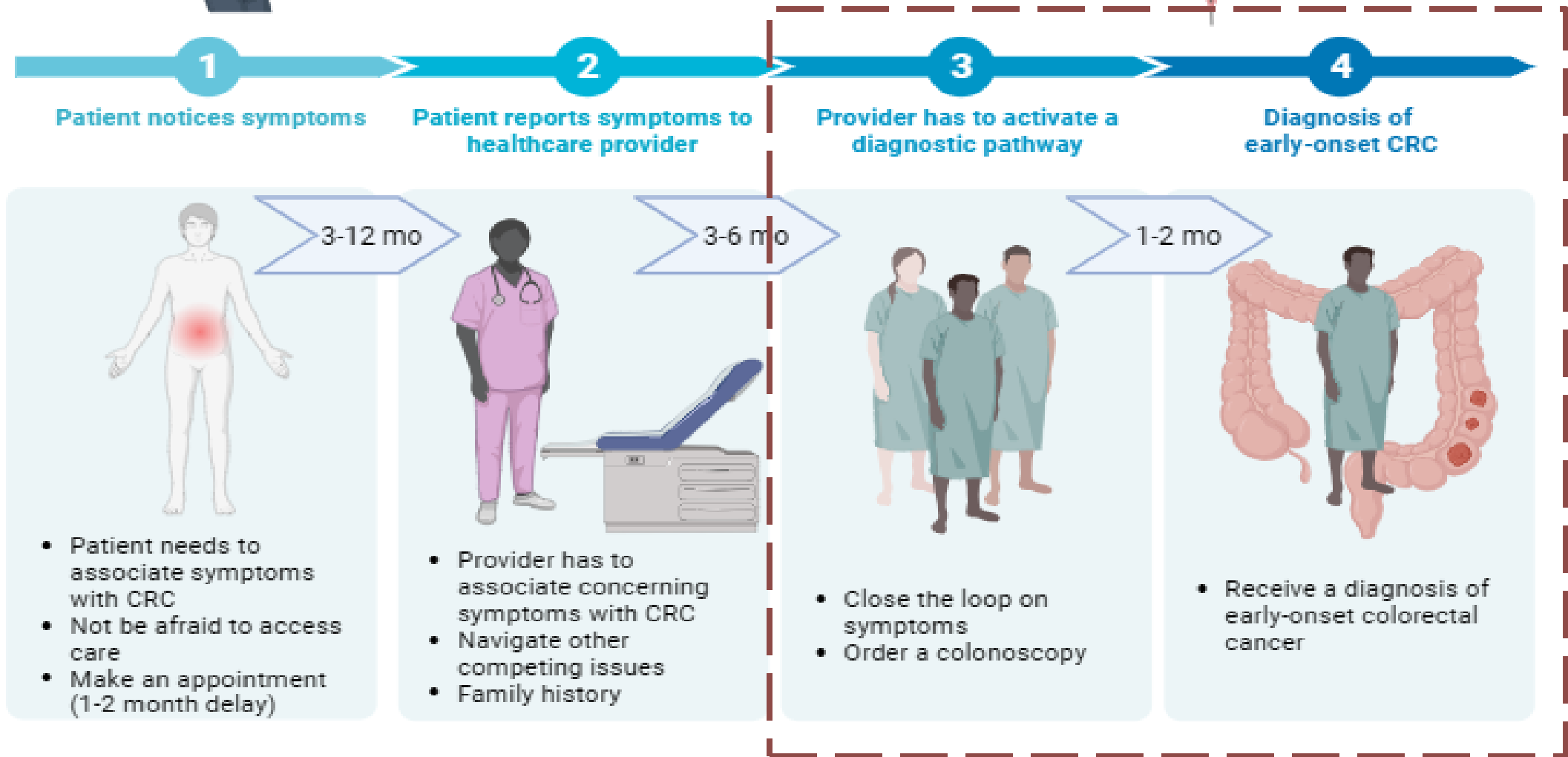
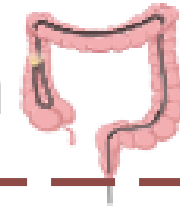


Cheng E. et al., JAMA Network Open. 2021  
Zhao J. et al., BMJ Oncology 2023

Zaki T et al. CGH. 2023



# From Symptoms to Detection



# Signs and Symptoms of Early-Onset Colorectal Cancer

**Objective:** To identify signs & symptoms with early-onset CRC and report associated diagnostic intervals 3 months to 2 years before diagnosis.

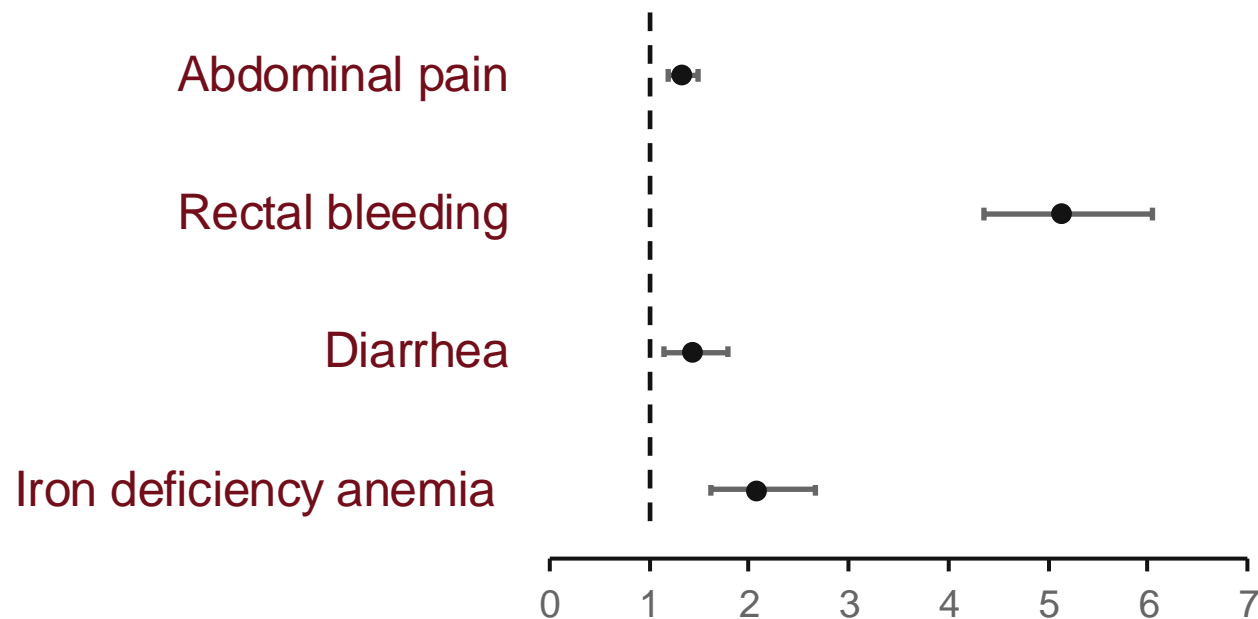
## Methods

- MarketScan commercial database including adults aged 18 to 49 years.
- Required at least 2 years of continuous enrollment prior to the index date (pathology diagnosis of CRC).
- Nested case-control study of 5075 incident early-onset CRC and 22378 matched controls.
- Multivariable logistic regressions
- Examined the median diagnostic intervals based on associated signs and symptoms.

# Early signs/symptoms for Early-Onset CRC

## Claims data, nested case-control, 2005-2016

### 4 Red-Flag Signs and Symptoms, 3mo to 2 years prior to index date



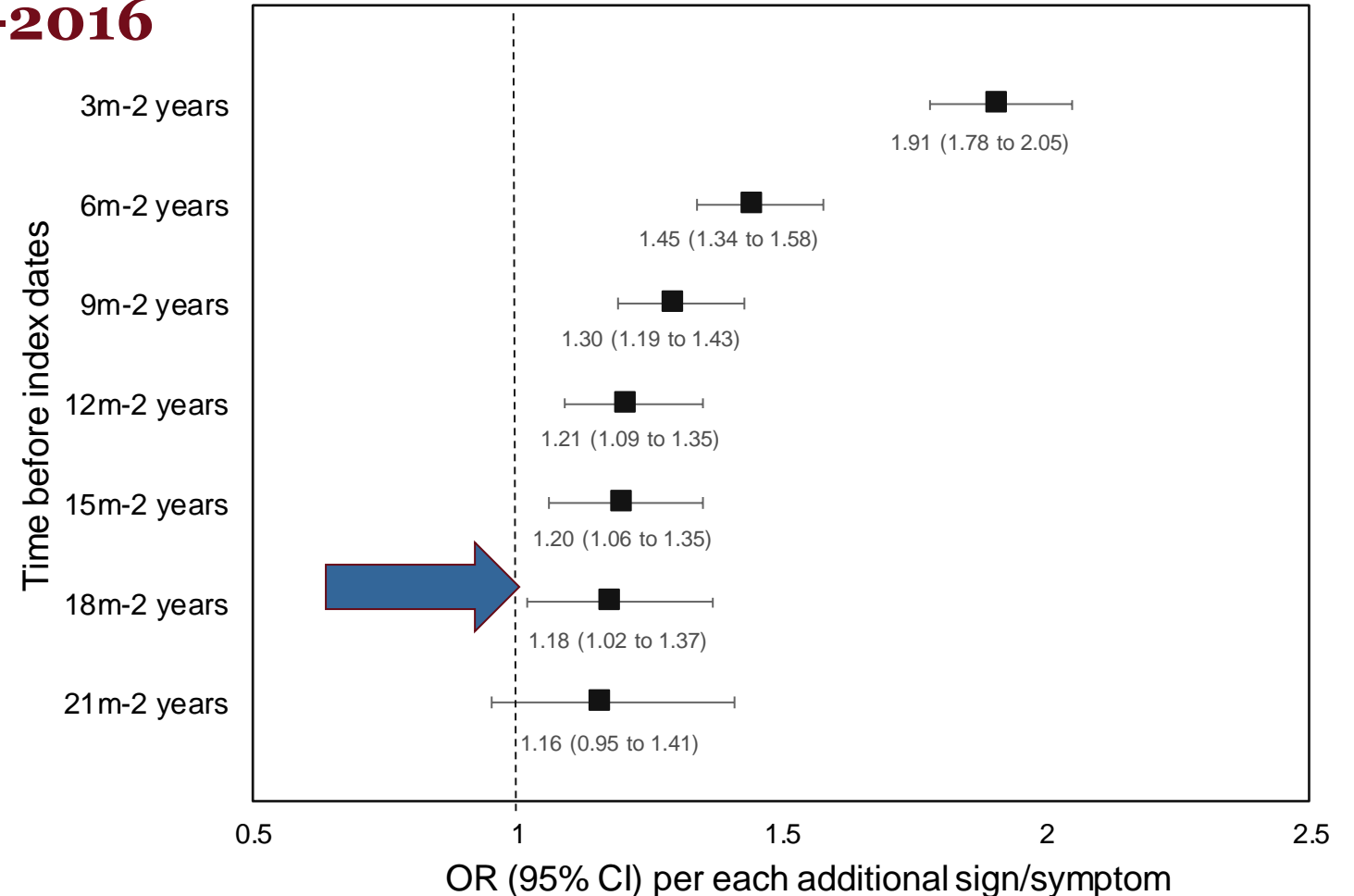
No. of red-flag signs/symptoms	OR (95% CI)
All participants	
0	1 (reference)
1	1.94 (1.76 to 2.14)
2	3.59 (2.89 to 4.44)
≥3	6.52 (3.78 to 11.23)
<b>Per each additional sign/symptom</b>	<b>1.91 (1.78 to 2.05)</b>
<b>P<sub>trend</sub></b>	<b>&lt;0.001</b>

Fritz CDL & Otegbeye *et al*, JNCI 2023

# Number of Red-flag Signs/Symptoms and Risk of Early-Onset Colorectal Cancer

## 3-month time intervals prior to the index date

### Claims data, cases only, 2005-2016



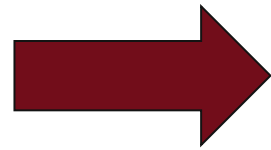
Fritz CDL & Otegbeye *et al*, JNCI 2023

# Duration of Signs and Symptoms in Young Adults

## Claims data, cases-only, 2005-2016

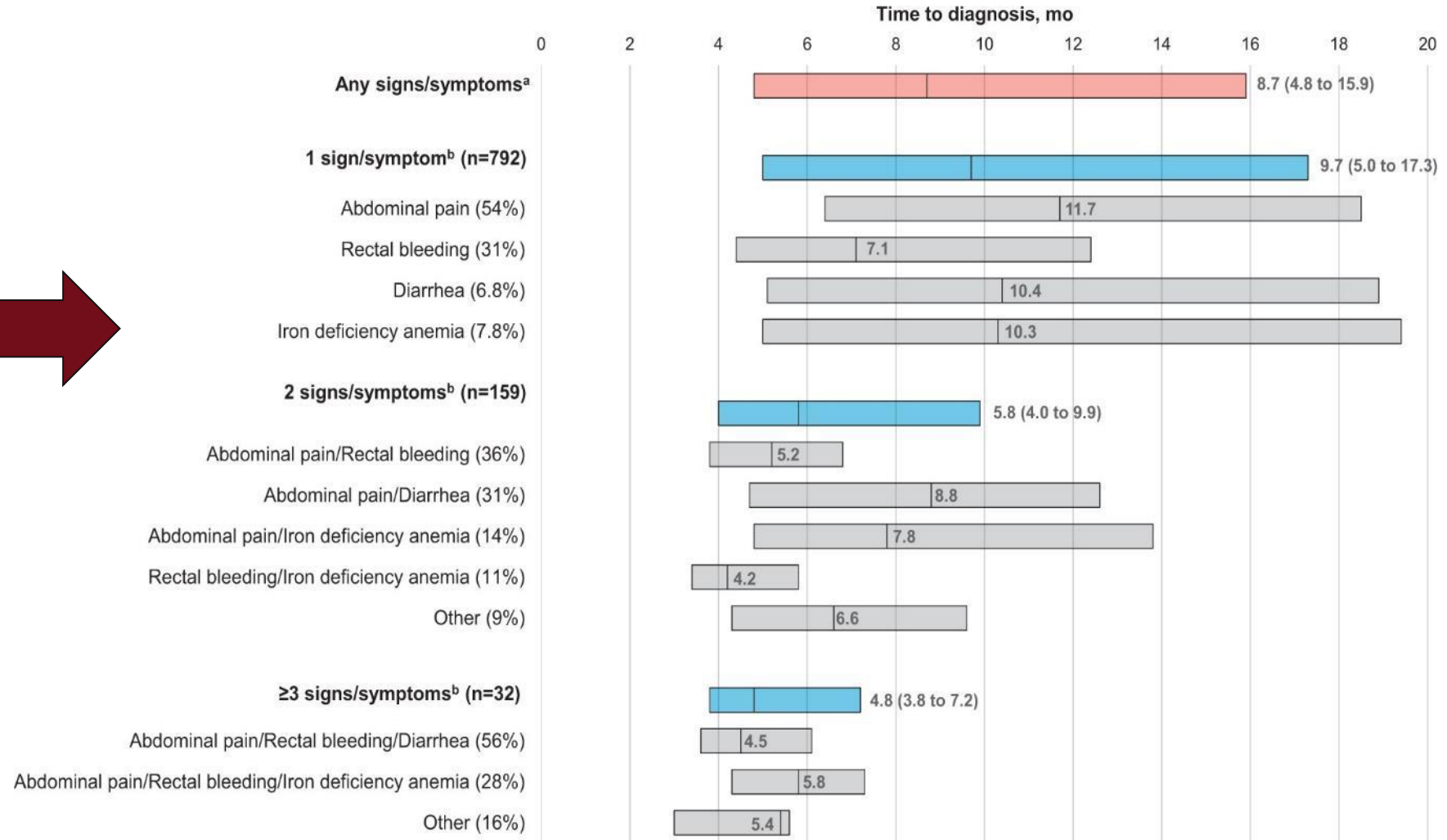
**19%**

of early-onset CRC cases reported their **first symptom > 3 months prior to diagnosis**



**50%**

of early-onset CRC cases reported their first symptom **< 3 months**

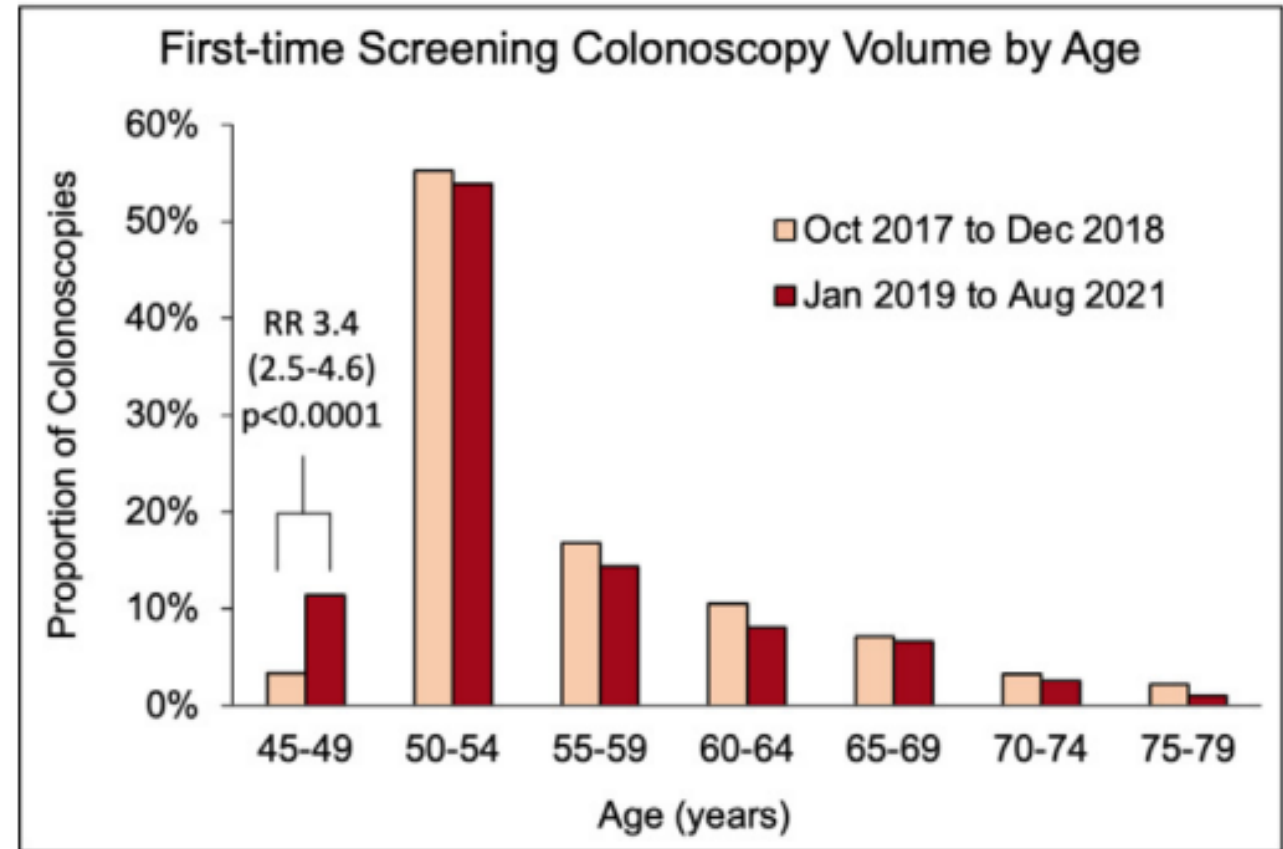


# Current Prevention Approach

Lowered CRC screening age to 45 years

~50% of early-onset CRC cases are diagnosed <45 years

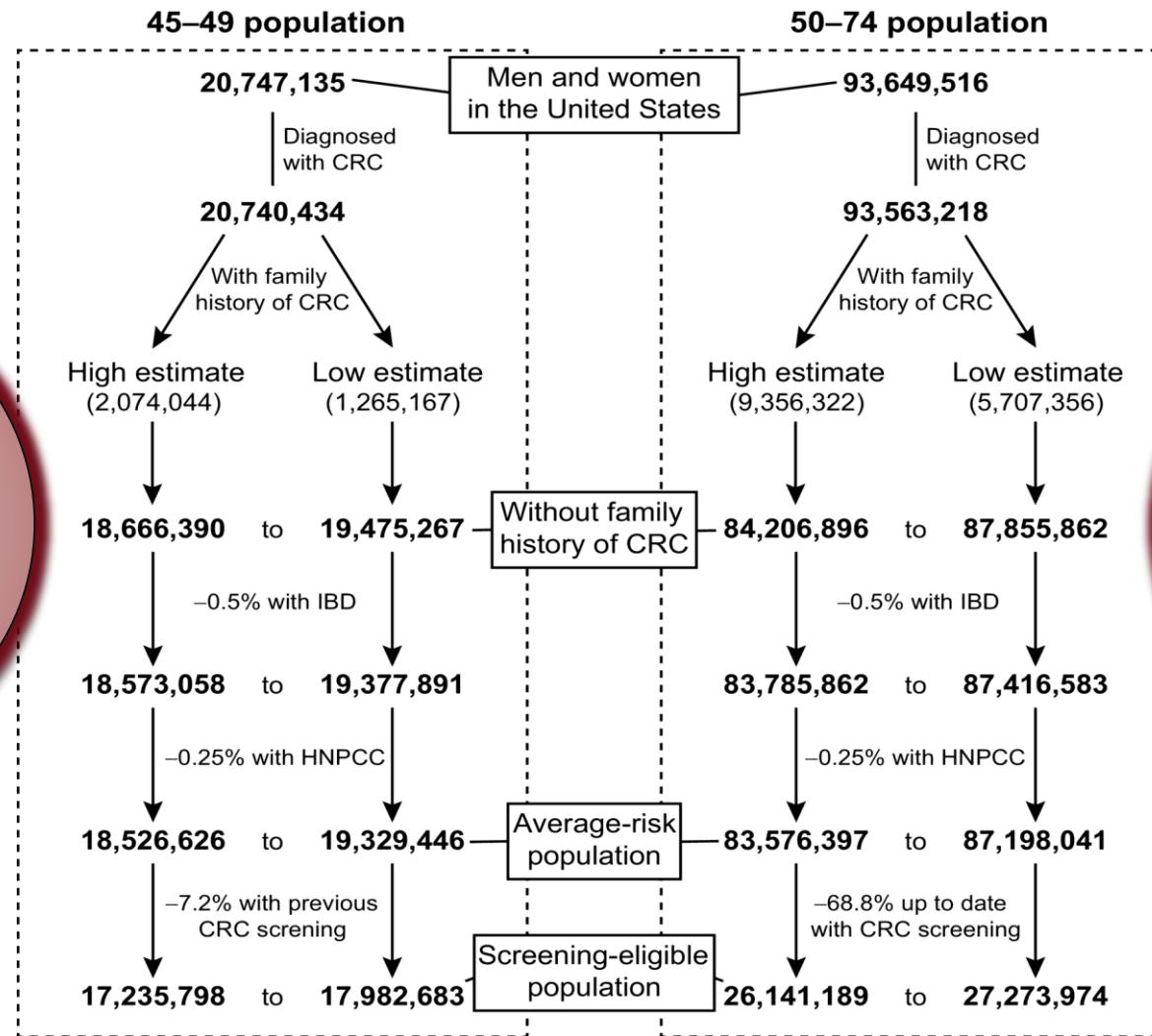
Screening in younger individuals has had slow uptake





# Estimating the Screening-Eligible Population Size, Ages 45–74, at Average Risk to Develop CRC in the United States

~20 million people aged 45-49 years + 27 million 50-74 years



60% increase in the “average-risk” screening pool size

Piscitello A. et al. Cancer Prev Res. 2020

# Do we have the resources?

Potentially, if we leverage stool-based testing

## Screening for CRC in the U.S.: Time trend by type of test

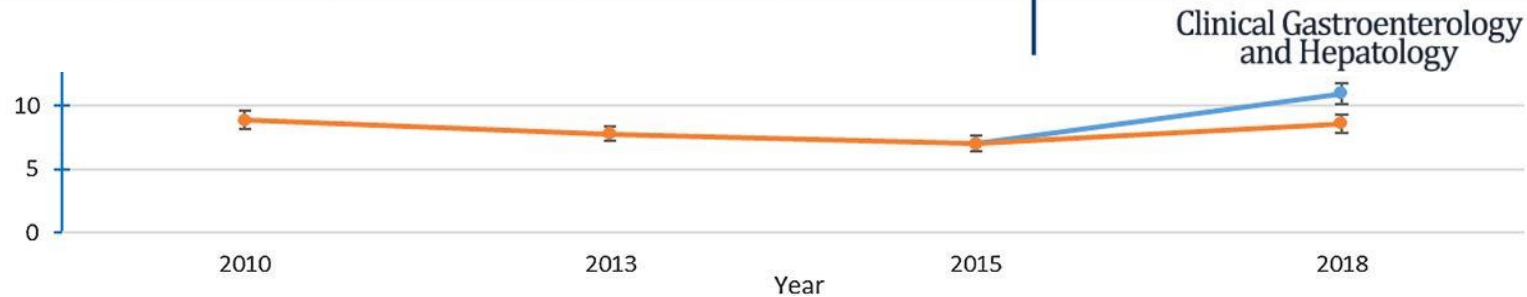


### US MSTF Five Recommended Tests

	MULTITARGET STOOL DNA TEST EVERY 3 YEARS	COLON VIDEO CAPSULE EVERY 5 YEARS	COLONOSCOPY EVERY 10 YEARS	FIT EVERY YEAR	COLON CT SCAN EVERY 5 YEARS
40-49 yo	34.6%	28.2%	13.7%	12.2%	11.3%
≥50 yo	37.3%	22.9%	13.6%	18.7%	7.6%

### US MSTF Tier 1 Tests

	FIT EVERY YEAR	COLONOSCOPY EVERY 10 YEARS
40-49 yo	68.9%	31.1%
≥50 yo	77.4%	22.6%

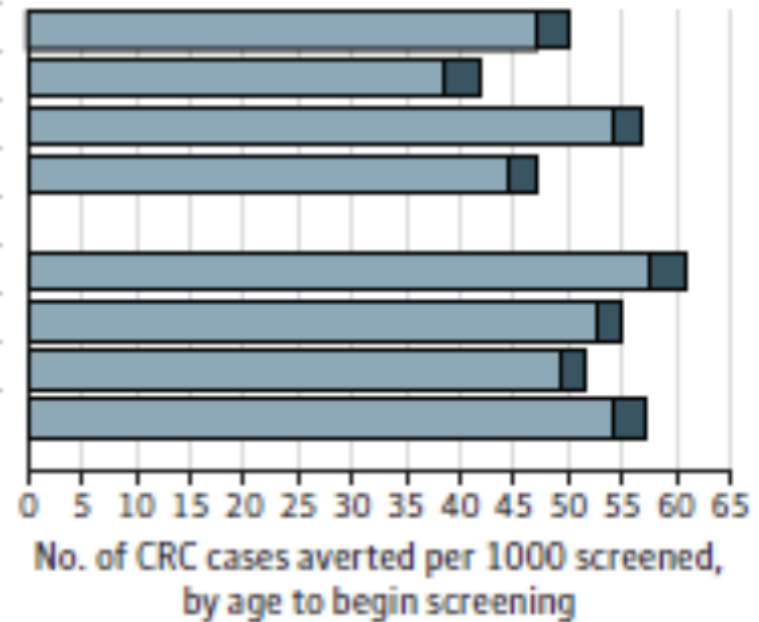


Shapiro JA, et al. *Cancer Epidemiol Biomarkers* 2021  
Makaroff KE et al. *CGH* 2022

# Screening: No difference between colonoscopy vs. FIT for additional early-onset CRC cases averted

**B** Benefit: Estimated No. of CRC cases averted per 1000 individuals screened<sup>a</sup>

Screening modality and frequency	Mean CRC cases averted if start screening <sup>b</sup>		Additional CRC cases averted if start screening at age 45 y
	At age 50 y	At age 45 y	
<b>Stool tests</b>			
FIT every year	47	50	3
HSgFOBT every year <sup>c,d</sup>	39	42	3
sDNA-FIT every year	54	57	3
sDNA-FIT every 3 y <sup>d</sup>	44	47	3
<b>Direct visualization tests</b>			
COL every 10 y	58	61	3
CT colonography every 5 y	53	55	2
Flexible SIG every 5 y	49	51	2
Flexible SIG every 10 y plus FIT every year	54	57	3

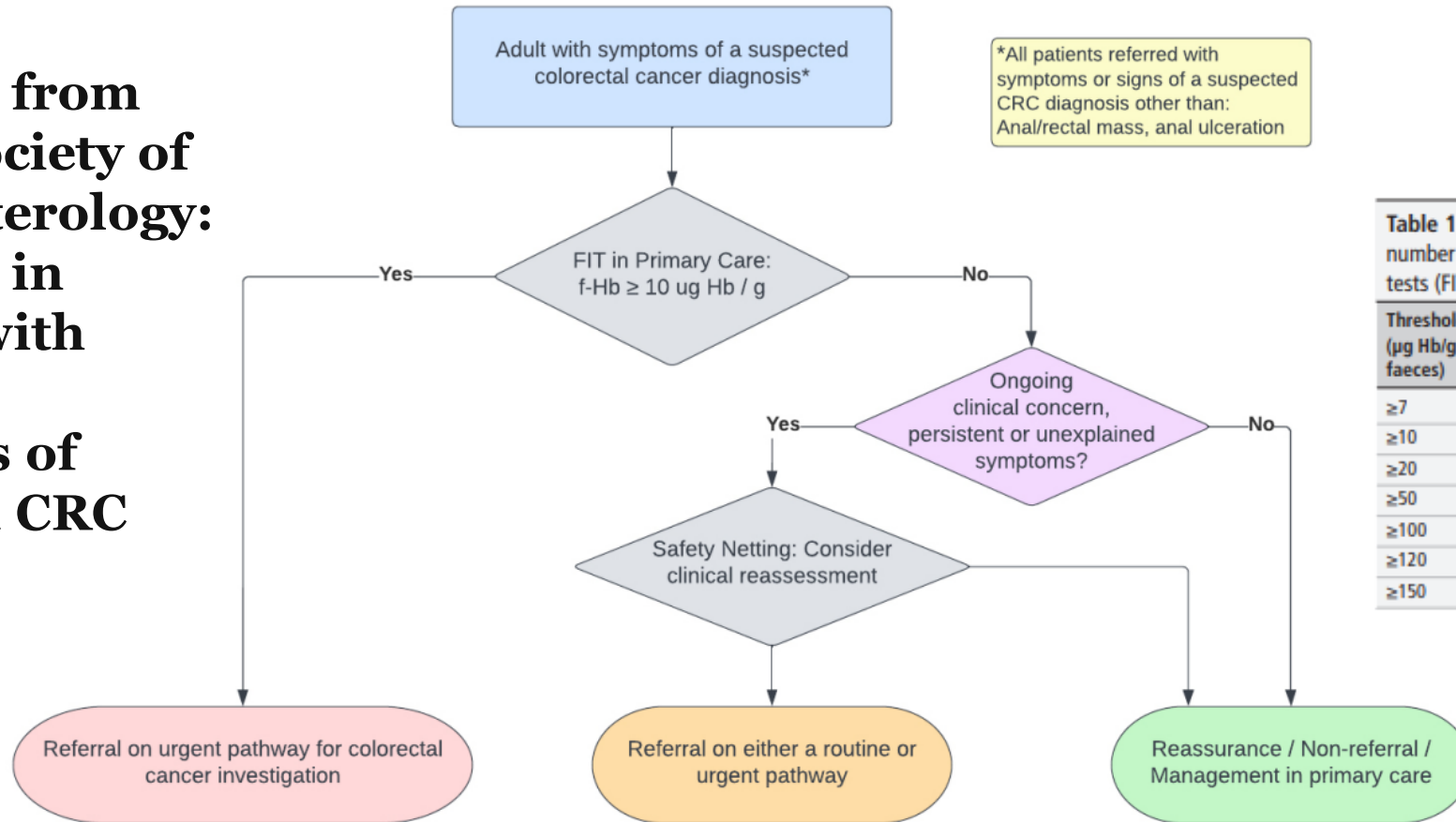


Knudsen AB. JAMA. 2021

# Opportunity to leverage FIT for diagnostic pathways?

- Likely yes but we don't have the data for early-onset CRC population

## Guideline from British Society of Gastroenterology: Using FIT in patients with signs and symptoms of suspected CRC



**Table 1** Number needed to scope (NNS) to detect one cancer and number of missed cancers (NMC) per 1000 faecal immunochemical tests (FITs) at various thresholds of FIT<sup>17</sup>

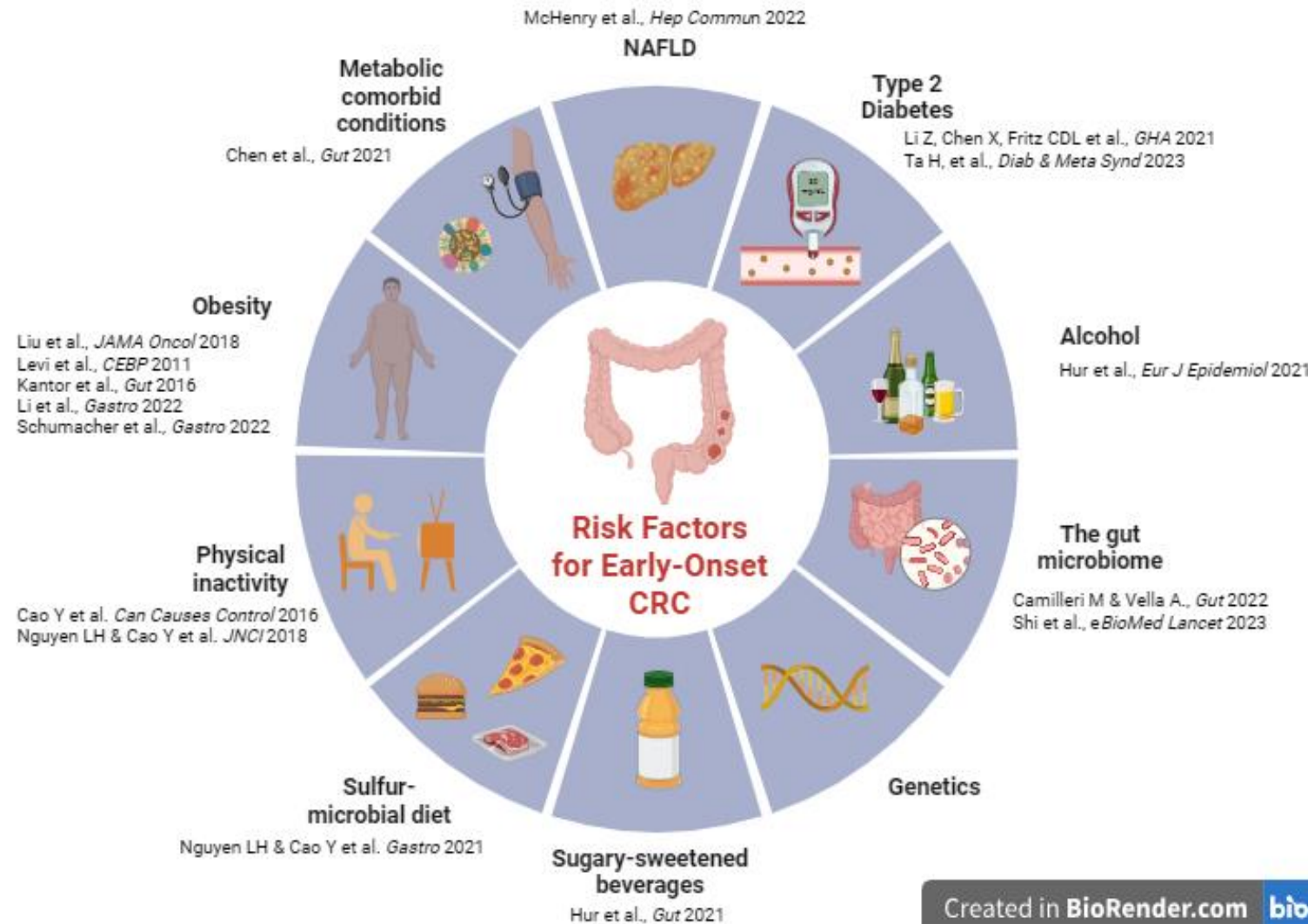
Threshold (µg Hb/g faeces)	Positive FITs n (%)	Negative FITs n (%)	Cancers detected n (%)	NNS to detect one cancer	NMC per 1000 FITs
≥7	111 (11)	889 (89)	10 (91)	11	1
≥10	96 (10)	904 (90)	10 (91)	10	1
≥20	71 (7)	929 (93)	9 (85)	8	2
≥50	44 (4)	956 (96)	8 (74)	6	3
≥100	30 (3)	970 (97)	7 (61)	5	4
≥120	28 (3)	972 (97)	6 (57)	5	5
≥150	25 (2)	975 (98)	6 (54)	4	5

Monahan KJ et al., Gut 2022

# Primary Prevention

Mitigation of risk factors

Chemopreventative agents



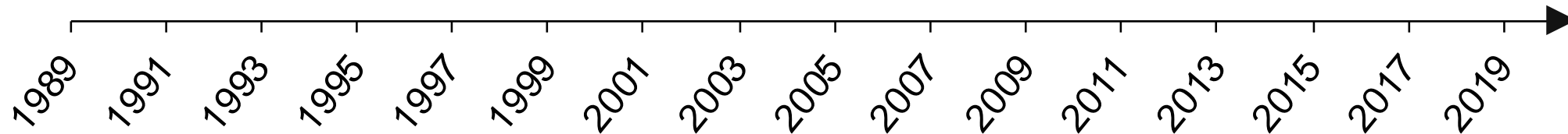
Created in **BioRender.com** **bio**

# Methods: Study population

**Nurses' Health Study II (NHSII):** N=116,429 | age 25-42 in 1989



NSAID/aspirin every two years .



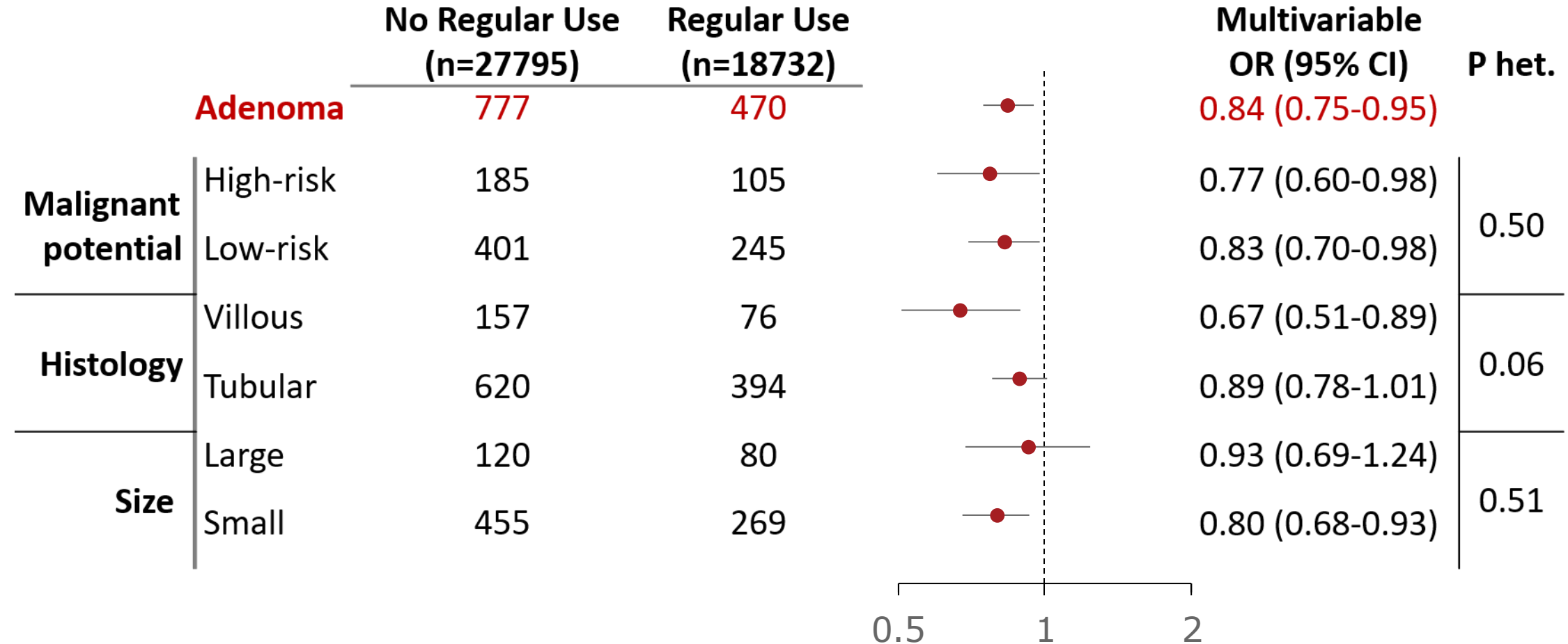
Lower endoscopy every two years



A sub-cohort of 32,058 women in NHS II with a lower endoscopy before age 50 between 1991-2015

- Excluded patients with CRC, inflammatory bowel disease, or missing medication info.

# Regular use (2+times/week) of aspirin or NSAIDs and risk of early-onset adenoma, NHSII, 1991-2015

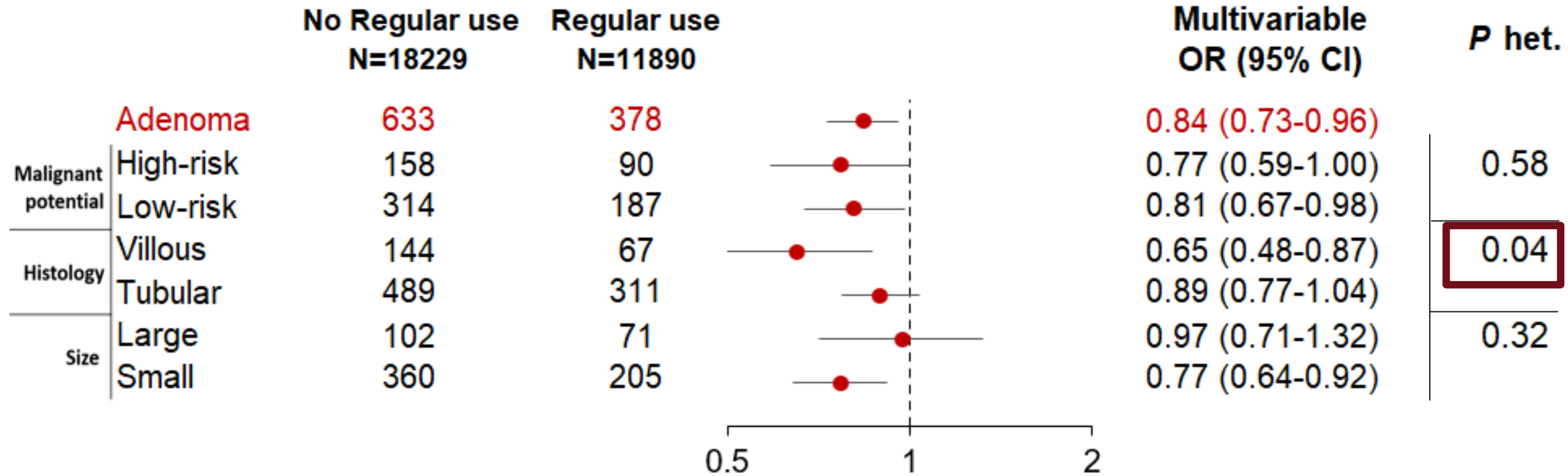


DO NOT POST

Fritz et al., unpublished

# Regular use (2+times/week) of aspirin or NSAIDs and risk of early-onset adenoma, NHSII, 1991-2015

## First endoscopy



DO NOT POST

Fritz et al., unpublished



# Chemoprevention for early-onset CRC



Regular aspirin/NSAID use (2+ times/week) was associated with a lower risk of early-onset adenomas, especially those with advanced histology



Evaluate aspirin/NSAIDs as promising agents for chemoprevention of early-onset CRC

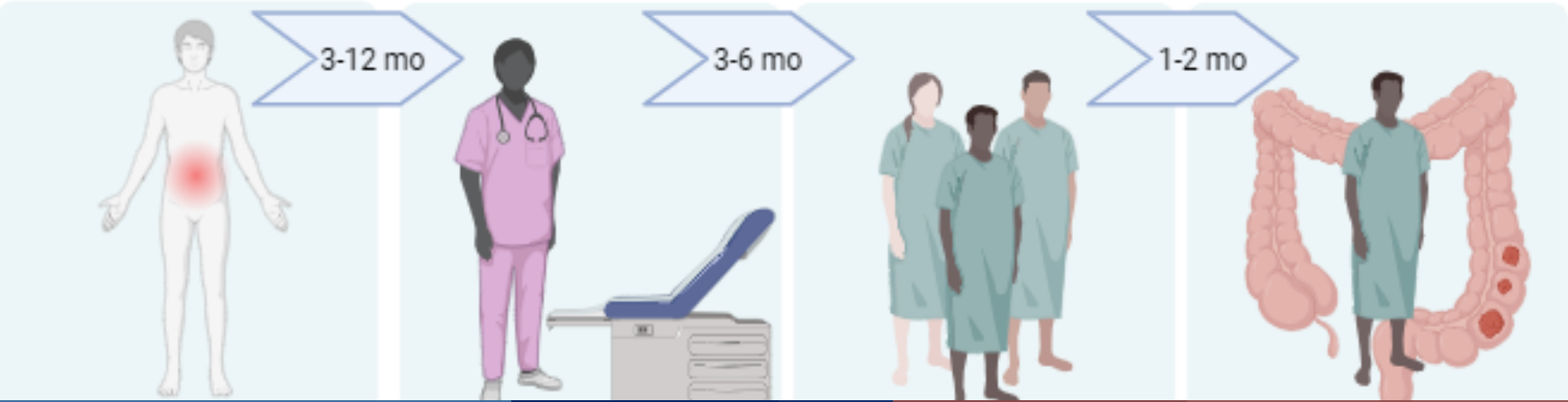
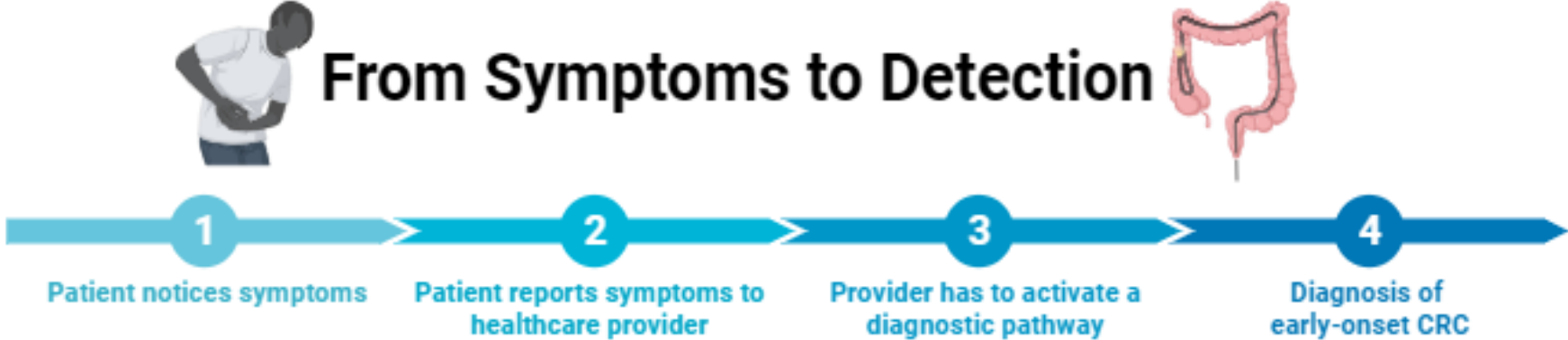
- Gender, racial/ethnic diversity
- Dose and duration for young adults
- Precision-based strategies

# Moving the needle on early-onset CRC



- Increased inclusion of minority populations into research and dissemination and implementation strategies
- Consider risk prediction models that incorporate family history, social vulnerability, risk factors, and genetics
- Change the conversation
  - Increase awareness of early-onset CRC & associated signs and symptoms
  - Targeting resources
  - System-level and population-level interventions

# Conclusions



- Increase awareness in general public and among front-line providers about signs & symptoms
- Encourage patients to accept interval
- Close the loop on no resolution -> symptoms
- Decrease delay in diagnostic interval
- Potential to utilize FIT as a risk stratifying step within the diagnostic pathway
- Urgent endoscopy referral

# Conclusions



**Risk factor mitigation**

**Chemoprevention**

**FIT for screening**

3-12 mo      3-6 mo      1-2 mo

- Increase awareness of symptoms & signs among the public and among providers about signs & symptoms
- Close the loop on symptoms, no resolution -> dx pathway
- Decrease delay in diagnostic interval
- Encourage patients to make an appointment
- Potential to utilize FIT as a risk stratifying step within the diagnostic pathway
- Urgent endoscopy referral

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# Thank You

[nccrt.org](http://nccrt.org) @NCCRTnews #80inEveryCommunity



# Q&A



# Table Talk Questions

1. What can our organizations do to take what we've learned about lead time messaging and EAO CRC signs and symptoms to make an impact in our communities?
2. What are some success stories from organizations that have specifically targeted EAO CRC awareness and processes that lead to timely diagnosis?