

Frequency and co-occurrence of younger age and CRC screening barriers: A systematic review and bibliometric analysis

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BACKGROUND

- In response to rising colorectal cancer (CRC) incidence rates in younger adults, the United States Preventive Services Task Force (USPSTF) recently recommended initiating average-risk CRC screening at age 45 instead of age 50¹
- This guideline update, which increases the number of screen-eligible individuals by ~19 million², is similar to the recommendation in 2018 by the American Cancer Society (ACS)³
- Only two-thirds of those age ≥50 years are up-to-date on CRC screening⁴, and screening adherence is generally lower in younger versus older age groups⁵
- Adherence to screening is complex and driven by test, patient, provider, setting, and neighborhood factors⁶

OBJECTIVE

- To better understand CRC screening adherence in younger age groups, we explored screening barriers identified from a systematic literature review and used a co-occurrence network to describe patient- and provider-level barriers frequently co-occurring with younger age

METHODS

- The systematic literature review identified CRC screening adherence studies in average-risk adults in the U.S.
- PubMed, Embase, and CENTRAL trial databases were searched on 10/23/2020 for English language articles published from 01/01/1950-12/31/2020
- Eligible studies examined factors impacting adherence to endoscopy or stool-based tests
- Study data were extracted and iterative thematic coding resulted in 71 patient- and 16 provider-level factors
- This analysis focused on the subset of studies defining adherence as up-to-date with CRC screening per national guidelines (n=44)
- Younger age group was defined as the youngest age range reported in each study; this included ages 40-64 and subgroups therein (e.g., 50-54, 50-59)
- Bibliometric analysis explored pairwise frequencies of barriers, and these relationships were visualized as a network to illustrate the frequency and co-occurrence of younger age and CRC screening barriers
- Co-occurrence was defined as two predictors being simultaneously reported in the same study, but does not necessarily imply an interaction between the predictors

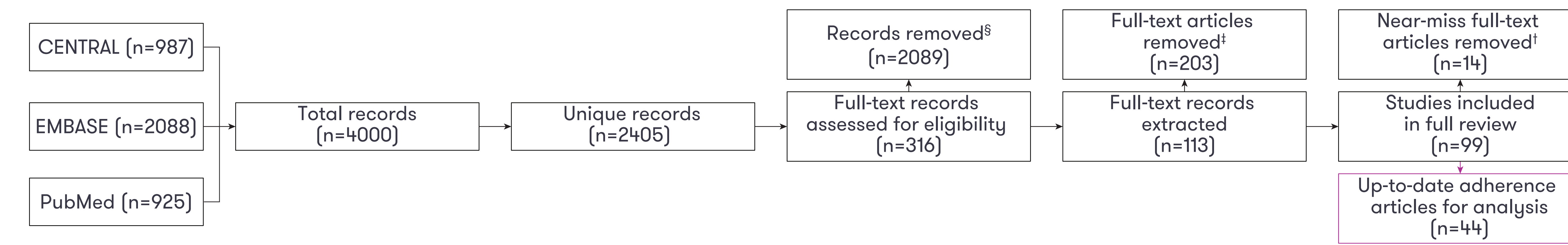
Table 1. Inclusion and exclusion criteria for systematic review

	Inclusion Criteria	Exclusion Criteria
Population	Average-risk individuals or general population (e.g., studies with no pre-defined population risk level) aged 40 years and older	High-risk individuals, disease-specific subgroups (e.g., diabetic), population-specific subgroups (e.g., specific ethnicity or tribal community)
Intervention	CRC screening tests: colonoscopy, flexible sigmoidoscopy, FIT, FOBT, FIT-DNA, blood	Other specific screening modalities (e.g., computed tomographic colonography, barium enema, pillcam, virtual colonoscopy)
Comparison	Adherence outcomes (initial screening, one time testing, diagnostic colonoscopy, longitudinal screening, up-to-date screening, and patient preferences)	Studies that do not include one or more of the defined adherence outcomes
Outcome	Quantitative predictors of CRC screening (e.g., odds ratios), qualitative facilitators and barriers of CRC screening, or patient preferences	Studies that did not report facilitators, barriers, and/or test preferences for CRC screening
Study type and content	Quantitative (e.g., cross-sectional, cohort, RCT) or qualitative studies with facilitators, barriers, and/or preferences to CRC screening as the primary outcome	Reviews, meta-analyses, commentaries; studies on cost-effectiveness, risk assessment, intervention outcome only, test performance, quality, provider perspective, utilization

¹Initial screening: first time testing; One time testing: test completion within a study-specified timeframe; Diagnostic colonoscopy: follow-up colonoscopy after a positive non-invasive test; Longitudinal screening: test completion at specified intervals over time; Up-to-date screening: current with screening as defined by national CRC screening guidelines; Patient preferences: test choice and/or attribute ranking

RESULTS

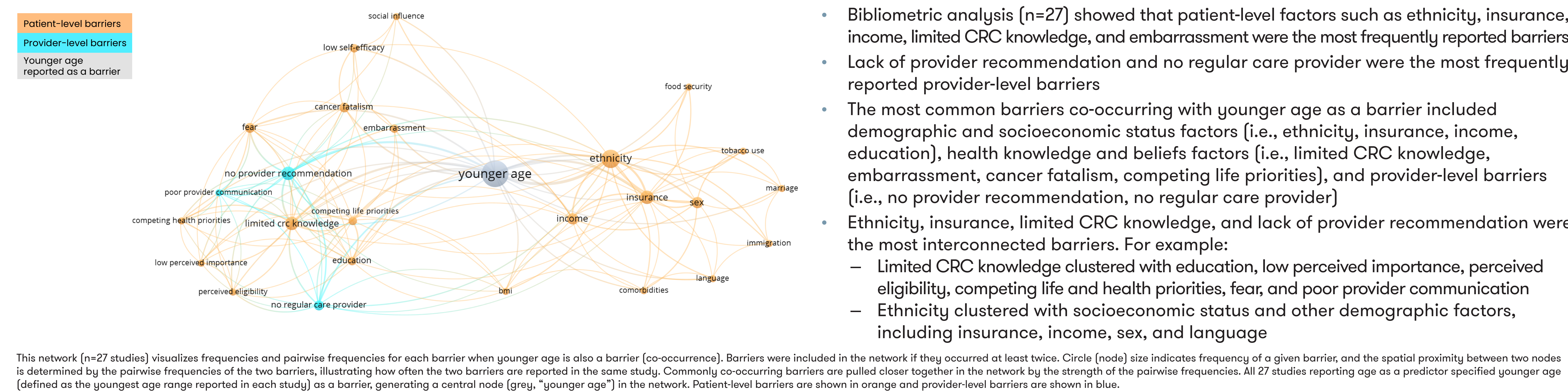
Figure 1. PRISMA flow diagram of the 44 studies in this sub-analysis on factors impacting up-to-date adherence



[§]Records removed: systematic review or commentary, international study, out-of-scope populations (high risk, disease-specific, race/ethnicity-specific), costing study, intervention, utilization data, quality, not relevant
[†]Full-text articles removed: abstract only, international study, intervention, utilization, not relevant
[‡]Examples of 'near-miss' articles removed: health beliefs, CRC knowledge, or provider recommendation as primary outcome; hospital administrator perspective

- The studies were nationally representative (West: 6; Midwest: 9; South: 8; Northwest: 7; and National: 14) and average sample size was 14,707 (range: 39-163,564)
- The majority of studies were in a community setting (n=20; e.g., BRFSS, NHIS, local surveys), while the remaining studies were set in primary care, specialty care, safety net hospital, or a mix of settings
- 30 studies reported adherence to screening with any guideline-recommended test; 27 studies reported adherence to endoscopy; and 23 reported adherence to stool-based tests
- Of the 44 studies where the adherence outcome was up-to-date screening, 27 identified age as a predictor of CRC screening: 24 quantitative studies identified younger age as a barrier and 3 qualitative studies explored age-specific barriers
- The youngest age groups reported in these 27 articles ranged from 40-64 and were predominantly 50-64 (n=9), 50-59 (n=5), 50-54 (n=5); these groups comprise the younger age group. Relative older age group included all older age brackets (e.g., if the youngest reported age group was 50-59 then the older age group was defined as ≥60)

Figure 2. Co-occurrence network highlights key barriers to CRC screening commonly reported with younger age as a barrier: demographics, socioeconomic status, health beliefs, and provider contact



This network (n=27 studies) visualizes frequencies and pairwise frequencies for each barrier when younger age is also a barrier (co-occurrence). Barriers were included in the network if they occurred at least twice. Circle [node] size indicates frequency of a given barrier, and the spatial proximity between two nodes is determined by the pairwise frequencies of the two barriers, illustrating how often the two barriers are reported in the same study. Commonly co-occurring barriers are pulled closer together in the network by the strength of the pairwise frequencies. All 27 studies reporting age as a predictor specified younger age (defined as the youngest age range reported in each study) as a barrier, generating a central node (grey, "younger age") in the network. Patient-level barriers are shown in orange and provider-level barriers are shown in blue.

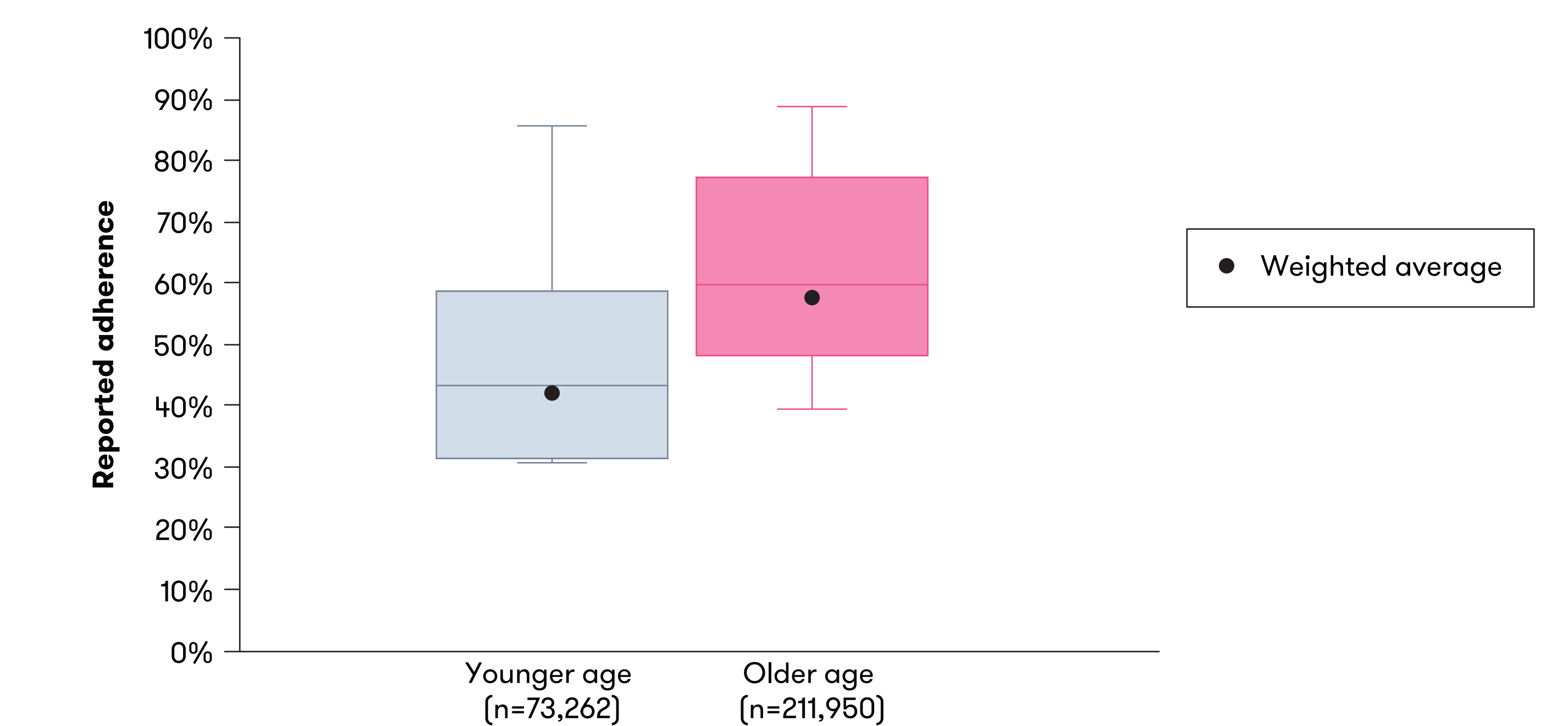
Figure 3. No insurance, Hispanic ethnicity, and low income were the most common barriers co-occurring with younger age* as a barrier

Demographic Barriers by Number of Articles				Socioeconomic Barriers by Number of Articles							
Sex	Count	Ethnicity/Race	Count	Marriage status	Count	Education	Count	Income	Count	Insurance status	Count
Female	4	White	0	Married/partnered	4	Less than high school	5	Below median household	7	Private	1
Male	5	Black	2	Not married/partnered	5	High school	4	Median household	0	Public	5
		Hispanic	8			Some college	3	Above median household	0	Uninsured	10
		AAPI	5			College or higher	0	Income not reported	0		
		Am. Indian/AK Native	3								
		Other/pooled groups	6								

*Younger age group was defined as the youngest age range reported in each study and included ages 40-64 and subgroups therein (e.g., 50-54, 50-59); n=27

- With the exception of White, every race/ethnicity co-occurred as a barrier with younger age
- Factors associated with low socioeconomic status often co-occurred with younger age as a barrier, such as less than a high school education, income below median household, and individuals who are uninsured

Figure 4. Reported adherence was lower in younger* versus older age groups



*Younger age group was defined as the youngest age range reported in each study and included ages 40-64 and subgroups therein (e.g., 50-54, 50-59)

- Weighted averages were calculated for the subset of studies (n=9) reporting adherence to 'any test' (up-to-date with screening by any guideline-recommended test) by relative age
- In these studies, adherence was 43% [IQR: 32-59%] for younger and 57% [IQR: 48-77%] for older age groups

CONCLUSIONS

- A comparison of study-defined relative age groups showed that younger ages reported lower adherence (43%) to CRC screening compared to older ages (57%)
- The most common barriers co-occurring with younger age as a barrier included demographics and socioeconomic status, health knowledge and beliefs, and provider-level factors, such as lack of a provider recommendation
- While co-occurrence suggests a potential relationship between two factors, this analysis cannot rule out that these factors are independent of age and unrelated predictors of adherence
- Although only two studies included the 45-49 year old age group, recent CRC guideline changes reinforce the need for additional studies to explore barriers among younger age populations
- Optimizing screening adherence for younger age groups who are not up-to-date on CRC screening will likely require interventions and strategies to address these barriers

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