

# Using Decision Tree Models to Depict Primary Care Physicians CRC Screening Decision Heuristics

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**OBJECTIVE:** The purpose of this study was to identify decision heuristics utilized by primary care physicians in formulating colorectal cancer screening recommendations.

**DESIGN:** Qualitative research using in-depth semi-structured interviews.

**PARTICIPANTS:** We interviewed 66 primary care internists and family physicians evenly drawn from academic and community practices. A majority of physicians were male, and almost all were white, non-Hispanic.

**APPROACH:** Three researchers independently reviewed each transcript to determine the physician's decision criteria and developed decision trees. Final trees were developed by consensus. The constant comparative methodology was used to define the categories.

**RESULTS:** Physicians were found to use 1 of 4 heuristics ("age 50," "age 50, if family history, then earlier," "age 50, if family history, then screen at age 40," or "age 50, if family history, then adjust relative to reference case") for the timing recommendation and 5 heuristics ["fecal occult blood test" (FOBT), "colonoscopy," "if not colonoscopy, then...", "FOBT and another test," and "a choice between options") for the type decision. No connection was found between timing and screening type heuristics.

**CONCLUSIONS:** We found evidence of heuristic use. Further research is needed to determine the potential impact on quality of care.

**KEY WORDS:** qualitative methods; decision styles; preventive care; physician behavior; clinical guidelines.

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Clinical guidelines recommend that adults having no risk factors should first be screened for colorectal cancer (CRC) at age 50.<sup>1</sup> Recent research found that, while the physician recommendation was important,<sup>2-4</sup> merely mention-

ing screening was not enough to motivate all patients,<sup>3,5,6</sup> and there was variation in the nature of recommendations.<sup>7</sup> Physicians often guide patients through trade-offs between the "best" and the "easiest" test. Multiple options and brief visits contribute to the task and time pressures on physicians to explain screening. Bounded rationality suggests physicians might use heuristics to simplify and expedite their process. This study was designed to identify decision heuristics used by primary care physicians in formulating CRC screening recommendations.

## METHODS

We conducted semi-structured in-depth interviews with a convenience sample of primary care physicians recruited by physician research team members. Efforts were made to recruit physicians from different types of practices.

### Decision Tree Development

Three researchers independently reviewed transcripts and developed decision trees for each physician. Tree development was guided by inclusion of specific questions: "What factors do you take into consideration when deciding whether or not to screen for colorectal cancer?", "What rules of thumb do you use?", "Describe a patient for whom you would not recommend CRC screening", and "What other patient characteristics make you lean away from recommending CRC screening?". Trees were discussed, and final trees were developed by consensus. As a verification step, a fourth researcher reviewed each transcript and tree, noted any discrepancies, and critically reviewed findings.

### Data Analysis

Three researchers developed categorization schemes using a modified constant comparative methodology.<sup>8</sup> More specifically, each researcher independently compared and contrasted each pairing of decision trees and identified common and unique features. Using this approach, the trees were grouped into similar categories. We confirmed that the trees did depict 2 interrelated decisions: (1) when to recommend screening and (2) what type of screening to recommend. We, therefore, pursued 2 distinct categorization schemes, grouping trees based on screening timing and type. The groupings were discussed and adjusted. This process was repeated until the researchers reached consensus. The "screening timing" cate-

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**Table 1. Inclusion, Exclusion, and Differentiation Criteria by Screening Timing Decision Heuristic; n (%)**

Total (N=66)	Age 50 (N=9)	Age 50, if earlier if family history (N=28)	Age 50, if family history, then at age 40 (N=12)	Age 50, if family history, then adjust relative to reference case (N=17)
<b>Inclusion criteria</b>				
Symptoms	26 (39.4%)	3	13	5
Cancer history	5 (7.6%)	1	2	1
History colon problems	12 (18.2%)	2	4	4
Family history other cancer	7 (10.6%)	0	4	2
<b>Exclusion criteria</b>				
Short life expectancy	42 (63.6%)	7	14	5
Comorbidities	15 (22.7%)	3	3	3
Contraindications	17 (25.8%)	2	8	3
Cognitive impairment	4 (6.1%)	0	0	1

gories were finalized after 3 iterations, the “screening type” after 5.

As a last step, inclusion, exclusion, and differentiation criteria were systematically documented via content analysis. We defined inclusion criteria as factors beyond those included in the timing heuristic that would make a patient a candidate for screening. Similarly, exclusion criteria were reasons a physician would not recommend screening to a patient who would have been a candidate according to their screening timing heuristic. Differentiation criteria were reasons a physician would recommend a strategy other than the one predicted by their screening type heuristic.

## RESULTS

### Sample Description

We interviewed 66 primary care internists and family physicians. An equal number of each physician type was recruited from academic and community practices. A majority of physicians were male, and almost all were white, non-Hispanic. On average, the respondents were 41.6 years old (range, 29–64),

had been practicing medicine for 14.1 years (range, 3–30), and were in their current setting for 8.2 years (range, 0.25–30).

We developed categorization schemes for the screening timing and the screening type decision heuristics (Tables 1 and 2).

### Screening Timing Decision Heuristics

**Age 50.** Family history was not factored into the decision of 6 of these 9 physicians. The others used family history to determine type of screening (e.g., as a differentiation criterion) but would not recommend earlier screening based on family history. A majority excluded those with short life expectancy.

**Age 50; If Family History, Then Earlier.** This heuristic reflected a vague age-adjustment rule as how much “earlier,” then age 50 was not defined. Three stipulated that the relative had to be a first-degree relative, and one of those physicians also indicated that the first-degree relative needed to be diagnosed before age 40. Of the 25 physicians referencing a general family history, one indicated that the family member needed to have been diagnosed before age 70. One of the physicians did not mention a family history of CRC specifically but indicated that he would screen earlier on the basis of family history of any cancer. Symptoms were common inclusion criterion. Half of the physicians would not recommend screening to a patient with short life expectancy.

**Age 50; If Family History, Then Screen at Age 40.** Twelve physicians used this heuristic. Many mentioned symptoms as inclusion criteria, excluding those with short life expectancy.

**Age 50; If Family History, Then Adjust Relative to Reference Case.** Seventeen physicians used this decision heuristic. The adjustment to patient age was typically to screen 10 years before the onset of CRC in the family member (a rule utilized by 15 out of the 17 physicians). The alternative age adjustment rules were to screen the patients when they turned the age of the reference case at diagnosis or when the patient was 5 years younger than the reference case at diagnosis. All but 2 of these physicians specified that the reference case needed to be a first-degree relative. Almost all would not screen those with a short life expectancy.

### Screening-Type Decision Heuristics

**Fecal Occult Blood Test.** Recommending FOBT was the least prevalent heuristic. Physicians in this group used FOBT as the initial screen. Their patients would only receive more extensive

**Table 2. Inclusion, Exclusion, and Differentiation Criteria by Screening-Type Decision Heuristic; n (%)**

Total (N=66)	FOBT (N=4)	Colonoscopy (N=8)	Colonoscopy, if that is unacceptable, then... (N=24)	FOBT and another test (N=16)	A choice between options (N=14)
<b>Differentiation criteria</b>					
Health insurance coverage	18 (27.3%)	0	4	6	3
Contraindications	34 (51.5%)	3	2	12	10
Short life expectancy	15 (22.7%)	0	2	7	5
Patient acceptance	47 (71.2%)	0	1	24	14
Frailty	12 (18.2%)	1	1	7	1
Symptoms	26 (39.4%)	2	2	10	4

screening if the FOBT was abnormal. All physicians modified their recommendation if the patient had a family history of CRC. Most of the physicians in this group also refined their recommendation in the presence of contraindications. Half would recommend a different screening type if the patient was experiencing symptoms.

**Colonoscopy.** A little more than 1 out of 10 physicians in our sample would recommend colonoscopy regardless of family history. Half would modify their recommendation if the patient did not have health insurance coverage for screening colonoscopy.

**If not colonoscopy, then....** Physicians using this heuristic explained colonoscopy as “the optimal choice,” but provided a “next best” alternative. Therefore, rank order of options was apparent. The “next best” alternative was predominately flexible sigmoidoscopy. A quarter of the physicians in our sample suggested that patients might choose the “next best” alternative because of cost or concerns about the “invasiveness” of or preparation for the exam (95.8%). If a patient had a family history of CRC, most of these physicians would stress colonoscopy over the other alternative. Half reportedly modified their policy if the patient had contraindications to colonoscopy. When a patient was experiencing symptoms, almost half of these physicians would stress the importance of undergoing a diagnostic colonoscopy. Alternatively, if patients were frail, some physicians would recommend non-invasive tests. The last common modification involved patients with short life expectancies.

**FOBT and Another Test.** A fifth of physicians recommended FOBT paired with either a flexible sigmoidoscopy or a colonoscopy. These physicians indicated the type of test recommended could be influenced by cost, contraindications, patient acceptance, symptoms, and family history. Several of these physicians would forgo the FOBT if a false positive was likely to occur.

**A Choice Between Options.** Fourteen physicians provided information about multiple options, often 2 or 3 choices, and let the patient decide. Almost all included FOBT and colonoscopy as options. About half included FOBT and flexible sigmoidoscopy, one-third flexible sigmoidoscopy alone, and one each FOBT and colonoscopy, FOBT and double contrast barium enema, or flexible sigmoidoscopy and double contrast barium enema. These physicians modified their recommendation if contraindications and family history of CRC were present. Half would suggest colonoscopy again in 1 year if the patient chose FOBT.

## DISCUSSION

We found that the physicians in this small nonrepresentative sample used 1 of 4 heuristics in making the CRC screening timing recommendation. They considered patient age and, sometimes, family history when identifying patients for CRC screening. While most recommended screening patients at age 50, some also recommended screening somewhat younger patients with a family history. It is with the second aspect of the decision, e.g., the family history component, that we

observed the greatest variability in terms of heuristic complexity. In this study, the most frequent additional inclusion criterion was “symptoms.” Although tests recommended for patients experiencing symptoms would technically not be classified as screening, we opted to include this finding, as it reflected the responses of our participants. A common exclusion criterion, lacking a consistent definition, was short life expectancy.

We also identified 5 CRC screening type heuristics that fell under the standard recommendation. A majority of the study physicians noted they would modify their recommendation based on patient acceptance. We found no connection between a physician’s choice of timing heuristic and type heuristic. This finding supports our conjecture that the CRC screening recommendation involves 2 interrelated decisions and affirms that independent and combined examination of these heuristics is warranted.

Heuristic or mental short cuts are not always inappropriate. They can be an efficient decision-making tool especially useful in time-constrained environments such as a typical clinic visit. Heuristics do involve trade-offs and, if used unreflectively, can lead to substandard outcomes. The use of heuristics and their impact on quality of care requires further research.

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**Conflict of Interest:** The funding agreement ensured the authors’ independence in designing the study, interpreting the data, writing, and publishing the report. None of the authors are employed by sponsors or have any other conflict of interest.

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