Do benefits and barriers differ by stage of adoption for colorectal cancer screening?

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Abstract

In 2003, over 148 300 people were expected to be diagnosed and 56 000 to die from colorectal cancer (CRC). First-degree relatives (FDRs) of people with colon cancer have a two- to eight-fold increased risk for CRC. Despite evidence that screening is effective, adherence with screening recommendations in this at-risk population is low. This study’s purposes were to (1) identify perceived benefits and barriers of fecal occult blood testing (FOBT), sigmoidoscopy and colonoscopy, and (2) compare demographic characteristics and perceived benefits and barriers by stage of adoption for CRC screening. Participating FDRs (n = 257) completed a 40-min structured telephone interview. Despite high rates of agreement with the benefits of screening, most FDRs were not contemplating being screened. Of those 50 and older, most were in precontemplation for FOBT, sigmoidoscopy and colonoscopy. Older age was related to stage for FOBT and sigmoidoscopy, but not colonoscopy. Lack of provider recommendation also was related to stage. Consistent with theoretical predictions, precontemplators had (1) higher rates of endorsement of specific barriers to screening and (2) lower rates of endorsement of benefits than contemplators or actors. For morbidity and mortality reduction, participation in routine, periodic screening is imperative. These findings can guide development of screening-promoting interventions.

Introduction

Colorectal cancer (CRC) is the most common cause of US cancer deaths among non-smokers (Burn et al., 1998). In 2003, about 148 300 people were diagnosed with and 56 000 died from CRC (Jemal et al., 2003). Other than age, family history is the most common risk factor, increasing risk two- to eight-fold (Houlston et al., 1990; St John et al., 1993; Fuchs et al., 1994; Lynch et al., 1994; Burt, 1996). When discovered early, CRC is highly treatable. Five-year survival rate for persons diagnosed with stage I disease is over 90% (Greenlee et al., 2000). Randomized trials have demonstrated efficacy of screening, with fecal occult blood tests (FOBT) reducing mortality by over 30% (Mandel et al., 1993). Endoscopic screening allows for removal of precancerous polyps, which decreases CRC incidence by 75–90% (Winawer et al., 1997). Therefore, increased screening would result in significant CRC mortality and morbidity benefits, especially for those at increased risk.

Current screening guidelines are stratified by risk level (Winawer et al., 2003). Recommendations for those with no risk factors other than age (average risk) are, at age 50, to begin screening via (1) annual FOBT, (2) flexible sigmoidoscopy every 5 years, (3) annual FOBT plus flexible sigmoidoscopy.
every 5 years, (4) colonoscopy every 10 years or
(5) double contrast barium enema every 5 years. Indi-
ciduals are at increased risk if they have a family his-
tory of CRC or adenomas (polyps) diagnosed in an FDR younger than age 60, two or more FDRs diagnosed with CRC at any age, or a personal history of CRC, adenomas or inflammatory bowel disease. Individuals at increased risk should have an examination of their entire colon, preferably with colonoscopy, starting at age 40 or 10 years earlier than the age at diagnosis of the youngest affected relative, whichever is earlier.

Screening participation among FDRs, although slightly higher than the general population, remains low (Batt et al., 1986; Caffarey et al., 1993). Recent studies indicate adherence in this population is approximately 50% (Manne et al., 2002). For the morbidity and mortality reduction benefits of screening to be realized, participation in routine, periodic screening is imperative. Effective interventions facilitating screening among those at greatest risk are needed. To guide development of interventions, we need to identify perceived benefits and barriers and examine their associations with screening.

The Transtheoretical Model (TTM) proposes that behavior change occurs in stages on a continuum rather than as a single, discrete event. The purpose of this study was to identify perceived benefits and barriers of FOBT, sigmoidoscopy and colonoscopy among FDRs, and to determine if they differ by stage of screening adoption.

Research questions were:

(1) To what extent do FDRs in precontemplation, contemplation, or action for CRC screening differ in demographic characteristics?

(2) To what extent do FDRs in precontemplation, contemplation, or action differ in perceived benefits of and barriers to CRC screening?

The TTM, which has been useful for understanding intentions and behaviors such as exercise, smoking cessation and cancer screening, includes the constructs of decisional balance, pros and cons (Sarkin et al., 2001). Pros and cons are similar to the Health Belief Model’s benefits and barriers. Predictable patterns of relationships of pros (benefits) and cons (barriers) have been observed across multiple behaviors (Prochaska, 1994; Prochaska et al., 1994). The TTM proposes that changes in perceived benefits, barriers and movement across stages are necessary for behavioral change. In precontemplation, barriers to engaging in a health-promoting behavior outweigh benefits. In contemplation, balance between benefits and barriers is more equal. To move to action, benefits must outweigh barriers. Understanding how benefits and barriers vary across stages for CRC screening could facilitate development of effective stage-targeted interventions to move people to action.

Several studies have identified perceived benefits of (pros) and barriers to (cons) CRC screening (Vernon, 1997; Beeker et al., 2000; Rawl et al., 2000a). Benefits identified by FDRs included finding cancer early, decreasing CRC mortality risks, freedom from worry about CRC and reassurance of being cancer-free. Barriers included lack of awareness of CRC and the need for screening, concerns about efficacy of screening tests, fear of finding cancer, embarrassment and lack of provider recommendation (Rawl et al., 2000a).

Research has examined relationships among stage of adoption, perceived benefits and barriers. Researchers found differences in barriers by stage of adoption for sigmoidoscopy; having fewer barriers and physician recommendation were the only significant predictors of having a sigmoidoscopy (Brenes and Paskett, 2000). Manne et al. found that, among siblings of patients with CRC, adherence and stage of adoption were significantly related to perceived benefits, barriers and susceptibility (Manne et al., 2002). As predicted, barriers decreased as stage progressed from precontemplation to maintenance.

In these studies, summated barriers (cons) scores were predictive of screening. While this is useful, understanding how individual benefits and barriers items differ across stages of adoption for each CRC screening test may better inform intervention development. Similar analyses of individual benefits and barriers by mammography stage yielded useful guidance for breast cancer screening research (Skinner et al., 1997).
Methods and sample

This cross-sectional study was conducted at two Midwestern sites during 1999 and 2000. Index CRC patients, diagnosed within the past 6–36 months and treated at university hospitals in St Louis or Indianapolis were asked for names and contact information of at least one FDR. Procedures were approved by the respective institutions’ Institutional Review Boards. Prior to contact, index cancer patients were sent a letter introducing the study from their treating physician. Trained research assistants then called index patients to explain the study and invite FDR referrals for the study. After obtaining referrals from cancer patients, eligible FDRs were similarly contacted by letter, followed by telephone. Of 326 patients contacted, 213 (65%) referred one or more FDRs; 341 FDRs were contacted and 257, representing 172 families, agreed to participate (response rate = 75.4%; 85 index cases referred more than one FDR). Characteristics of participants, who completed a 40-min telephone interview, are presented in Table II. Mean age was 48.6 (SD = 12.5) years; most were Caucasian, employed full-time, female and had at least some college education.

Instruments

Scales assessing benefits and barriers were adapted from the Champion Breast Health Survey and refined through focus groups with FDRs of CRC patients (Champion, 1999; Rawl et al., 2000a). Instrument development and psychometrics for benefits and barriers scales are reported elsewhere (Rawl et al., 2001). Perceived benefits and barriers for each screening test were measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree); participants were asked to indicate how much they agreed or disagreed with each statement for each test. Stage of adoption was measured using algorithms adapted from mammography studies (Rakowski et al., 1993). Descriptions of each test were provided prior to asking questions to assess stage, perceived benefits and perceived barriers separately for each test. Test descriptions and items to assess stage are listed in Figure 1. Stage definitions are shown in Table I.

Data analyses

Univariate analysis was conducted for all outcomes regarding benefit and barrier beliefs for each screening test (FOBT, sigmoidoscopy and colonoscopy). Contingency tables with Pearson $\chi^2$ and two-sided Fisher’s exact test for the overall $R \times C$ cross-classification table were used to detect general association between each benefit and barrier item and stages for each screening test. Relationships between age and stages of adoption for each screening test were tested using analysis of variance (ANOVA). Post-hoc comparisons between all pairs of means were tested using the Tukey–Kramer method.

Because responses on individual benefit and barrier items were ordered multinomial responses classified as (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree, we fit a proportional odds model to the cumulative logits to examine item differences across all three stages. Ordinal item score was the dependent variable and categorical stage was the independent variable. We modeled the higher score (greater agreement) as the outcome. Because 85 (33%) of the 257 participants were not independent observations (i.e. more than one participant was from the same family), we ran models accounting for correlated data inherent in clustering of individuals within families; to account for correlation among item scores in family-related individuals, we used generalized estimating equations (GEE) for ordinal data—an extension to the GEE for binary data (Liang and Zeger, 1986; Lipsitz et al., 1994). GEE models with correlation structures of exchangeability were formed using the multilog procedure in SUDAAN software (Bieler and Williams, 1997). Results were similar to Wilcoxon rank sum analyses assuming independence; however, we report results from the GEE models, which correctly account for correlated data.

Residual $\chi^2$ was evaluated for each model; the Wald statistic was evaluated for each variable, and compared to coefficients from the univariate analyses for similarity of sign and magnitude. Estimated
**FOBT**

A stool blood test is a test that you can do at home to examine your stool for hidden blood. The test requires you to place a small sample of your stool/bowel movement on a special piece of cardboard. This cardboard is then sent to your doctor’s office or a lab for testing.

1. Have you ever done a stool blood test at home and mailed the card back to your doctor’s office or lab?
2. How long ago did you do your last stool test?
3. Have you thought about doing a stool blood test in the next 6 months?

**Sigmoidoscopy**

Flexible sigmoidoscopy is another colorectal cancer screening test. A flexible sigmoidoscopy is when a doctor inserts a long, flexible tube with a light into your rectum to examine your colon for any unusual growths. Before the test, your doctor may have you take a laxative or use an enema to completely clean out your colon. During the test, you may be lying on your side or kneeling while the doctor inserts the lighted tube into your rectum. Through the tube the doctor can see the inside of your colon and check for any unusual lumps or growths. The test usually takes about 15 min.

1. Have you ever had a flexible sigmoidoscopy?
2. How long ago was your last flexible sigmoidoscopy?
3. Have you thought about having a sigmoidoscopy in the next 6 months?

**Colonoscopy**

A colonoscopy is when a doctor inserts a long, flexible tube with a light into your rectum to examine your colon for any unusual growths. The tube is longer than a sigmoidoscope and allows the doctor to see more of your colon. Before having a colonoscopy, you do not eat solid food for 1–2 days and must drink a special liquid to clean out your colon. Right before the test, you are given some medicine to help you relax. While lying on your side, the doctor inserts the lighted tube into your rectum. It usually takes 30–60 min to complete the test, depending on whether growths or polyps need to be removed. Afterwards, you wait for the relaxing medicine to wear off and you need to bring someone to drive you home. Most people do not remember much about having a colonoscopy.

1. Have you ever had a colonoscopy?
2. How long ago was your last colonoscopy?
3. Have you thought about having a colonoscopy in the next 6 months?

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Fig. 1. Screening test descriptions and items assessing stage
odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each stage comparison.

### Results

#### Stage of adoption and demographics

More than 60% of FDRs were in precontemplation for all three screening tests. For FOBT, 66% were in precontemplation, 20% were contemplating having the test in the next 6 months and 14% were in action. For sigmoidoscopy, 61% were in precontemplation, 17% were contemplating and 21% were in action. For colonoscopy, 64% were in precontemplation, 15% were contemplating and 21% were in action. Whether the 21% who had a sigmoidoscopy sometime in the past represents the same 21% who reported having had a colonoscopy is unknown. Results were only slightly better among those 50 and older, most of whom were in precontemplation and only 20–26% contemplating having one of the screening tests. Only 21% were in action for FOBT, 30% were in action for sigmoidoscopy and 21% were in action for colonoscopy. Notably, the proportion in action for colonoscopy (21%) was the same among FDRs aged 50 or older as in the entire sample.

All demographic characteristics were examined for relationships with stage of adoption; only age differed across stages with older FDRs more likely to be in action for FOBT and sigmoidoscopy. *Post-hoc* tests revealed that those in action for FOBT and sigmoidoscopy were significantly older than those in precontemplation ($P < 0.01$). Contemplators of

### Table I. Stage definitions

<table>
<thead>
<tr>
<th></th>
<th>Precontemplation</th>
<th>Contemplation</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOBT</td>
<td>never had OR had one more than 12 months ago AND not thinking about having one in next 6 months</td>
<td>never had OR had one more than 12 months ago AND thinking about having one in next 6 months</td>
<td>had one in last 12 months</td>
</tr>
<tr>
<td>Sigmoidoscopy</td>
<td>never had OR had one more than 3 years ago AND not thinking about having one in next 6 months</td>
<td>never had OR had one more than 3 years ago AND thinking about having one in next 6 months</td>
<td>had one in the past 3 years</td>
</tr>
<tr>
<td>Colonoscopy</td>
<td>never had OR had one more than 3 years ago AND is not thinking about having one in next 6 months</td>
<td>never had OR had one more than 3 years ago AND thinking about having one in next 6 months</td>
<td>had one sometime in the past</td>
</tr>
</tbody>
</table>

### Table II. Sample demographics (n = 257)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50</td>
<td>152</td>
<td>59.1</td>
</tr>
<tr>
<td>≥50</td>
<td>105</td>
<td>40.9</td>
</tr>
<tr>
<td>Years of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than high school</td>
<td>23</td>
<td>8.9</td>
</tr>
<tr>
<td>completed high school</td>
<td>66</td>
<td>25.7</td>
</tr>
<tr>
<td>some college</td>
<td>78</td>
<td>30.4</td>
</tr>
<tr>
<td>completed college</td>
<td>90</td>
<td>35.0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>242</td>
<td>94.2</td>
</tr>
<tr>
<td>African-American</td>
<td>14</td>
<td>5.4</td>
</tr>
<tr>
<td>Native American</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>112</td>
<td>43.8</td>
</tr>
<tr>
<td>Female</td>
<td>144</td>
<td>56.3</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
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<tr>
<td>full time</td>
<td>165</td>
<td>64.2</td>
</tr>
<tr>
<td>part time</td>
<td>26</td>
<td>10.1</td>
</tr>
<tr>
<td>not employed</td>
<td>66</td>
<td>25.7</td>
</tr>
<tr>
<td>Income (US$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;15000</td>
<td>11</td>
<td>4.6</td>
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<tr>
<td>15000–30000</td>
<td>42</td>
<td>17.7</td>
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<td>30001–50000</td>
<td>79</td>
<td>33.3</td>
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<td>50001–75000</td>
<td>47</td>
<td>19.3</td>
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<tr>
<td>75001–100000</td>
<td>33</td>
<td>19.8</td>
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<tr>
<td>100000–150000</td>
<td>18</td>
<td>7.6</td>
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<tr>
<td>&gt;150000</td>
<td>7</td>
<td>3.0</td>
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<tr>
<td>Relation to index patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>father</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>mother</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>brother</td>
<td>40</td>
<td>15.6</td>
</tr>
<tr>
<td>sister</td>
<td>62</td>
<td>24.2</td>
</tr>
<tr>
<td>son</td>
<td>70</td>
<td>27.3</td>
</tr>
<tr>
<td>daughter</td>
<td>76</td>
<td>29.7</td>
</tr>
</tbody>
</table>
FOBT also were significantly older than precontemplators (P < 0.05). Interestingly, age was not related to colonoscopy stage of adoption.

**Differences in perceived benefits and barriers by stage**

Response distributions for perceived benefits and barriers as well as results for pair-wise comparisons across stages for the three screening tests appear in Tables III–V. Benefits and barriers are listed in descending order based on percentages of precontemplators in agreement with each item. Estimated ORs and 95% CIs are presented for each two-level comparison between stages. For benefits and barriers, higher ORs indicate higher levels of endorsement (more agreement). However, greater endorsement (higher OR) is the positive outcome for benefits, while lower endorsement (lower OR) is the positive outcome for barriers. Data for each test are presented below.

**FOBT**

Regardless of stage, FDRs almost universally agreed that FOBT will help find CRC early; at least 80% agreed that FOBT would decrease chances of dying from CRC (Table III). Although agreement was high for decreased worry as a benefit (73%), over one-quarter of precontemplators disagreed with this statement, which also had lower agreement among actors (86%) than any other benefit. There were no significant differences in the proportions of FDRs who agreed with each of three FOBT benefit items.

Among precontemplators, the top five barriers to FOBT were health care provider never recommended (86%), don’t know how to do a stool blood test

<table>
<thead>
<tr>
<th>Table III. FOBT benefits and barrier items by stage of adoption (n = 257)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% Agree</strong></td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
</tr>
<tr>
<td>Stool blood test will help find CRC early</td>
</tr>
<tr>
<td>Stool blood test will decrease your chance of dying from CRC</td>
</tr>
<tr>
<td>Stool blood test will help you not worry as much</td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
</tr>
<tr>
<td>Health care provider never recommended stool blood test</td>
</tr>
<tr>
<td>Do not know how to do a stool blood test</td>
</tr>
<tr>
<td>Collecting a stool sample is unpleasant</td>
</tr>
<tr>
<td>Do not need stool blood test because you have no problems</td>
</tr>
<tr>
<td>Stool blood test is embarrassing</td>
</tr>
<tr>
<td>Afraid to do a stool blood test because you might find something wrong</td>
</tr>
<tr>
<td>Do not have time to do a stool blood test</td>
</tr>
<tr>
<td>Cost would keep me from doing stool blood test</td>
</tr>
<tr>
<td>Do not have privacy to do a stool blood test</td>
</tr>
</tbody>
</table>

The ORs for comparisons and CIs are for a one-unit increment in the ordinal outcome of endorsement of (agreement with) the item. Only significant comparisons are listed. We used ordinal logit models, with GEE, in Tables II–IV to account for clustered data. P = precontemplators, C = contemplators, A = actors.
(39%), collecting a stool sample is unpleasant (38%), do not need a stool blood test because I have no problems (27%) and a stool blood test is embarrassing (23%). Comparatively, those in the action stage endorsed fewer barriers; top three were collecting a stool sample is unpleasant (34%), stool blood test is embarrassing (20%) and health care provider never recommended one (14%).

Comparisons across FOBT barriers showed that precontemplators displayed significantly more agreement than both contemplators and actors on four barriers: health care provider never recommended (P < 0.001), do not need to have a stool blood test because I have no problems (P < 0.001), don’t know how to do a stool blood test (P = 0.002 and P = 0.01, respectively) and cost (P = 0.02 and P = 0.01, respectively). Contemplators did not differ significantly from actors on any barrier items.

Table IV. Sigmoidoscopy benefits and barriers items by stage of adoption

<table>
<thead>
<tr>
<th>Benefits</th>
<th>% Agree</th>
<th>Comparison</th>
<th>OR</th>
<th>CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sigmoidoscopy will help find CRC early</td>
<td>97</td>
<td>A versus P</td>
<td>2.18</td>
<td>1.09–4.36</td>
<td>0.030</td>
</tr>
<tr>
<td>Sigmoidoscopy will decrease your chance of dying from CRC</td>
<td>88</td>
<td>A versus P</td>
<td>1.79</td>
<td>1.03–3.12</td>
<td>0.040</td>
</tr>
<tr>
<td>Sigmoidoscopy will help you not worry about CRC</td>
<td>80</td>
<td>A versus C versus P</td>
<td>2.01</td>
<td>1.02–3.94</td>
<td>0.043</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barriers</th>
<th>% Agree</th>
<th>Comparison</th>
<th>OR</th>
<th>CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health care provider never recommended sigmoidoscopy</td>
<td>94</td>
<td>A versus P</td>
<td>0.12</td>
<td>0.06–0.25</td>
<td>0.001</td>
</tr>
<tr>
<td>Sigmoidoscopy is embarrassing</td>
<td>54</td>
<td>A versus C versus P</td>
<td>0.29</td>
<td>0.13–0.66</td>
<td>0.004</td>
</tr>
<tr>
<td>Sigmoidoscopy is painful</td>
<td>48</td>
<td>A versus C versus P</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Do not need sigmoidoscopy because you have no problems</td>
<td>42</td>
<td>A versus P</td>
<td>0.39</td>
<td>0.21–0.71</td>
<td>0.002</td>
</tr>
<tr>
<td>Feel anxious about having a sigmoidoscopy because you do not understand what will be done</td>
<td>26</td>
<td>A versus P</td>
<td>0.48</td>
<td>0.27–0.85</td>
<td>0.010</td>
</tr>
<tr>
<td>Do not have time for a sigmoidoscopy</td>
<td>15</td>
<td>A versus C versus P</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Cost would keep me from having a sigmoidoscopy</td>
<td>11</td>
<td>A versus P</td>
<td>0.54</td>
<td>0.31–0.94</td>
<td>0.030</td>
</tr>
<tr>
<td>Having to follow special diet and take a laxative would keep you from having a sigmoidoscopy</td>
<td>10</td>
<td>A versus C versus P</td>
<td>0.5</td>
<td>0.27–0.93</td>
<td>0.029</td>
</tr>
<tr>
<td>Afraid to have a sigmoidoscopy because you might find something wrong</td>
<td>9</td>
<td>A versus C versus P</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Sigmoidoscopy

Respondents almost universally agreed that sigmoidoscopy would help find CRC early (Table IV). Although rates of agreement were high for all three benefit items, one-fifth of precontemplators disagreed that sigmoidoscopy would help them not worry as much about CRC.

Actors indicated significantly greater agreement than precontemplators on two sigmoidoscopy benefit items: will help find CRC early (P = 0.03) and will decrease my chance of dying from colorectal cancer (P = 0.04). Contemplators also showed greater agreement than precontemplators on a sigmoidoscopy will decrease my chance of dying from CRC (P = 0.04).

Top barriers for sigmoidoscopy endorsed by precontemplators were health care provider never recommended (93.5%) and sigmoidoscopy is embarrassing (54%) and painful (48%), do not
need...because I have no problems (42%), and feeling anxious because you don’t understand what will be done (26%). At least some actors agreed with all nine barriers; the top four endorsed by actors were embarrassing (57%), health care provider never recommended (41%), painful (37%) and no need...because I have no problems (22%).

Four of nine sigmoidoscopy barrier items differed by stage. Compared to actors, precontemplators had greater endorsement for: health care provider did not recommend (P = 0.001), do not need...because you have no problems (P = 0.002), feel anxious because you do not understand what will be done (P = 0.01) and cost will keep you from having one (P = 0.03). Contrary to expectations, actors were more than twice as likely as contemplators to agree that you do not need to have a sigmoidoscopy because you have no problems or symptoms (P = 0.04). Compared to contemplators, precontemplators reported higher agreement with health care provider did not recommend (P = 0.004), you do not need...because you have no problems (P < 0.001) and cost (P = 0.03).

Colonoscopy

Table V shows universal agreement among actors that colonoscopy can help find CRC early and very high levels of agreement among respondents in other stages. Contemplators had the highest proportion who disagreed with any benefit item; 16% disagreed that having a colonoscopy would help them not worry as much about CRC. Only one

| Table V. Colonoscopy benefits and barrier items by stage of adoption |
|-------------------------|-----------------|-----------------|---|---|---|
|                         | % Agree | Comparison | OR  | CI    | P    |
|                         | P      | C      | A |
| Benefits               |         |         |   |       |     |
| Colonoscopy will help find CRC early | 99   | 97   | 100 | A versus P | 2.6 | 1.28–5.28 | 0.010 |
| Colonoscopy will decrease your chance of dying from CRC | 93   | 89   | 87  | A versus C versus P | NS |
| Colonoscopy will help you not worry as much about CRC | 88   | 84   | 91  | A versus C versus P | NS |
| Barriers               |         |         |   |       |     |
| Health care provider never recommended colonoscopy | 94   | 46   | 26  | A versus P | 0.04 | 0.02–0.11 | <0.001 |
| Colonoscopy is embarrassing | 49   | 57   | 33  | A versus P | 0.47 | 0.28–0.80 | 0.006 |
| Colonoscopy is painful | 49   | 50   | 20  | A versus C versus P | NS |
| Do not need a colonoscopy because you have no problems | 45   | 6    | 9   | A versus C versus P | NS |
| Feel anxious about having a colonoscopy because you do not understand what will be done | 34   | 29   | 13  | A versus P | 0.21 | 0.10–0.43 | 0.001 |
| Cost would keep me from having a colonoscopy | 15   | 13   | 6   | A versus P | 0.34 | 0.19–0.61 | 0.001 |
| Afraid to have a colonoscopy because you might find something wrong | 9    | 26   | 13  | A versus C | 0.46 | 0.22–0.97 | 0.040 |
| Do not have time for a colonoscopy | 14   | 11   | 4   | A versus P | 0.26 | 0.08–0.80 | 0.020 |
| Having to follow a special diet and take a laxative would keep you from having a colonoscopy | 14   | 11   | 4   | A versus C versus P | NS |
| Afraid to have a colonoscopy because of possible bleeding or tearing of the colon | 14   | 23   | 4   | A versus P | 0.36 | 0.21–0.62 | 0.001 |
| Transportation problems would keep you from having a colonoscopy | 5    | 3    | 1   | A versus P | 0.36 | 0.14–0.94 | 0.040 |

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colonoscopy benefit item significantly differed by stage; a colonoscopy will help find CRC early; actors were more than twice as likely as precontemplators to agree with this benefit \((P = 0.01)\).

Top barriers for colonoscopy among precontemplators were health care provider never recommended (94%), colonoscopy is embarrassing (49%) and painful (49%), do not need...because I have no problems (45%) and feel anxious because I do not understand what will be done (33.5%). Top three barriers endorsed by actors were colonoscopy is embarrassing (33%), health care provider never recommended (25.5%) and colonoscopy is painful (20%).

Eight of 11 barrier items for colonoscopy differed significantly by stage. Compared to actors, precontemplators and contemplators reported greater agreement with five barriers: afraid to have a colonoscopy because of possible bleeding or tearing of the colon \((P = 0.001 \text{ and } P = 0.002, \text{ respectively})\), feel anxious because you don’t understand what will be done \((P = 0.001 \text{ and } P = 0.004, \text{ respectively})\), colonoscopy is embarrassing \((P = 0.006)\), cost would keep you from having a colonoscopy \((P = 0.001 \text{ and } P = 0.04, \text{ respectively})\) and transportation problems would keep you from having a colonoscopy \((P = 0.003 \text{ and } P = 0.04, \text{ respectively})\). Precontemplators had greater agreement than contemplators on one barrier item—health care provider did not recommend \((P < 0.001)\). Interestingly, contemplators were almost twice as likely as precontemplators to agree they were afraid to have a colonoscopy because you might find something wrong \((P = 0.03)\). Compared to actors and contemplators, precontemplators reported significantly greater agreement with my health care provider never recommended a colonoscopy \((P < 0.001)\).

**Discussion**

To develop interventions promoting CRC screening, we need to understand variables related to stage of adoption. This study examined how perceived benefits and barriers to screening differ across stages of adoption. Findings can inform stage-targeted interventions. This study involved FDRs—a group with potentially more CRC knowledge than the general population. Most participants agreed with the benefit statements for FOBT, sigmoidoscopy and colonoscopy. These high rates of agreement, or ceiling effects, may have limited ability to detect differences across stages.

Despite high rates of agreement with screening benefits, the majority of these FDRs were precontemplators (had never thought about being screened). Even when analyses were limited to FDRs aged 50 years or older, most were not even contemplating FOBT, sigmoidoscopy, or colonoscopy; only 21% of screening-eligible FDRs were in action for FOBT and colonoscopy; 30% were in action for sigmoidoscopy. These low rates of CRC screening in a group who, theoretically, should have been motivated by family history and recent experience with CRC in a close relative, indicate that other factors may influence behavior. Age was related to stage of FOBT and sigmoidoscopy adoption—with older FDRs more likely to be in action—but not for colonoscopy.

Lack of physician recommendation has been well established as a significant barrier for CRC screening. Results of this study are consistent with previous work and indicate that, even among those with a family history, lack of provider recommendation is the most commonly endorsed barrier to adoption of CRC screening. However, readers should note that the marginal significant difference between contemplators and actors may indicate that more than provider recommendation is needed to move people to action at least for more invasive tests. A limitation of our study is that we had more power to detect significant differences between precontemplators and other stages because of the large numbers in the precontemplation group.

Barriers to FOBT that need to be overcome by individuals at all stages include limited understanding of the importance of testing absent symptoms and lack of knowledge regarding how to do the test. Consistent with theoretical predictions, there were some differences by stage. Precontemplators, in
particular, may be motivated by specific information about what screening is, why it is important, the natural progression of polyps to cancer, lack of symptoms in early disease, how to do an FOBT and its low cost.

The same four barriers were significant for sigmoidoscopy—no need for sigmoidoscopy if you have no problems, feeling anxious because you do not understand what the test involves and cost. That precontemplators were more likely to agree with these barriers indicates they may benefit from interventions directed at overcoming these specific barriers. We were surprised that those in the action stage were more likely than contemplators to agree that I do not need a sigmoidoscopy because I have no problems. The potential explanation that those who previously had a sigmoidoscopy learned their colons were healthy and, as a result, endorsed this item was not supported with the same barrier item for colonoscopy. It may be that, for sigmoidoscopy, stressing importance of screening absent symptoms may be more important for moving precontemplators to contemplation than contemplators to action.

It is notable that eight of 11 colonoscopy barriers differed by stage, with actors consistently demonstrating less agreement than precontemplators and contemplators. Other than provider recommendation, only one barrier differentiated precontemplators from contemplators—afraid to have a colonoscopy because you might find something wrong.

At first glance, the consistent finding of the barrier item, I don’t need (an FOBT or sigmoidoscopy) because I have no problems as significantly different for these two tests with this sample was surprising. One interpretation may be that FDRs lack understanding of asymptomatic screening (versus diagnostic testing). This is consistent with a previous focus group study (Harris et al., 1998) with 40 FDRs in which the asymptomatic nature of early colon cancer was not well understood. An alternate explanation may be that FDRs who have been screened with sigmoidoscopy or colonoscopy and found to have clear colons would logically endorse this statement. Further analyses are needed to determine if FDRs are more or less likely than the general population to understand the need for screening absent symptoms.

Several limitations are noteworthy. Theoretically, making decisions about colorectal cancer screening is a complex process involving a variety of factors which includes, but is not limited to, each individual’s stage of adoption and perceived benefits of and barriers to screening. Other factors that have been shown to influence these decisions include physician recommendation and insurance coverage. These analyses were limited to examining relationships between stage, perceived benefits and barriers. Examining relationships between stage and all other factors potentially related to screening was beyond the scope of this paper.

The cross-sectional design did not allow for examination of within-individual changes in benefits and barriers across stages over time. Because analyses of group differences by stage may not correspond with individual changes during movement across stages, longitudinal analyses are needed. Generalizability of findings is limited because the sample was predominantly Caucasian, middle class and well-educated. Whether these results would be observed in a more diverse or disadvantaged population is unclear. This FDR sample also may have different perspectives on CRC and screening behavior than the general population, although their screening participation rates are only slightly higher.

The TTM has increased our ability to measure behavioral changes with greater sensitivity by detecting change along a continuum rather than as a discrete behavioral outcome. However, there are challenges in applying the TTM to CRC screening. For individuals considering CRC screening for the first time, appropriate TTM stages include pre-contemplation, contemplation and preparation; those who have been screened are actors. In this study, precontemplators had never thought about getting screened or were not interested in getting screened in the future. Contemplators were considering screening within 6 months. Because we did not assess whether individuals currently had an appointment to be screened, we were not able to assess the
preparation stage. In contrast to FOBT, in which those in the action stage reported having had an FOBT in the past year, for sigmoidoscopy and colonoscopy, actors had simply been screened with these tests at some time in the past. We have since modified our staging questions for sigmoidoscopy and colonoscopy to more accurately determine who is in Action based on whether individuals have been screened in the appropriate timeframe.

For CRC screening, however, assessing whether individuals are truly in action or maintenance according to a specified timeframe is difficult. For FOBT, repeat adherence (i.e. maintenance) is a measurable stage but determining maintenance for behaviors that occur only once every 5 years or more—sigmoidoscopy or colonoscopy—presents a different and important challenge. Significant information about an individual’s objective risk for CRC is obtained through direct clinical examination of the colon via sigmoidoscopy and/or colonoscopy. Results of screening sigmoidoscopy and colonoscopy provide evidence for risk stratification and guide physician recommendations for follow-up (Mandel et al., 1993). The only appropriate follow-up recommendation for a positive FOBT or sigmoidoscopy is complete examination of the entire colon via colonoscopy. If colon findings are significant (i.e. polyps are large, numerous or histologically advanced), follow-up recommendations may be to repeat colonoscopy in 1–3 years. Alternatively, repeat colonoscopy may be recommended in 5 years if findings are less significant (Slattery and Kerber, 1994). Because physicians’ recommendations are individualized based on sigmoidoscopy and colonoscopy findings, determining adherence to follow-up after endoscopic screening is complex.

For people screened via colonoscopy, annual FOBT is no longer necessary or recommended; therefore, measuring their adherence to annual FOBT (maintenance) does not make sense. However, little research has been conducted on colonoscopy adherence and studies examining FOBT and flexible sigmoidoscopy participation, without including colonoscopy, are seriously limited. No studies addressing the complexities of CRC screening by examining utilization of all three screening tests and their interdependence on one another have been identified. Much additional work is needed to assess the extent to which the TTM is helpful in the context of CRC screening. Adequately measuring CRC screening behavioral outcomes is a necessary first step.

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