CANCER SCREENING BENEFITS AND HARMS: NEWS COVERAGE AND PROVIDER PERCEPTIONS

Emily A. Elstad

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Approved by:

Noel T. Brewer

Jo Anne Earp

Valerie F. Reyna

Christine Rini

Stacey L. Sheridan

ABSTRACT

Emily A. Elstad: Cancer Screening Benefits and Harms: News Coverage and Provider Perceptions
(Under the direction of Noel T. Brewer)

Background. Cancer screening poses both potential benefits and potential harms to patients. This dissertation explored news coverage and provider perceptions of screening by comparing colonoscopy, which results in net benefit for many adults, to the prostate-specific antigen (PSA) testing, which may do more harm than good.

Methods. Study 1 data came from a 2012 survey of clinicians (*n*=126) from 24 family/internal medicine practices in North Carolina. Analyses examined clinicians' perceptions of screening benefits and harms and potential mediators of the relationship between screening test and clinicians' likelihood estimates. Study 2 data came from a content analysis of articles on PSA testing or colonoscopy in the top 10 U.S. print newspapers. Analyses examined whether newspapers' portrayal of screening changed after the 2008 U.S. Preventive Services Task Force recommendation changes.

Results. In Study 1, we found that clinicians perceived PSA testing to have greater likelihood of harm than colonoscopy and lower likelihood of lengthening life. These associations were mediated by clinicians' gist of screening and perceived benefits, but not perceived harms. In Study 2, we found that mentions of PSA harms in newspapers were stable before 2008 but increased after that time. Mentions of PSA benefits and colonoscopy harms and benefits did not change over time.

Discussion. Clinicians and the news media both fell short as sources of information on PSA testing and colonoscopy. Patients may be receiving imbalanced information on cancer screening. Thus, clinicians, experts in dissemination, and the USPSTF may face hurdles in communicating new recommendations to patients. Messages to clinicians intended to decrease over-recommendation of PSA testing may need to emphasize its relatively few benefits rather than its many harms.

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CHAPTER 1: SPECIFIC AIMS

Currently, three quarters of the preventive services graded by the U.S. Preventive Services Task Force have possible or clear harms that outweigh benefits (1), yet many of these preventive services are delivered at rates in excess of recommendations (2-4). Overuse of potentially harmful screenings can lead to adverse patient outcomes, excess health care costs, and non-ideal patient care. Yet little is known about what leads clinicians to recommend potentially harmful screening tests.

We know that individuals often do not use calculated, rational decision making for everyday decisions (5,6); rather, they rely upon intuitive, automatic, and highly efficient strategies such as heuristics to overcome the difficulties posed by uncertainty (7). Heuristic processing can involve attribute substitution, a psychological process whereby the individual substitutes an easily calculated attribute for a more complex or uncertain one (8). One well-documented heuristic, the availability heuristic, is a cognitive short-cut whereby people estimate the likelihood of a future event based upon the ease with which they can call to mind instances of such events (9). Like laypeople (10), experts also use heuristics such as availability in making decisions (11-15). For example, physicians' overestimation of disease likelihood is associated with greater ease of their recalling instances of that disease (16,17). If the harms of cancer screening do not come easily to mind, it follows that clinicians may underestimate these harms and subsequently over-recommend cancer screening tests.

There are several explanations for why some information comes to mind more easily than other information. In some cases, easily remembered information may reflect real risk (18) and therefore be the most appropriate information upon which to base decisions. However, easily recalled information may reflect what makes an emotional impact (19) or what the news media emphasizes (20,21). While the benefits of cancer screening have received substantial attention in the medical literature, media, and even from the U.S. postal service (22), the harms of cancer screening have received less exposure (23). Indeed, media coverage of cancer screening benefits and harms is frequently unbalanced, inaccurate or biased (23-25). Understanding the degree and framing of screening harms coverage in the media may speak to the availability of harms for the general public, including clinicians.

The objectives of this dissertation are twofold: First, to determine whether the availability of harms and benefits correlates with clinicians' perceived likelihood of harm for two screening tests that vary substantially in their ratio of benefits to harms; and second, to characterize news media coverage of these cancer screening harms and benefits from 2005-2012. In this dissertation, I pursue the following specific aims:

Aim 1a. Describe clinicians' perceptions of the benefits and harms of screening for prostate and colorectal cancer.

Aim 1b. Understand how clinicians arrive at their perceptions of the likelihood of life lengthened and likelihood of harm from prostate and colorectal cancer screening.

Aim 2a. Describe newspapers' portrayal of the benefits and harms of screening for prostate and colorectal cancer from 2005-2012.

Aim 2b. Determine whether this portrayal changed after the 2008 USPSTF recommendation changes.

CHAPTER 2: INTRODUCTION

Public Health Challenge

Cancer screening poses both potential benefits and potential harms to patients. Cancer screening can be beneficial, lengthening lives by reducing cancer-related morbidity and mortality. For example, regular screening for colorectal cancer has contributed to reducing the age-adjusted mortality rate for colorectal cancer from approximately 34 deaths among men and 25 deaths among women per 100,000 in 1975 by almost half to approximately 19 deaths among men and 13 deaths among women per 100,000 in 2010 (27,28). However, cancer screening can also result in harms from over- and inappropriate use. For example, screening for prostate cancer with the prostate-specific antigen (PSA) test can result in bleeding and hospitalization from follow-up biopsies, and incontinence, impotence, and even death from treatment (e.g., prostatectomy) for cancer that may never cause harm. Clinicians' recommendations are instrumental in shaping patients' screening decisions (29-31), yet we know little about how clinicians arrive at their evaluations of the likelihood of benefit or harm from screening. Further, media coverage of cancer screening benefits and harms is frequently unbalanced, inaccurate or biased (23-25), but how the news has portrayed screening benefits and harms in recent years is unknown.

This dissertation examines clinicians' perceptions and media portrayal of cancer screening benefits and harms by comparing two screening tests that vary substantially in their ratio of benefit to harms: colorectal cancer screening with colonoscopy, which results in net

benefit for many adults (32); to prostate cancer screening with the PSA test, which results in net harm for the majority of men (33) (Table 1). PSA testing and colonoscopy are the two most common screening tests that men receive, and they have diametrically opposed ratings by the U.S. Preventive Services Task Force (USPSTF): For a 70-year old man, colonoscopy is an "A"-rated service reflecting clear benefit, whereas PSA testing is a "D"-rated service reflecting net harm. There are qualitative differences between the harms of PSA testing and colonoscopy, making the comparison a complex one; however, comparing real screening tests will yield more clinically meaningful results than comparing hypothetical tests.

Table 1.

Similarities and Differences between the PSA Test and Colonoscopy (for a 70-year-old Man)

	PSA Test	**Colonoscopy**
2012 USPSTF rating	"D"-rating for all men (recommendation against regular screening with the PSA test)	"A"-rating (recommendation that adults aged 50-74 be screened every 10 years with colonoscopy)
Main public health concern	Overuse	Appropriate use
Screening involves	Simple blood test	Burdensome preparation involving diet changes, laxatives; internal exam for polyp detection and removal
Harm concern	"Screening cascade"	Test itself & prep for test

Most relevant harms	Physical
	• Blood test
	  ○ Bruising
	• Biopsy
	  ○ Fever, infection, bleeding, hospitalization
		Physical
		• Colonoscopy
		  ○ Perforation, bleeding, cardiovascular events, diverticulitis, abdominal pain

	• Treatment
	  ○ Impotence, incontinence, vascular events, death
	Psychological
	• False positives, overdiagnosis
	  ○ Worry, anxiety
	Financial Strain
	Opportunity Costs
	• Work or health opportunities missed
	Hassle
	• Unnecessary follow up and treatment
		• Prep for colonoscopy
		  ○ Pain, discomfort
		Psychological
		• Annoyance or fear of prep for test
		Financial Strain
		Opportunity Costs
		• Work or health opportunities missed
		Hassle
		• Unnecessary follow up and treatment

Prostate and Colorectal Cancer Screening Recommendations

In 2008, the USPSTF recommended against PSA testing for men over 75 ("D" grade) and maintained their "I" grade for all other men, indicating insufficient evidence to assess the test's benefits and harms (34). Then in May 2012, the USPSTF recommended against using the PSA test for screening purposes altogether ("D" grade for all men), concluding that while many men are harmed by the PSA test, few, if any, benefit (33). In 2008, the USPSTF released a new recommendation for colorectal cancer screening. They recommended that adults between ages 50-75 receive screening for colorectal cancer with colonoscopy, sigmoidoscopy, or fecal occult blood testing (FOBT). They also recommended against routine colorectal cancer screening in adults ages 76-85 ("C" grade) and against screening altogether in adults over 85 ("D" grade) (32).

This dissertation references the USPSTF's screening recommendations, as they are the pre-eminent source of preventive service-related recommendations for the U.S. The USPSTF recommendations have been adopted by the American Academy of Family

Physicians (35) and play a central role in whether Medicare covers screening services (36). While not all organizations' guidelines completely align with the USPSTF recommendations, a recent survey found that 90% of clinicians believe the USPSTF recommendations to be very or extremely influential in their screening recommendations (37), and the USPSTF recommendations continue to be the strongest influence on primary care physicians' screening recommendations related to prostate cancer screening (38). Differing somewhat from USPSTF recommendations, the American Cancer Society recommendations state that the decision whether to get a PSA test should be an informed decision made by the patient in consultation with his doctor (39). The American Urological Association, which until May 2013 recommended routine screening with the PSA test, now recommends shared decision making for men ages 55-69 and screening at intervals no more frequent than every two years. Their new recommendation now also recommends against PSA screening altogether for men under 40 and against routine screening for men ages 40-55, men older than 70, or men whose life expectancy is less than 10-15 years (40).

Prostate Cancer Screening with the PSA Test

In 2003, the PSA test was more common than colorectal cancer screening with colonoscopy, a service with proven and substantial efficacy (3,32). This is no longer the case, as the number of people over 50 who have received a colonoscopy in the past 10 years has risen since 2003 (48.1% in 2002 compared with 64.2% in 2010) (41). As the BRFSS is self-report data, these rates may be slightly higher than rates attained through medical chart review (42,43). The number of men over 40 who have received a PSA test in the past two years has remained relatively constant, and does not appear to have been influenced by the

publication of the results of large clinical trials showing net harm of PSA (44,45) or recommendation changes. The testing rates for men aged 40 to 49 years, 50 to 59 years, and 60 to 64 years were 12.1%, 32.7%, and 42.7%, respectively, in 2001 versus 15.7%, 34.2%, and 42.0%, respectively, in 2011, based on medical claims data (46).

Screening overuse occurs when patients receive screening at intervals more frequent than is recommended. Overuse of the PSA test can lead to a "screening cascade" of harms for patients. An overwhelming 80% of positive PSA test results are false-positives (44), which are associated with negative psychological effects such as worry and anxiety (47,48), and increased additional testing (49). Such additional testing usually involves a biopsy, and roughly one third of men who have prostate biopsy experience pain, fever, bleeding, infection, transient urinary difficulties, or other issues requiring clinician follow-up that men consider a "moderate or major problem," and around 1% require hospitalization (50). In addition, the harms related to treatment of screen-detected cancer are significant (49). Almost 90% of men with PSA-detected prostate cancer in the U.S. have early treatment with surgery, radiation, or androgen deprivation therapy (51,52). Approximately 5 in 1000 men will die within one month of prostate cancer surgery, and 10-70 men will have serious complications but survive. Radiotherapy and surgery result in long-term adverse effects, including urinary incontinence, bowel and erectile dysfunction in at least 200 to 300 of 1000 men (53). These harms might be justified if they prolonged life, but screening with the PSA test is not associated with significant reduction in prostate cancer mortality; the benefit of PSA screening and early treatment ranges from 0 to 1 prostate cancer deaths avoided per 1000 men screened (34).

Overdiagnosis and overtreatment of prostate tumors through PSA testing also pose potential harms. Overdiagnosis occurs when individuals with cancer that would remain asymptomatic for the rest of their lives receive screening and subsequent treatment that does not benefit them. Clinicians and their patients frequently elect to treat cases of screen-detected cancer, but given our current inability to distinguish tumors that will remain harmless from those that are deadly, many patients will not benefit from this treatment (51,54). Instead, many men who will never become symptomatic are subjected to the harms of treatment. Of those men whose screen-detected cancer would have been later identified without screening, most experience the same outcome (i.e., non-lethal disease) and are, therefore, subjected to these harms for a much longer period of time (55,56). One recent study found that PSA testing was associated with large increases in the number of men overdiagnosed with and unnecessarily treated for prostate cancer (57). In addition to leading to possible harm and non-ideal patient care, PSA testing results in excess health care costs. For example, the annual cost of PSA screening in the U.S. is at least $3 billion, much of this paid for by Medicare and the Veteran's Administration (58).

Colorectal Cancer Screening with Colonoscopy

Colonoscopy is the most sensitive and specific screening test for colorectal cancer. Unlike sigmoidoscopy or FOBT, colonoscopy allows for both detection and prevention through detection and removal of polyps during the procedure. Despite its known life-saving benefit (32), some people experience harms of colonoscopy. Harms of colonoscopy are due to preparation for the procedure, the sedation used during the procedure, and the procedure itself (32). In the United States, perforation of the colon occurs in an estimated 3.8 per 10,000

procedures (59). Serious complications, including death or adverse events such as major bleeding, diverticulitis, severe abdominal pain, and cardiovascular events requiring hospitalization occur in an estimated 25 per 10,000 procedures (60).

Overdiagnosis of colorectal cancer occurs when people over the age of 85 who have a short life expectancy are screened, even though they cannot benefit from the screening, or when the colonoscopy procedure detects and removes polyps. Overuse of colonoscopy occurs when surveillance and colonoscopy occur at more frequent than recommended intervals. While underuse of screening for colorectal cancer screening has been reported (i.e., when individuals in the appropriate age range of 50-74 do not receive screening every 10 years) (61,62), several studies found that colonoscopies were administered to some patients more frequently than recommended and without sufficient indication (i.e., for surveillance only) (62-65). Specifically, one large study of Medicare patients found that 33% of those aged 80 or older received a repeated colonoscopy within 7 years (65). Another study found that thirty-five percent of clinicians recommended colonoscopy at intervals more frequent than every 10 years (66).

Dual Process Models

Dual process models propose two contrasting modes of thinking: thinking quickly and intuitively versus slowly and analytically. Some dual process models refer to these two modes to as “System 1” and “System 2” (67). System 1 processing is automatic, quick, intuitive, and operates with little or no effort and no sense of voluntary control. System 2 processing involves effortful attention, deliberation, and complex cognitive computations

(68). Certain heuristics involve System 1 thinking (69) while others are conscious and deliberative in nature and are thus the domain of System 2 (70).

Another dual process theory that may help explain clinician risk perception is Fuzzy Trace Theory (FTT), which holds that people have two ways that they remember events and facts (71). They can recall the precise "verbatim" information, but this information fades quickly over time. More enduring is "gist" memory for the underlying meaning or meanings that people ascribe to the event or fact. Individuals generally prefer and rely upon vague "gist" information even when they can remember specific details or verbatim information (71). Reyna has defined "gist-based thinking" as "the distillation of meaning of past experiences into an intuitive, bottom-line interpretation" (Reyna, 2008, 852). Thus, a clinician may store verbatim or quantitative information about screening harms in her mind (e.g., specific probabilities such as "my patient has a 2 in 1000 chance of experiencing a harm"), but the gist information (e.g., "my patient's chance of experiencing harm is remote") will ultimately be what drives her decision to recommend screening. Indeed, health care professionals and other experts commonly rely on gist, more so as experience and training increase (72-75)

The Availability Heuristic

One well documented heuristic is the availability heuristic, whereby people base their estimates of the future likelihood of an event upon the ease with which they can call to mind instances of such events (9). At least two theories address how heuristics of judgment work. Shah and Oppenheimer (2008) propose that all heuristics rely on *effort reduction* by one or more of the following: (1) examining fewer cues, (2) reducing the effort of retrieving cue

values, (3) simplifying the weighting of cues, (4) integrating less information, and (5) examining fewer alternatives. Another explanation for the functioning of the availability heuristic comes from Kahneman and Frederick, who propose that heuristics of judgment involve *attribute substitution*, a psychological process whereby the individual substitutes an easily calculated attribute for a more complex or uncertain one (8). Thus, when individuals estimate the size of a category or frequency of an event, they frequently rely upon an impression of the ease with which instances of that category or event come to mind.

Over the past thirty years, a large body of experimental research has linked the availability heuristic with an individual's assessment of outcomes. In perhaps the most well-known of these studies, Tversky and Kahneman demonstrated biases of availability by showing that categories of information whose instances are easily retrieved seem more numerous than categories of equal frequency whose instances are less retrievable (7). In one experiment in which study participants were shown lists of men's and women's names, the inclusion of famous names of one particular gender lead to increased frequency estimates for names in this gender (9). In another experiment, Tversky and Kahneman found that individuals judge there to be more words that start with *t* in the English language than words with *t* in the third position, presumably because the former are more easily retrieved from memory. Several subsequent lines of research have focused on what *content* is recalled in assessment of outcomes (76-79). For example, Higgins and colleagues showed that we interpret ambiguous information in terms of the information that is most accessible at the time of cognitive processing (80). Bodenhausen and Wyer subsequently demonstrated that we rarely retrieve all the relevant information but base our judgments on the subset of information that is most accessible in memory (81).

Availability can be operationalized in two ways: as the sheer number of instances of a category one can recall (9,82,83), and as the subjective ease of recalling those instances, which has also been described as "accessibility" (83-86). As I will be testing both availability constructs in my dissertation, to avoid confusion, I will refer to the number of instances of a category clinicians recall as "number of benefits/harms" (87) and the experienced ease of recall with which these instances are brought to mind as "subjective ease of recall."

While it may seem that subjective ease of recall is reliant upon recalled content, these two variables frequently function independently, which has been demonstrated by the attenuation of subjective ease of recall when the informational value of recalled content is called into question (88-91). However, with two sets of letters, Kahneman clearly and simply demonstrates the independence of recalled content and the subjective ease of recall (2012):

XUZONLCJM

TAPCERHOB

Kahneman notes that when we look at these two sets of letters, we know *without coming up with any instances*, that one set contains many more possibilities for constructing words than the other. Thus, subjective ease of recall is different from recalled instances of a category, though they may act in concert under some conditions. Several researchers have added to this finding by exploring how numerosity affects the availability heuristic. Beyth-Marom and Fischhoff found that frequency estimates of a category were correlated with two "direct measures of availability": time to produce first instance and number of instances in the first five seconds. They also found that exhaustively listing instances of a category led to improved frequency estimation (92). As well, Schwarz and colleagues found that both recalled content and the subjective ease of recall mediate this relationship (89).

Importantly for this study, the number of cases an individual is asked to list influences frequency estimates. Schwarz and his colleagues found that if asked to retrieve four examples of a case, subjective ease of recall will be high, leading people to estimate the frequency of that case as higher. However, when asked to retrieve 12 examples, subjective ease of recall is lower, leading to the conclusion that the frequency of that case is lower (89). As described in greater detail in the Methods section of this proposal, the number of harms we asked clinicians to recall was an important consideration, given that this variable has the potential to influence both subjective ease of recall and estimation of harm.

Likelihood Perceptions

Perceived likelihood of harm and life lengthened assess risk perception, a construct that is central to many theories of decision making and health behavior. Likelihood estimates are important as they are a strong predictor of protective behavior (47,93). The notion that perceived risk should have a positive relation to subsequent decisions and protective behaviors has its roots in Subjective Expected Utility Theory (SEU). Subjective probability refers to a decision maker's degree of belief in the likelihood of the realization of events (94). Broadly, SEU is a normative theory that holds that individuals' choices can be explained as a function of their subjective perception of the probability of an uncertain event occurring and its expected utility to them (95). With roots in SEU, the behavior motivation hypothesis maintains that elevated risk perceptions lead to protective behavior, and empirical findings lend support to this theory (47,93,96,97).

Research has documented the availability heuristic in various constructs relevant to probability or likelihood judgments. Tversky and Kahneman originally demonstrated the effect of the availability heuristic on recalled set size/frequency of occurrence (9). A survey of Midwestern residents showed that those with high recall for antidepressant direct-to-consumer advertising tended to estimate the prevalence of depression higher than those with low ad recall (20). Lichtenstein and colleagues (1978) reported that their subjects' estimates concerning the relative frequencies of death from various causes were directly correlated with the extent of past personal experiences involving each class of lethal event (98). Personal experience has been used as a proxy for availability (99,100), though evidence suggests that personal experience is a separate concept from availability, and that the relationship between personal experience and risk perception is mediated by subjective ease of recall (101-103).

Availability, and variables similar to availability such as personal experience, influence judgments of the likelihood of future events as well (104). For example, using personal experience as a proxy for availability, Gana and colleagues (2008) found that female students who had personal experiences with breast cancer overestimated their own risks of getting breast cancer in the future (100). As well, clinicians overestimate disease likelihood based on how well they can recall instances of that disease (16,17).

Role of the Media

In some cases, easily remembered information may reflect real risk (105) and therefore be the most appropriate information upon which to base decisions. However, the availability of information may simply reflect what makes an emotional impact (19) or what

is emphasized in the news media (20,21). By emphasizing certain topics and events, the news media plays a significant role in shaping—and sometimes distorting—availability and risk perceptions (21,98,106). For example, Lichtenstein et al. (1978) observed that people's median estimated frequency was higher for risks for which newspaper coverage was more extensive, irrespective of the true risk. They found that study participants overestimated the likelihood of sensational or vivid causes of death such as botulism, tornado, flood, homicide, motor vehicle deaths and cancer, while underestimating more common but undramatic causes of death such as diabetes, stroke, and heart disease. One possible explanation the authors offer is that sensational events become more durable memories ("gist" memories) that are more easily retrieved than undramatic events.

Kuran and Sunstein have explained the phenomenon whereby the news media distorts risk perception as an "availability cascade" (107). An availability cascade is a self-sustaining chain of events, usually starting with the news media covering a relatively minor event, which sparks an emotional reaction among the public, which in turn becomes a news media story in and of itself, leading to yet more emotional outcry (outrage) and more coverage. The issue, once considered a minor story, is now of political interest because of the public outcry and news media attention. In this way an "availability cascade" may affect policy priorities and health outcomes. One relevant example of an availability cascade is the effect of the news of Kylie Minogue's breast cancer diagnosis. Her diagnosis spurred a 20-fold increase in news coverage of breast cancer, and overall bookings of breast cancer screenings rose 40% in the two weeks of publicity following her public announcement (108). Other studies have reported similar increases in screening uptake attributed to increased news coverage of newsworthy cancer-related events (109-111).

The availability cascade and availability heuristic may be inextricably intertwined with another heuristic of judgment: the affect heuristic (112,113). Antonio Damasio observed that emotions play a critical role in shaping decisions, and thoughts that are especially laden with emotion come to mind with greater ease than thoughts that are unemotional, which can lead to errors of judgment (114-118). Different emotions can vary in their influence on risk judgments (119,120).

News media coverage frequently skews towards poignancy, novelty and stories that elicit an emotional response from readers (121,122) as these qualities draw and keep peoples' attention. Because media coverage stresses highly improbable risk in an effort to captivate audiences, it may distort the public's perceptions of risk. Recent research indicates that media may most strongly influence risk perception through affect (e.g., emotions such as dread (123)) (121). Thus, for example, if the media sensationalizes the potential benefits of cancer screening or presents them alongside emotion-laden testimonials, consumers may more easily access thoughts of those benefits than thoughts of the potential harms.

The press may not accurately represent the benefits and risks of medical issues, which may also have an impact on the accuracy and availability of information that patients and clinicians recall when making decisions about medical care. Indeed, media coverage of cancer screening benefits and harms is frequently unbalanced (25,124-127), incomplete or inaccurate (24,128-131), or biased (25). Several studies have found that articles on cancer screening emphasize the major benefits of screening while underemphasizing its harms (23,25,124,126). For example, Katz and colleagues found that the benefits of prostate and colon cancer screening were mentioned in 89% of popular magazine articles, while harms were mentioned in 43-58% of articles (2005).

If cancer screening harms are under-, or mis-represented in the media, this may make the harms of cancer screening more difficult for clinicians to call to mind. Moreover, disproportionate exposure of certain topics by the media (such as a disproportionate focus on benefits of screening) may result in persistent, systematic biases that interfere with decision making, especially as individuals may be unable to correct for biases even when specifically instructed to avoid them (98).

About half of the U.S. population is exposed to some form of news media on a daily basis (132). Thus, understanding the degree and framing of screening harms coverage in the news media may speak to the availability of harms information for the public. While print newspapers are not the form in which most Americans consume news (133), research on mass media frequently uses newspapers as proxies for all news media (134,135) as newspapers often set the agenda for other news formats (136,137). Furthermore, both TV and radio are structurally and temporally constrained in that they have limited time to devote to the news, and this brevity results in an inability to adequately explain health problems and medical tests (131). Cancer screening may be considered less newsworthy or have less mass-appeal when compared with more high profile, dramatic news. In addition, TV news is the least trusted media source, frequently lacking a full-time health journalist (131,138). In contrast, print newspapers frequently have entire sections dedicated to health-related news, and full-time health journalists and may, therefore, contain more stories related to cancer screening. Research on online news sources faces practical challenges due to available search engines' (e.g., Google, Bing) search algorithms, which act as a "gatekeeper," limiting the researcher's ability to control their search terms and search systematically. Given this rationale, print newspapers are the most appropriate proxy for news media coverage of

cancer screening for this study.

Comparison of PSA Testing to Colonoscopy

In Aim 1, I test whether the availability of harms and benefits information differs by screening test, comparing a screening test with net harm (PSA testing) to one with net benefit for many adults (colonoscopy). In particular, I hypothesize that harms information is likely to be more available for PSA testing relative to colonoscopy, leading to greater perceived likelihood of harm for PSA testing. I have chosen the PSA test as a proxy for a screening test with a low benefit-to-harm ratio for several reasons. First, it is perhaps the most well-known example of an inefficacious cancer screening test. Moreover, there is good evidence that the harms of PSA testing outweigh its benefits and it has a corresponding "D" rating from the USPSTF. Conversely, I have chosen colonoscopy as a proxy for a screening test with high benefit-to-harm ratio given that it is the reference standard test for colorectal cancer, and it has a diametrically opposed "A" rating from the USPSTF for adults ages 50-75. This comparison of prostate cancer screening to colorectal cancer screening is an interesting and important one given that screening rates for these tests are comparable to each other and relatively high, and despite net harm of PSA testing, clinicians continue to order the test. This comparison will allow me to provide evidence of low availability or knowledge of harms as one explanation for why clinicians persist in ordering the PSA test, contributing to our understanding of the problem of overuse and over-recommendation of the PSA test.

In Aim 2 of this dissertation, I compare news coverage of screening harms across PSA and colonoscopy and explore how this coverage has changed over time. Given controversial USPSTF recommendation changes for PSA screening in 2008 and a less

controversial one for colonoscopy in the same year, I assess changes in mentions of harms/benefits and gist before and after 2008. Colonoscopy articles are likely to be predominantly "pro" screening with greater discussion of benefits, and I do not expect the gist or presentation of harms/benefits to change over time for colonoscopy articles. The reason for this assumption is that there has been no emergent evidence or controversial (newsworthy) recommendation changes for colonoscopy during the same time period. Taken together, this research will provide a better understanding of two important predictors of screening behavior by exploring how the news media portrays, and how clinicians perceive, the benefits and harms of prostate and colorectal cancer screening.

Explanation of Dissertation's Conceptual Model

As depicted in Figure 1 below, Aim 1 of my dissertation examines whether cancer screening test predicts clinicians' perceived likelihood of harm, and whether the availability of harms—operationalized as number of harms listed and the subjective ease of recall—mediates this relationship. Per the request of my dissertation committee, I will also test whether: 1) screening test moderates the relationship between availability and perceived likelihood of harm; 2) number of benefits listed mediates the relationship between screening test quality and perceived likelihood of life lengthened; and 3) "overall gist" (defined as the summed magnitude of benefits minus the summed magnitude of harms) mediates the relationship between screening test and both perceived likelihood of harm perceived and likelihood of life lengthened.

My second aim is to assess how newspapers depict harms and benefits of screening for colorectal and prostate cancer from 2005-2012, as shown in Figure 2. I will assess the

effect of time on mentions of harms/benefits and on expected expert and lay gist in newspapers. Findings from Aim 2 will not directly explain the findings from Aim 1. The Aim 2 findings will, however, provide us with a better understanding of the scope of news media coverage of screening harms and the social context within which harms information is made "available" to the public, and within which clinicians make screening-related decisions.

Figure 1. Conceptual model of Aim 1

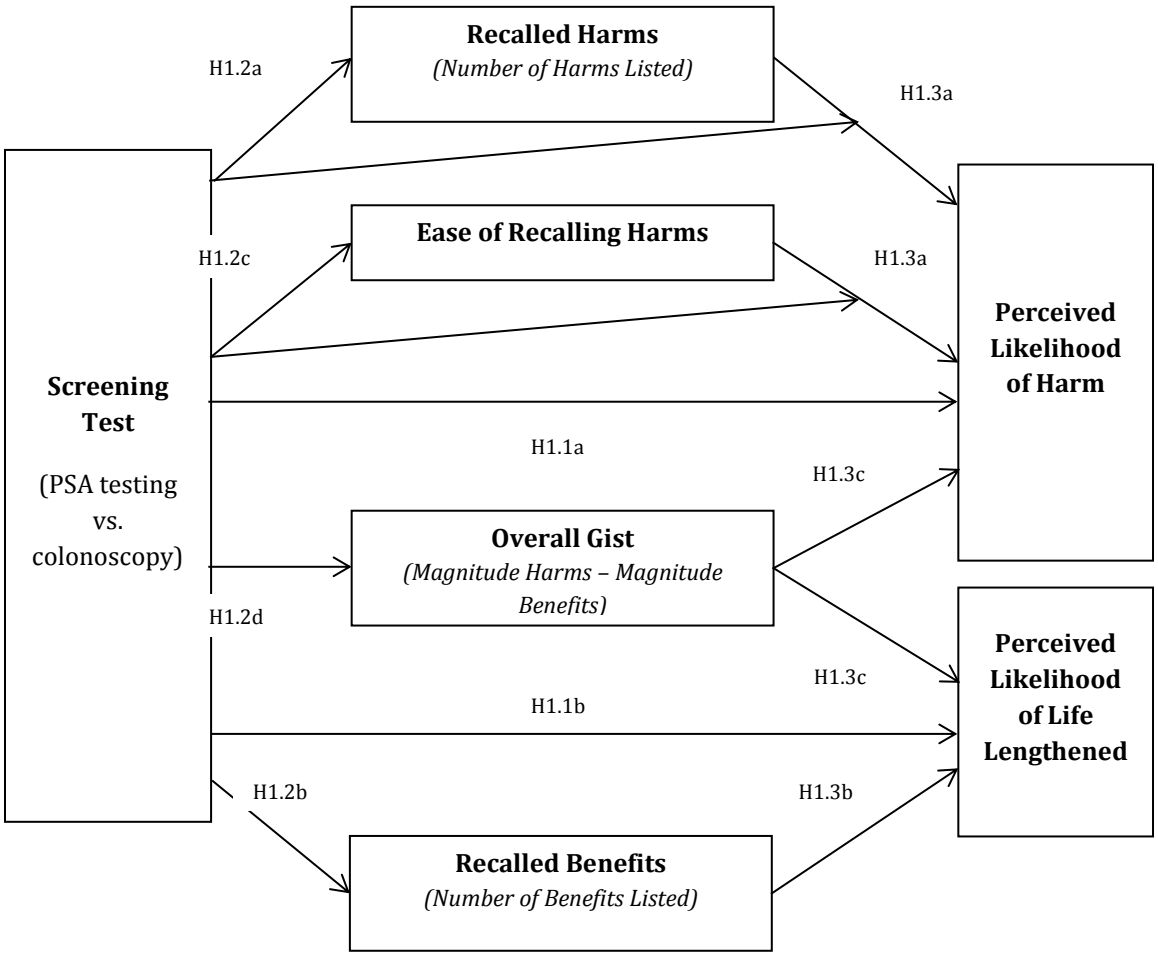
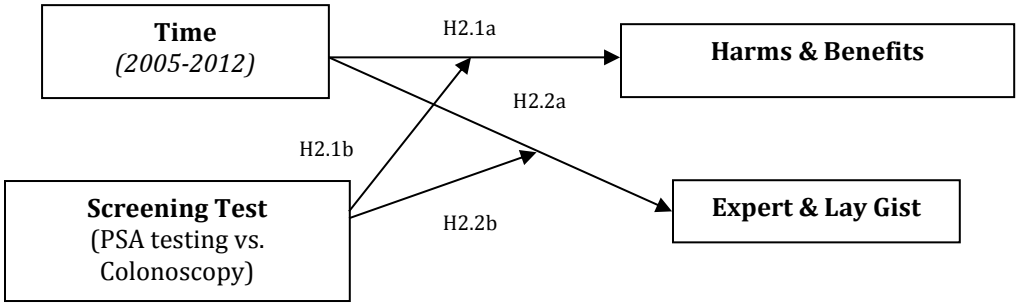


Figure 2. Conceptual model of Aim 2



CHAPTER 3: CLINICIANS' PERCEPTIONS OF THE BENEFITS AND HARMS OF PROSTATE AND COLORECTAL CANCER SCREENING (Paper 1)

Introduction

Cancer screening poses both potential benefits and potential harms to patients. It can lengthen life and increase quality of life by reducing cancer-related morbidity. However, cancer screening can result in harms from the screening procedure itself and from overdiagnosis and unnecessary follow up and treatment (139). Clinicians' recommendations are instrumental in shaping patients' screening decisions (29-31), yet we know little about clinicians' perceptions of screening benefits and harms or how they arrive at their perceptions of the likelihood of benefit or harm from screening. These kinds of perceptions and likelihood judgments are a useful focus of research because they play an important role in theories of decision making (140) and health behavior (141).

To understand how clinicians formulate these perceptions and likelihood judgments, it is helpful first to know that people often do not use calculated, rational decision strategies (5,6) but instead rely upon quick, intuitive, automatic strategies, sometimes called heuristics, to make decisions under uncertainty (7). Laypeople and experts, including clinicians, frequently rely upon heuristics (10,12,15), more so as expertise increases (72,75,142,143). One such heuristic is the availability heuristic, whereby people estimate the likelihood of future events based on the ease with which they can call to mind instances of such events (9). For example, patients (144) and physicians (16,17) tend to overestimate the likelihood of a

disease if they can more easily recall details about it. Researchers frequently operationalize availability of information in two ways: as the number of instances of a particular type of information that participants can recall (9,82,83) and as the subjective ease of recalling those instances (83,85,86). By this reasoning, clinicians who recall more benefits of screening with greater perceived ease may also perceive a greater likelihood of benefit from screening.

Another possibility is that clinicians may perceive the benefits and harms of screening as a gestalt, again more so as expertise increases (72-75). According to fuzzy trace theory, memories of precise, verbatim information (e.g., specific probabilities such as "my patient has a 2 in 1000 chance of experiencing a harm") fade quickly over time; more enduring is gist memory, or the bottom-line meaning ascribed to an event (e.g., "my patient's chance of experiencing harm is remote") (71). Individuals generally rely upon gist information, even when they can remember verbatim information (71), and they may base likelihood estimates on gist impressions rather than disease prevalence (145). Clinicians' gist of screening may manifest as an overall impression of net benefit or harm, which takes into account both the number of benefits and harms and the magnitude of those benefits and harms (146). Thus, if clinicians have a negative gist of screening (i.e., they ascribe greater total magnitude to harms than benefits), they may judge the likelihood of harm from screening to be higher. Similarly, if they have a positive gist of screening, they may judge the likelihood of benefits from screening to be higher.

In order to better understand clinicians' perceptions of screening benefits and harms, the present study compared clinicians' perceptions of two screening tests that vary in their balance of benefits and harms. One of the two tests we chose was colonoscopy, a high

efficacy screening test that has been shown to result in net benefit in adults ages 50-75 and reduces colorectal cancer mortality (147,148), and national recommendations suggest its use for that age group (32,147,148). The second screening test we chose was PSA testing, which has been shown to lead to net harm, and national screening recommendations discourage the test (149) or recommend it only conditionally (39,40).

The study had two distinct but complementary aims. First, we sought to describe clinicians' perceptions of the specific benefits and harms of our two chosen screening services, including the number and perceived magnitude of benefits and harms they could call to mind. Second, we sought to understand how clinicians arrive at their perceptions of the likelihood of life lengthened or harm from screening. We predicted that clinicians would perceive the likelihood of harm to be greater and likelihood of life lengthened to be lower for a screening test with harms that outweigh benefits (PSA testing) relative to a screening test with benefits that outweigh harms for many adults (colonoscopy). We had two competing hypotheses about mediators of this association. Our *availability hypothesis* was that availability would explain the association of test to likelihood, consistent with the availability heuristic. We predicted that, for PSA testing (relative to colonoscopy), clinicians would list more harms and fewer benefits, and that they would have less difficulty recalling harms. We further predicted that these variables would mediate the association of screening test (PSA vs. colonoscopy) to clinicians' perceived likelihood of harm and life lengthened. Our *fuzzy trace hypothesis* was that clinicians' gist of screening tests as good or bad would mediate the association between screening test and clinicians' likelihood perceptions. We predicted that clinicians would perceive the likelihood of harm to be greater and likelihood of life

lengthened to be lower for PSA relative to colonoscopy if their gist of colonoscopy was more positive than their gist of PSA testing.

Methods

Participants

Eligible participants were clinicians from 24 family medicine or internal medicine practices in a North Carolina university-affiliated, practice-based research network. In fall 2012, practices in the network employed a total of 155 practicing clinicians: 127 medical doctors, three doctors of osteopathic medicine, 16 physician assistants and 12 nurse practitioners. We excluded registered nurses (*n*=19) and clinical support nurses (*n*=2) because they did not have their own panel of patients. We recruited clinicians through practice representatives (e.g., chief medical officers, practice managers) at their monthly meeting in September 2012.

Procedures

Practice representatives distributed the study surveys to clinicians in their practices. The study packet included a $20 bill as an incentive to complete and return the survey (150). Clinicians received reminders after two days and one, five, and seven weeks. The institutional review board of the University of North Carolina approved the study protocol and materials.

The survey included two vignettes that held a hypothetical patient's sex, age, race, health status, family and screening history constant, but varied the screening test (PSA testing or colonoscopy). Hypothetical vignettes are a well-established methodology for

understanding clinicians' cancer risk perceptions. A significant benefit of using them is that they allow for standardization across clinicians (151,152). We counterbalanced the order of questions on screening tests by randomly assigning clinicians to one of two questionnaire conditions in which prostate or colorectal cancer screening vignettes and questions appeared first. The hypothetical patient for PSA testing was Mr. Morton, a 70-year old white male with good cognitive status, no fatal disease, no family history of prostate cancer, no previous prostate findings or abnormal PSA tests, and a normal PSA test result two years ago. The hypothetical patient for colonoscopy was Mr. Lewis, a 70-year old white male with good cognitive status, no fatal disease, no family history of colon cancer, no risk factors or history of polyps, and a normal colonoscopy result ten years ago.

Measures

Outcomes

Perceived likelihood of harm. The survey measured perceived likelihood of harm with the question, "Think of 100 healthy patients, like Mr. Morton [Mr. Lewis] age 70, whom you screen with the PSA test [colonoscopy] and find an elevated PSA of 8.0. [a 1.0 cm adenomatous polyp that is removed]. You continue to follow them for the next 10 years. Having the PSA test [colonoscopy] will lead to at least moderate physical harm at some point over the next 10 years for how many of these men?" Response options were 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, and 91-100 men out of 100 men.

Perceived likelihood of life lengthened. The survey measured perceived likelihood of life lengthened with the question, "Think of 100 healthy patients, like Mr. Morton [Mr. Lewis] age 70, whom you screen with the PSA test [colonoscopy] and find an elevated PSA of 8.0. [a 1.0 cm adenomatous polyp that is removed]. You continue to follow them for the

next 10 years. At the end of 10 years, how many of these men do you think will have had their lives lengthened by having had the PSA test [colonoscopy]?" Response options were 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, and 91-100 men out of 100 men.

Mediators

Number of Benefits. Studies of the availability heuristic commonly operationalize availability by summing the number of instances of a category a participant can recall (9,82,83). Thus, we measured availability as the number of benefits of PSA testing [colonoscopy] with the question, "list as many benefits from PSA testing [colonoscopy] as you can think of for Mr. Morton [Mr. Lewis], a 70-year old patient." Clinicians could list up to seven benefits, a number deemed adequate by clinicians on the study team. We instructed clinicians to use only the lines they needed. Previous research has shown that providing a qualifier of this sort can cancel out any effects of enhanced or diminished difficulty of recall (153).

Number of Harms. The survey measured the number of harms of PSA testing [colonoscopy] with the question, "list as many harms from PSA testing [colonoscopy] as you can think of for Mr. Morton [Mr. Lewis], a 70-year old patient." Clinicians could again list up to seven harms.

Subjective Ease of Recalling Harms. Another common way to operationalize the availability of information is to measure the subjective ease or difficulty of recall (83-86). Accordingly, the survey measured subjective difficulty of recall by asking, "on average, how difficult was it for you to come up with these harms for prostate [colorectal] cancer

screening?" Response options were: not at all (coded 0), somewhat, moderately, very, and extremely difficult (coded 4).

Magnitude of Benefit [Harm]. For each benefit [harm] that clinicians listed, the survey asked them to "indicate how large you believe that benefit [harm] would be." Response options were almost no benefit [harm] to patient (coded as 1), small benefit [harm], moderate benefit [harm], and large benefit [harm] (coded as 4) (154,155). We calculated the magnitude of benefit [harm] as the sum of the ratings of each benefit [harm] a clinician listed.

Gist. We created a variable to capture the gist of each screening test and to put benefits and harms into a common "scale," allowing us to compare harms and benefits. We separately summed the magnitude ratings of listed harms and the magnitude ratings of listed benefits. For each test, we then calculated gist as the summed magnitude of benefits minus the summed magnitude of harms (146). A positive gist score indicated that a clinician listed more benefits with greater magnitude than harms, whereas a negative gist score indicated that a clinician listed more harms with greater magnitude than benefits.

Demographics

The survey assessed demographic characteristics of clinicians including sex, age, race, ethnicity, medical credentials, and years in medical practice.

Data Analyses

Two researchers (EE and MV) tabulated the benefits and harms clinicians listed for each test then established a classification of benefits and harms. For descriptive purposes, we calculated frequencies for each specific benefit/harm. Additionally, two coders (EE and

ASH) independently categorized harms clinicians listed into five categories (physical effects, psychological effects, financial strain, opportunity costs, and hassle (i.e., sometimes unnecessary difficulties associated with complex requirements of testing and treatment)) informed by the taxonomy of screening harms proposed by Harris and colleagues (139). Inter-rater reliabilities for each category were good (Cohen's kappa>.80).

Paired *t*-tests compared the mean number of PSA testing harms clinicians listed to the mean number of PSA testing benefits. We repeated this test for colonoscopy and for the magnitude sum scores, perceived likelihood of harm, and perceived likelihood of life lengthened. We used paired *t*-tests to compare mean PSA testing benefits to mean colonoscopy benefits. We repeated this analysis for harms, subjective difficulty of recall, magnitude sum scores for benefits and harms, gist, likelihood of harm, and likelihood of life lengthened. McNemar tests compared the frequency of mentions of each benefit and harm category between PSA test and colonoscopy.

Some clinicians did not list benefits or harms on the survey, possibly due to the extra burden of doing so. As a result, up to 19% of values were missing for the number and magnitude of benefits and harms and gist measures. Gist had the most missing data (19%), as we calculated this variable from other variables. We used multiple imputation with the expectation-maximization algorithm to impute missing data and reduce bias. This algorithm computes missing observations given the observed data and replaces missing observations with the conditional mean based on the regression equations (156). Based on exploratory analyses, we determined our data to be missing at random as required by multiple imputation (157). Auxiliary variables in the imputation included all the variables in the mediation analyses. We set the number of imputations at 300 (158).

The main outcome measures were clinicians' perceived likelihood of harm and life lengthened from screening. We used generalized estimating equations that accounted for repeated measurements to examine whether perceived likelihood of harm differed by screening test (PSA vs. colonoscopy). We report the results of regressions using *z* statistics. We repeated this analysis to assess the association between screening test and perceived likelihood of lengthening life. In separate models, we then tested several potential mediators of these associations: number of harms and benefits and subjective difficulty of recall (availability hypothesis); gist (fuzzy trace hypothesis); and additional gist components (perceived magnitude of benefit and perceived magnitude of harm). We used a causal steps approach to mediation (159). Consistent with that approach, we tested: (1) the associations described above; (2) whether screening test predicted potential mediator variables; (3) whether mediator variables predicted likelihood estimates statistically controlling for screening test; and (4) whether the effect of screening test on likelihood estimates attenuated after controlling for the effect of gist and gist components on likelihood estimates in separate models (159). In each model, we controlled for the order in which clinicians viewed questions on each screening test. We conducted Sobel tests to establish whether reductions in the association in step 4 were attributable to the mediators. We conducted all analyses in SAS (160) using two-tailed tests and a critical alpha of .05.

Results

A total of 126 clinicians returned the survey (80% response rate). Respondents were primarily male (62%) and physicians (79%). Seventy-six percent of participants were White, 11% Asian, and 10% Black or African American. Participants were 45 years old on average and mean years in medical practice was 15 (Table 2).

PSA testing

The benefits of PSA testing that clinicians most frequently mentioned were early detection and treatment (72%) and psychological effects (e.g., peace of mind) (37%) (Table 3). The most frequently listed harms were unnecessary treatment (56%), psychological effects (e.g., anxiety) (53%), and follow-up procedures (47%). Many clinicians listed at least one physical harm of PSA testing (70%) and many listed at least one psychological harm (68%). However, fewer clinicians recognized hassle (56%) or financial strain (13%). No clinicians listed opportunity costs of PSA testing (e.g., missing work, distraction from other important healthy activities). Most clinicians (90%) listed a PSA testing harm from at least one category from the Harris et al. taxonomy of screening harms (139), and 65% listed harms in at least two categories. Few clinicians cited PSA testing harms from more than three categories of the taxonomy (Table 4).

Clinicians listed more harms than benefits of PSA testing (M =3.03 vs. 1.57, p<.001). The summed magnitude of PSA harms was greater than the summed magnitude of PSA benefits (M=8.92 vs. 7.16, p<.001). On average, difficulty of recalling harms was low (M=0.42, SD=0.26). Mean PSA testing gist indicated that clinicians listed more harms with greater magnitude than benefits (M= -4.12, SD=5.56). Clinicians estimated that getting a PSA test was more likely to harm men than to lengthen their lives (M =4.41 vs. 2.70, p<.001) (Table 5).

Colonoscopy

The most frequently mentioned benefits of colonoscopy were early detection/treatment (74%) and longevity (21%). The most frequently listed harms were

perforation (58%), discomfort of preparing for the procedure (21%), and psychological effects (e.g., anxiety) (21%) (Table 3). Most clinicians listed at least one physical harm of colonoscopy (95%), but fewer clinicians recognized psychological harms (29%), hassle (24%), financial strain (19%), or opportunity costs (4%). Most clinicians (88%) listed a colonoscopy harm from at least one category from the taxonomy of screening harms (139), and 44% listed harms in at least two categories. Few clinicians cited colonoscopy harms from more than three categories (Table 4).

Clinicians listed more harms than benefits of colonoscopy (M=2.82 vs. 2.02, p<.001). The summed magnitude of colonoscopy benefits was greater than the summed magnitude of harms (M=8.06 vs. 4.75, p<.001). On average, difficulty of recalling harms was low (M=0.44, SD=0.24).Mean colonoscopy gist indicated that clinicians listed more benefits with greater magnitude than harms (M=0.94, SD=4.87). Clinicians estimated that receiving a colonoscopy was more likely to lengthen life than to cause harm (M =4.27 vs. 2.45, p<.001) (Table 5).

PSA testing vs. colonoscopy

As predicted, clinicians perceived higher likelihood of harm (z=8.76, p<.001) and lower likelihood of life lengthened (z= -7.22, p<.001) for PSA testing relative to colonoscopy. Clinicians' gist of screening was more negative for PSA testing relative to colonoscopy (z= -8.21, p<.001). Considering the components of gist, the summed magnitude of harms clinicians listed was greater (z=3.90, p<.001) and the summed magnitude of benefits lower (z= -8.80, p<.001) for PSA testing relative to colonoscopy. Clinicians listed fewer benefits (z= -3.78, p<.001) for PSA testing compared to colonoscopy. Clinicians did

not perceive the number of harms (z=1.42, p=.16) or the difficulty of recall (z= -.32, p=.90) to be different between screening tests (Table 5, Figure 3).

Mediation Analyses

We used separate mediation models to test our two competing mediation hypotheses (availability vs. fuzzy trace theory). Specifically, mediation models tested whether: (1) screening test predicted perceptions of likelihood; (2) screening test predicted potential mediator variables; (3) mediator variables predicted likelihood estimates statistically controlling for screening test; and (4) the effect of screening test on likelihood estimates attenuated after controlling for the effect of gist and gist components on likelihood estimates in separate models. The above section, "PSA testing vs. colonoscopy," shows the results for steps 1 and 2 and indicates that gist and number of benefits were potential mediators. Number of harms and difficulty recalling harms were not candidate mediators, because they failed in step 2 (i.e., were not associated with perceptions of likelihood). We ran additional analyses to examine whether magnitude of benefits were mediators for the sake of completeness, although they were only indirectly part of our mediation hypothesis (as components of gist). Results for the third and fourth steps of the mediation analyses are below.

Effects of Potential Mediators on Perceived Likelihood of Harm

The more positive clinicians' gist of screening was, the lower was their perceived likelihood of harm from screening, controlling for the effect of screening test (z= -1.91, p<.05). In a model that controlled for gist, clinicians estimated that more men would be harmed from PSA testing relative to colonoscopy (z=7.44, p<.001) (Figure 3). The Sobel test

indicated that gist mediated the relationship between screening test and perceived likelihood of harm from screening (z= -.25, p<.05). Furthermore, the Sobel test showed that the number of benefits (z=.17, p<.05) and magnitude of benefit (z=.25, p<.001) also mediated this relationship. There were no mediation effects of the number of harms, magnitude of harms, or difficulty of recall.

Effects of Potential Mediators on Perceived Likelihood of Life Lengthened

In a model that controlled for gist, clinicians estimated that fewer men would have their life lengthened from PSA testing than colonoscopy (z= -4.67, p<.001) (Figure 3). The Sobel test indicated that gist mediated the relationship between screening test and perceived likelihood of life lengthened (z=.41, p<.05). Furthermore, the Sobel test showed that the number of benefits (z= -.26, p<.05) and magnitude of benefits (z= -.37, p<.05) also mediated this relationship. Similar to our findings for perceived likelihood of harm, we found no mediation effects of the number of harms, magnitude of harms, or difficulty of recall.

Discussion

Clinicians' perceptions of the likelihood that screening will help or harm play an important role in shaping their screening recommendations. Findings suggest that clinicians are aware of the potential harms of screening, but that they had low awareness of the different types of harms. Clinicians in our study judged PSA testing to be more likely to cause harm and less likely to lengthen life relative to colonoscopy, and their gist impressions, mainly of screening benefits, mediated these judgments. Targeting benefits and gist may be the most effective ways to change clinicians' risk perception and screening practices.

Out study is consistent with previous studies showing that clinicians recognize the importance of communicating the harms of cancer screening (161-163), but our study provides new evidence that clinicians can identify some screening harms with ease. As a group, clinicians listed harms from all categories of the screening cascade identified in the Harris taxonomy (139). For PSA testing, clinicians listed mostly psychological harms of testing (e.g., anxiety, false positives), physical harms of distal follow up procedures (e.g., impotence, incontinence), and hassle of unnecessary testing and procedures, suggesting that these types of PSA harms are most available for clinicians. For colonoscopy, clinicians listed mostly physical harms related to the procedure itself (e.g., discomfort of preparation, perforation, bleeding), suggesting that physical harms of colonoscopy are most available for clinicians. However, individual clinicians were less likely to list the full scope of screening harms. Few clinicians listed more than two harms of any type. As well, few clinicians enumerated anything beyond physical harms of colonoscopy, and fewer mentioned financial strain or opportunity costs for either screening test. Clinicians may either be unaware of these latter harms, or they may perceive them to be trivial and not worth enumerating for themselves or their patients. These findings suggest that, if the full spectrum of harms are important to screening decisions (e.g., for populations that experience net harm from a particular screening test), messages to clinicians should emphasize the full scope of harms (139).

Our study also provides new evidence to increase our understanding of clinicians' perceptions of the benefits of cancer screening. Benefits are important because they play a role in shaping clinicians' screening recommendations (164,165), which in turn affect patients' screening decisions (29-31). Our findings suggest that, for PSA testing and

colonoscopy, clinicians perceived early detection and treatment and saving lives were the most important benefits, and that early detection and treatment was the most available benefit. This finding is not surprising given that the primary goal of cancer screening is to reduce deaths due to cancer, thereby increasing patients' length of life, as well as curtailing the development of symptomatic metastatic disease (32,149). However, fewer clinicians listed the psychological benefits of screening (e.g., peace of mind) or enumerated longevity, preventing cancer, ruling out cancer, or having more information. Developing a parallel framework of screening benefits similar to the taxonomy of screening harms developed by Harris and colleagues (139) and testing it to determine patients' values for various benefits could help researchers understand screening benefits, facilitate comparison to screening harms, and ultimately facilitate decision making.

Our study further shows that clinicians relied on the gist they had of screening to formulate their estimations of the likelihood of benefit and harm from screening. These findings offer more support for our fuzzy trace hypothesis than for the availability hypothesis. This mediating role of gist is not surprising given past research showing that physicians frequently rely upon gist when making decisions (72,75,142,143). Increased reliance on gist-based reasoning may reduce errors in probability judgment (166,167) and decrease unhealthy decisions (168,169). Research has shown that gist is malleable (170,171) and can therefore be targeted for change. Thus, targeting clinicians' gist of screening, for instance through graphical displays that allow clinicians to make gist-based relative magnitude comparisons and detect overarching patterns (172), could affect their risk perception and reduce over-recommendation of screening.

Interestingly, breaking gist down into its component parts, we found that clinicians' perceptions of screening benefits played a mediating role, but harms did not. This finding deserves further exploration, as it diverges from past research showing that harms information alters risk perception but benefits information does not (173-175). It may be that, for clinicians, benefits are more congruent than harms with thinking about screening tests. In other words, clinicians as a group may associate screening with benefits in a categorical, gist-like way. This finding suggests that messages to clinicians to decrease over-recommendation of screening may need to focus on benefits rather than harms. Future research on the role of gist-based thinking in decision making should assess whether patients and providers formulate risk perceptions in this gist-like way. For example, it is possible that risk perceptions about certain typically beneficial behaviors such as screening elicit benefits-based decisions while typically harmful actions like drug use might elicit decisions based upon harms but not benefits.

Strengths of our study are the rigorous study design and high response rate. Although the sample size may seem modest to some (n=126), this is a reasonably large sample compared to typical studies of clinicians. Furthermore, the within-subjects design controlled for individual differences and thus increased statistical power. While the juxtaposition of PSA testing to colonoscopy was informative, these two screening tests are qualitatively different in ways that make this comparison an imperfect one. PSA testing and colonoscopy involve different procedures (i.e., blood test versus internal exam) that have different harms that occur at different stages of the screening process. We chose the comparison, however, because we wanted to compare screening tests of varying benefit-to-harm ratio in order to get a more complete understanding of clinicians' likelihood judgments related to screening. We

did not measure clinicians' ease of recalling benefits due to limited space on the questionnaire, preventing us from comparing clinicians' ease of recalling harms to benefits. Findings are from an academic group of clinicians who may be better informed than the average clinician. Future research should establish whether the findings that we reported here generalize to other populations of clinicians and to beliefs about cancer screening tests delivered solely to women. We acknowledge that results from our hypothetical vignettes may differ from clinicians' reactions to real life patients that occur under time pressure and complex circumstances. We also acknowledge the need to replicate findings with vignettes that vary the characteristics of hypothetical patients and assess additional screening tests.

Nonetheless, our findings are promising in that they suggest that clinicians are aware that cancer screening has potential harms as well as benefits, while still being likely to benefit from information to expand their understanding of the different types of screening harms. Findings also indicate that clinicians' gist perceptions of screening, specifically their perceptions of benefit, are vehicles through which clinicians arrive at their likelihood estimates. Findings may be of special interest to health professionals and health services researchers, who may be interested in potential ways to impact clinicians' risk perception and screening practices. Messages to clinicians to decrease over-recommendation and overuse of PSA testing may need to focus on its few benefits rather than its many harms.

Table 2.

Demographic Characteristics of Clinicians (n=126)

	%
Women	38
Race	
Asian	11
Black or African American	10
White	76
Other	2
Refused	1
Hispanic	3
Degree	
MD	79
DO	2
NP	8
PA	11
Age in Years, Mean (SD, Range)	45 (10, 29-69)
Years in Medical Practice, Mean (SD, Range)	15 (9, 1-40)

Table 3.

Frequency of Mentions and Mean Magnitude of PSA Testing and Colonoscopy Benefits and Harms

	Listed for PSA (%)	**Listed for Colonoscopy** (%)	**Magnitude Rating for PSA** (Mean)	**Magnitude Rating for Colonoscopy** (Mean)
Harms				
Bleeding	1	13*	2.67	2.60
Discomfort of "Prep" for Colonoscopy	-	21	-	2.17
False Negatives	4	5	2.75	3.00
False Positives	28	6*	2.92	3.20
Financial Cost	0	19*	2.06	2.40
Follow-up Procedures	47	10*	3.11	2.67*
Impotence	19	-	3.20	-
Incontinence	21	-	3.41	-
Increased Mortality	3	4	4.00	3.69
Overdiagnosis	28	8*	3.48	2.67*
Pain	13	13	2.71	2.08
Perforation	-	58	-	3.48
Psychological Effects (e.g., Anxiety)	53	21*	2.83	2.38
Unnecessary Treatment	56	11*	3.43	2.64*
Benefits				
Early Detection/Treatment	72	74	3.02	3.81*
Knowledge/Having More Information	8	9	3.11	2.90
Lifesaving/Reduced Mortality	12	13	3.23	3.33
Longevity	12	21*	2.75	3.87*
Prevent Cancer	3	12*	2.20	3.68*
Psychological Effects (e.g., Peace of Mind)	37	18*	2.81	2.95
Rule out cancer	3	7*	2.00	3.13*

Note. Clinicians rated the magnitude of benefit [harm] on a four-point scale ranging from "almost no benefit [harm] to patient" (coded as 1) to "large benefit [harm] to patient" (coded as 4). - = not applicable

* $p<.001$.

Table 4.

Proportion of Clinicians Who Listed Harms from Screening

	PSA Testing (%)	**Colonoscopy (%)**
Taxonomy category[1]		
Physical harm	70	95
Psychological harm	68	29*
Financial strain	13	19**
Opportunity cost	0	4
Hassle	56	24
All 5 categories	0	0
Any 4 categories	3	5
Any 3 categories	30	16*
Any 2 categories	65	44*
Any 1 categories	90	88
No harms listed	10	12

[1] Categories are based on the Harris et al. taxonomy of harms (139).
*$p<.05$, **$p\leq.001$

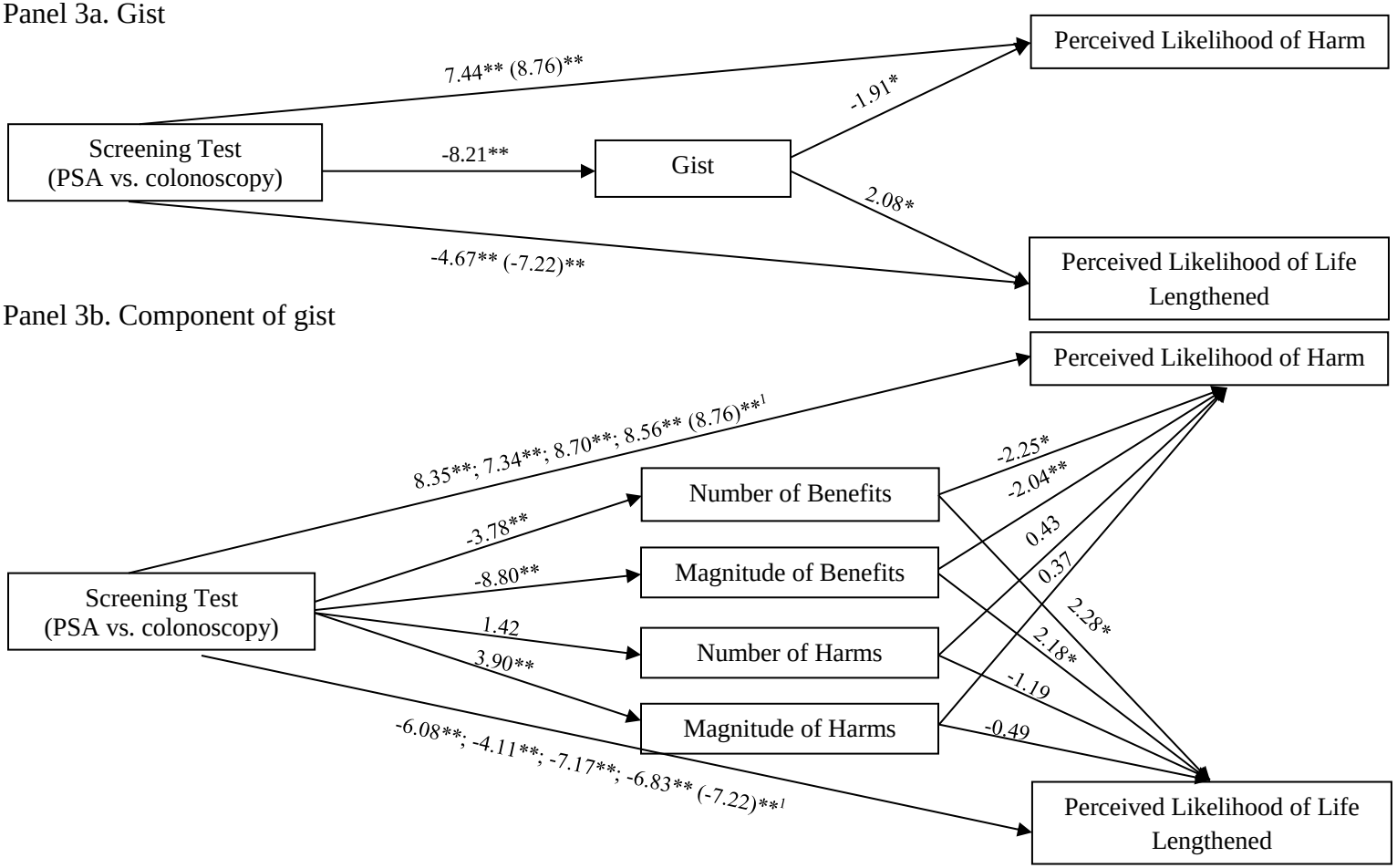
Table 5.

Clinicians' Evaluation of PSA and Colonoscopy

	PSA Mean (SD)	**Colonoscopy** Mean (SD)
Gist	-4.12 (5.56)	0.94 (4.87)*
Number of Harms	3.03 (1.52)	2.82 (1.45)
Number of Benefits	1.57 (0.72)	2.02 (1.22)*
Summed Magnitude of Harm	8.92 (4.70)	7.16 (3.91)*
Summed Magnitude of Benefit	4.75 (2.65)	8.06 (3.95)*
Subjective Difficulty of Recall	1.42 (0.76)	1.44 (0.74)
Likelihood of Harm	4.41 (2.29)	2.45 (1.47)*
Likelihood of Life Lengthened	2.70 (1.74)	4.27 (2.62)*

Note. Gist was the summed magnitude of benefits minus the summed magnitude of harms.
*$p<.001$.

Figure 3. Relationship between screening test and perceived likelihood



Note. Numbers are *z* statistics from separate mediation models controlling for survey order.
[1] Effect of screening test on likelihood perceptions controlling for number of benefits; magnitude of benefits; number of harms; magnitude of harms. Main effects in parentheses.
*p<.05. **p≤.001.

CHAPTER 4: HAVE SCREENING HARMS BECOME NEWSWORHTY? NEWS COVERAGE OF PROSTATE AND COLORECTAL CANCER SCREENING SINCE THE 2008 USPSTF RECOMMENDATION CHANGES (Paper 2)

Introduction

Cancer screening recommendations have changed substantially in recent years. In 2008, the U.S. Preventive Services Task Force (USPSTF) changed its recommendations on prostate cancer screening. While they again concluded that evidence was insufficient to determine the balance of benefits and harms of prostate cancer screening in men ages 50 to 75 ("I grade"), they newly concluded that screening men over 75 resulted in net harm and recommended against routinely screening these men ("D grade") (34). In 2012, the USPSTF further amended its recommendation based on evidence from two major trials (176,177), recommending against routine prostate cancer screening with the prostate-specific antigen (PSA) test for men regardless of age (178). The USPSTF also revised its recommendations on colorectal cancer screening in 2008. They reiterated recommendations that all adults age 50-75 regularly screen for colon cancer; however, they also newly recognized that the balance of benefits and harms changes with age and, for those age 76-84, they recommended screening only when individual factors warrant it ("C grade") and no screening for those over 85 ("D grade") (32). The updated colorectal cancer screening recommendations were largely undisputed, but the prostate cancer screening recommendations in 2008 and 2012 drew criticism from clinicians (179-181) and patients (182-185) and sparked debate in the media (182,186,187).

It is important to monitor news coverage of screening recommendations given the potential of the media to influence consumer behavior (188). In the past, media coverage of cancer screening has focused on benefits, under-emphasizing harms (23,25,124,126). Imbalanced cancer screening coverage can increase patient information-seeking (189,190) and screening uptake (108,191); however, imbalanced coverage can also increase screening uptake in age groups not normally recommended to receive screening, with no added benefit in cancer outcomes (192).

This study sought to establish whether newspapers' portrayal of screening harms and benefits changed after the release of the 2008 USPSTF recommendations. It compared newspaper coverage of PSA testing and colonoscopy, allowing us to juxtapose a controversial screening test that has disputed effectiveness (PSA testing) (178) with a well-accepted screening test widely considered to be effective (colonoscopy) (147,148). We expected mentions of PSA testing harms to increase and mentions of PSA testing benefits to decrease in the years following the 2008 recommendation change. This hypothesis was based on the premise that newspapers would describe why the Task Force judged the test's harms to outweigh its benefits for men over 75. We also expected newspapers to increasingly discuss PSA testing harms as the results of two large trials of the effects of prostate cancer screening on cancer-related mortality became available (44,45,176) leading up to the 2012 USPSTF recommendation against routine PSA testing in all men. We expected that mentions of harms and benefits in colonoscopy articles would not change because the USPSTF maintained an "A" grade for men ages 50-75 and the changes for adults over 75 were not widely contested.

Methods

Identifying articles

Newspapers frequently set the agenda for other news formats and thus their content may influence and reflect news from other news sources (136,137). We conducted a quantitative content analysis of news coverage in the top 10 U.S. newspapers with the highest daily circulation (Online Supplement A) as they are the most read and arguably the most influential newspapers in the U.S. To identify relevant articles, we used four databases: Lexis Nexis (Daily News [New York], LA Times, New York Post, New York Times, San Jose Mercury News, USA Today, and Washington Post); Newspaper Source Plus (Wall Street Journal), America's News (Chicago Sun-Times); and ProQuest Digital Microfilm (Chicago Tribune). We searched for (1) prostate or colon/colorectal, (2) cancer, and (3) screening or synonyms for screening. With Lexis Nexis, for example, the Boolean search string was *((prostate OR colorectal OR colon) AND cancer AND (screen! OR "prostate specific antigen" OR PSA OR P.S.A. OR colonosop! OR detect! OR diagnos! OR test! OR prevent! OR surveillance))*.

The first author coded articles for inclusion. We included articles if prostate cancer screening with the PSA test or colorectal cancer screening with colonoscopy was in the headline or in the article lede (i.e., the first ten sentences) and over half of the sentences in the article were dedicated towards the topic. We included articles published from January 1, 2005, to December 31, 2012, in order to capture the time periods before and after the release of the 2008 USPSTF recommendations for prostate cancer screening (in August, 2008) and colorectal cancer screening (in October, 2008). We excluded articles if they were not

relevant (e.g., articles addressing benign prostatic hypertrophy, cancer treatment or vaccination to prevent cancer) or were not a news article (e.g., advertisements, obituaries). We also excluded articles that: addressed screening tests for prostate cancer other than PSA testing (e.g., experimental tests, digital rectal exam) and screening tests for colorectal cancer other than colonoscopy (e.g., virtual colonoscopy, fecal occult blood testing, sigmoidoscopy); mentioned prostate or colorectal cancer screening only in passing; or discussed screening only generally (e.g., using several screening tests as exemplars).

Measures

We developed a standardized coding instrument using an iterative process. To pilot test the instrument, two coders (EE, JL) each coded three prostate and three colorectal cancer screening articles, then reviewed and discussed their findings. The coders repeated this process until they reached agreement and revised the coding instrument accordingly. Then, to assess reliability of coding, both coders independently assessed 40 articles (~10% of the corpus). We calculated reliability using Krippendorf's alpha (193) and included variables with $\alpha \geq .80$ (193). One author then coded the remaining articles (EE).

The coding instrument included a list of potential harms and benefits generated by 112 primary care clinicians in a previous study (37). Examples of harms included false-positive tests, psychological effects such as worry or stress, unnecessary treatment, physical complications such as pain, bowel perforation, impotence, or incontinence, and hospitalization. Examples of benefits included early detection and early treatment, ruling out cancer, increased longevity, having more information, and reduced worry or anxiety. We coded whether an article mentioned the word "harm" or "benefit" (or a synonym, e.g., "good/bad outcome"), taking context into account (e.g., "no benefit" was not coded as a

mention of benefit). We included an "other" category to capture any harms or benefits that were not on our list.

Number of harms and benefits. We counted the number of harms and benefits mentioned in each article. Inter-coder reliability was α=.99 for the number of harms and α=.83 for the number of benefits.

Expected Lay Gist. We created a variable to capture the gist that lay readers might be expected to take away from articles in terms of whether articles gave the overall impression that a person should or should not be screened with PSA/colonoscopy. To determine whether the expected lay gist was positive, negative, or neutral towards screening, coders weighed the way the issues were presented through the use of anecdotes, emotion, memorable quotes, or convincing quantitative evidence leaning in one direction. Since article length varied considerably, coders coded the article lede, defined as the headline and first ten sentences thereafter. However, most consumers read less than half of news articles (194), and the positive or negative projection of an article lede is strongly correlated with the projection of the entire article (195). Thus, coding the article lede was unlikely to misrepresent the valence of the complete article. Expected lay gist was coded -1 for negative toward screening, 0 for neutral, and 1 for positive. Inter-coder reliability for expected lay gist was α=.85.

Expected Expert Gist. We created a variable to capture the gist that experts might take away from articles by measuring the balance of the magnitude of benefits and harms in articles. In a previous study (37), clinicians listed and rated the magnitude of PSA testing and colonoscopy benefits [harms] using a four-point rating scale ranging from "almost no benefit [harm] to patient" (coded as 1) to "large benefit [harm] to patient" (coded as 4). We assigned

a magnitude to each benefit and harm mentioned in articles corresponding to the mean clinician rating in this previous study (Online Supplement B). For each test, we then calculated expert gist as the magnitude of benefits minus the magnitude of harms mentioned in the article. A positive expert gist score indicated that an article discussed benefits with greater magnitude than harms, while a negative expert gist score indicated that an article discussed harms with greater magnitude than benefits.

Other variables. We coded the year the article was published (2005-2012). We coded two other variables that could influence the outcome variables: article length (in words) and the newspaper that published the article.

Data Analysis

For PSA articles, we compared mean harms to mean benefits using paired *t*-tests. We repeated the same analysis for colonoscopy articles. We then compared mean benefits in PSA articles to mean benefits in colonoscopy articles using independent samples *t*-tests and repeated the analysis for harms. We compared the frequency of mentions of each harm and benefit between articles on PSA and articles on colonoscopy using chi-square tests. We used one-sample *t*-tests to determine whether expected lay gist and expert gist were positive or negative.

We tested several predictions from our hypothesis. To test a prediction that mentions of harms of PSA testing would increase after the release of the 2008 USPSTF recommendations, we used piecewise regression. This approach allowed us to test whether the linear slope of mentions of harms was significantly different from zero separately for the time period before the recommendation changes (Time Period 1) and after (Time Period 2).

Since the USPSTF released their recommendations in August 2008 for prostate and October 2008 for colorectal cancer screening, and we did not want to capture proximal news coverage of one but not both of the recommendations, we chose to set a conservative "breakpoint" at the end of 2008. Thus, we created two continuous variables to represent Time Period 1 (2005-2008) and Time Period 2 (2009-2012). We used the same piecewise regression approach to test a second prediction, that mentions of PSA benefits and colonoscopy harms and benefits would not change appreciably in either time period. We also used this approach to examine changes in the valence of articles' expected expert and lay gist. We predicted that the valence of lay and expert gist in PSA articles would not change in the first time period but would be more negative after 2008, and that there would be no changes in gist for colonoscopy articles in either time period.

Regression analyses controlled for article length and newspaper. To test for clustering effects of articles within newspapers, we calculated the intra-class correlation coefficient (ICC). The ICC was statistically significant (ρ=.29; *CI*=.12-.52), hence we controlled for effects of clustering in regression analyses. Also, coding revealed that two newspapers (Chicago Sun-Times and Daily News [NY]) were sponsoring PSA testing clinics during the study time period, and a majority of articles on PSA testing in these newspapers promoted these clinics. To control for this potential source of variation, we created a dichotomous variable (Chicago Sun-Times and Daily News [NY] versus the other eight newspapers) and included it as a control variable in our analyses. We report the results of regressions using standardized regression coefficients (βs). Analyses used two-tailed tests and a critical alpha of .05. We conducted analyses in STATA.

Results

Of 8,248 articles we identified, 7,840 were not relevant to our research question or were not a news article (e.g., obituary or advertisement) (Figure 4). Of the 408 remaining articles, we excluded 121 because they used two or more screening tests as exemplars (*n*=48), because they did not feature screening as the main topic (*n*=36), or because they addressed a different type of prostate or colorectal cancer screening test other than PSA or colonoscopy (n=37), leaving 287 articles in the analytic sample.

Over three-quarters of the articles addressed PSA testing (*n*=222) while about one quarter addressed colonoscopy (*n*=65) (Table 6). This inequality in proportion of colonoscopy versus PSA articles existed before (PSA *n*=101, colonoscopy *n*=32) and after (PSA *n*=121, colonoscopy *n*=33) the 2008 recommendation change. The mean article length was 615 words (SD=424), and each year had about equal numbers of articles, with the most articles appearing in 2011 (18%) and the fewest in 2005 (9%). A quarter of the articles were published in the Daily News (NY), 22% in the New York Times, and 17% in the Chicago Sun-Times. The fewest articles appeared in the New York Post (1%) and San Jose Mercury News (4%).

PSA testing articles

PSA testing articles mentioned a mean of 2.83 benefits (SD=.12). The most commonly mentioned benefits of PSA testing were diagnosis/detection, lifesaving/reduction in mortality, low cost, early treatment, and convenience (Table 7). PSA articles mentioned a mean of 3.67 harms (SD=.25). The most commonly mentioned harms of PSA testing were

impotence, overdiagnosis, unnecessary treatment, incontinence, harms of follow up procedures, psychological harms (e.g., worry, anxiety), and false positive tests (Table 7).

PSA articles mentioned more harms than benefits (mean harms per article=3.67, SD=.25 vs. mean benefits per article=2.83, SD=.12; $p<.01$). On average, the gist a lay person might get from PSA articles was positive (mean=.18, SD=.06; $p<.01$), but the gist an expert might get was negative (mean= -2.01, SD=.78, $p=.01$).

Colonoscopy articles

Colonoscopy articles mentioned a mean of 2.97 benefits (SD=.22). The most commonly mentioned benefits of colonoscopy were diagnosis/detection, lifesaving/reduction in mortality, preventing cancer, and early treatment (Table 7). Four percent of colonoscopy articles specifically mentioned the word "harm" (or a synonym). Colonoscopy articles mentioned a mean of 1.06 harms (SD=.21). The most commonly mentioned colonoscopy harms were financial cost, discomfort of "prep," bowel perforation, unnecessary treatment, bleeding, and harm from follow-up procedures (Table 7).

Colonoscopy articles mentioned more benefits than harms (mean benefits per article=2.97, SD=.22 vs. mean harms per article=1.06, SD=.21; $p<.01$). On average, the gist that lay people and experts might get was positive for colonoscopy articles (mean expected lay gist=.78, SD=.08; $p<.01$) (mean expected expert gist=5.17, SD=.73; $p<.01$).

PSA testing articles compared to colonoscopy articles

Articles about PSA mentioned more harms, on average, than articles about colonoscopy (M=3.67 vs. 1.06 harms; p<.01). Thirty-five percent of PSA articles specifically used the word "harm" (or a synonym) compared to only 4% of colonoscopy articles (p<.001) (Table 7). Most of the specific harms that were mentioned appeared more often in articles about PSA testing, and the harms with the largest difference between PSA and colonoscopy articles were overdiagnosis and overtreatment (both p<.001). The mean number of benefits mentioned in PSA articles did not differ from the mean number of benefits mentioned in colonoscopy articles (PSA M=2.83, colonoscopy M=2.97; p=.25). The word "benefit" (or a synonym) appeared more frequently in PSA articles (34% vs. 13%, p<.001). Mentions of most types of benefits did not differ by screening test. However, articles mentioned the benefits of preventing cancer more often for colonoscopy and convenience more often for PSA (both p<.001).

The gist that a lay person might get from articles about colonoscopy was more positive than for PSA testing articles (colonoscopy M=.78, PSA M=.18; p<.001). The gist an expert might get from the articles was also more positive for colonoscopy articles (colonoscopy M=5.17, PSA M= -2.01; p<.001).

Changes over time

Mentions of PSA harms in newspaper articles did not change between 2005 and 2008 (Figure 5, Table 8). However, mentions of PSA harms increased between 2009 and 2012 (β=.19, p=.002). Mentions of PSA benefits did not change in either time period (Figure 5,

Table 8). Longer PSA articles mentioned more harms (β=.31, p<.001) and more benefits (β=.30, p<.001). The Daily News (NY) and Chicago Sun Times mentioned fewer harms (β=-.46, p<.001) and more benefits (β=.43, p<.001) of PSA testing compared with the other newspapers.

Mentions of colonoscopy harms and benefits did not change in either time period (Figure 5, Table 8). Longer articles mentioned more colonoscopy harms (β=.52, p<.001) and more benefits (β=.24, p=.05). There was no variation in mentions of colonoscopy harms by newspaper. The Daily News (NY) and Chicago Sun-Times discussed more colonoscopy benefits compared with the other eight newspapers (β=.36, p=.004).

The gist that a lay person might get from PSA or colonoscopy articles did not change in either time period (Table 8). Longer PSA articles tended to have more negative expected lay gist (β= -.16, p=.007). The Daily News (NY) and Chicago Sun-Times printed more PSA articles with positive expected lay gist compared with the other eight newspapers (β=.57, p<.001). Expected lay gist did not change for colonoscopy articles.

The gist an expert might take away from PSA articles decreased between 2009 and 2012 (β= -.17, p=.006), indicating that PSA articles increasingly discussed harms with greater magnitude after 2008 (Table 8). Longer articles mentioned more harms with greater magnitude than shorter ones (β= -.13, p=.01). The expert gist of articles in Daily News (NY) and Chicago Sun-Times was more positive than articles in the other eight newspapers (β=.62, p<.001). Expert gist did not change for colonoscopy articles.

Discussion

News coverage is an important way that the public receives health messages. Newspaper coverage of PSA testing harms increased after 2008, apace with new research showing the harms of prostate cancer screening outweigh its benefits and pursuant USPSTF recommendation changes. However, between 2005 and 2012, newspapers did not scale back their discussion of PSA testing's benefits. Newspapers mentioned the benefits of PSA testing, a screening test with disputed effectiveness, as much as they mentioned the benefits of colonoscopy, an effective screening test. This suggests that potential benefits of PSA testing such as cancer detection and reduced mortality were newsworthy irrespective of test efficacy or balance of benefit to harm. We also found that, while the gist an expert might have gotten from PSA articles was negative and became more negative over time, the gist a lay person might have gotten from PSA articles was positive and did not change. In addition, the gist lay and expert consumers may have taken away from colonoscopy articles was positive. Thus, consumers, especially lay and older consumers, may be receiving imbalanced information on cancer screening.

Our findings related to newspapers' portrayal of cancer screening benefits are in line with previous studies showing that the media is biased towards discussing the benefits of screening (23,124,126). However, the observed increase in media discussion of PSA testing harms is a new finding. The simplest explanation for this finding is that newspapers have been describing and providing rationale for the 2008 USPSTF recommendation changes and the more recent changes in 2012. Namely, the USPSTF recommended against screening for all men in 2012 after assessing new mortality evidence from two major randomized trials

(176,177) as well as additional evidence of PSA harms (50,196,197). Thus, the observed increase in coverage of PSA testing harms may reflect a growing evidence base that PSA is more harmful than beneficial.

Another possible explanation for the observed increase in news coverage of prostate cancer screening harms may have to do with the controversy surrounding PSA testing. PSA testing has been controversial for many years (198) due to disagreement and uncertainty over test effectiveness, balance of benefits and harms, and how best to interpret and act upon test results. As well, changes in recommendations can lead to public confusion over the incorrect belief that the government is rationing health care (199). Media coverage often functions in a circular, self-sustaining way: a news story sparks controversy, which in turn becomes a news media story in and of itself, leading to yet more public response and more coverage (107). In this way, the increasing discussion of harms documented in the present study may reflect the controversy surrounding PSA testing. In contrast, past studies have found that colorectal cancer screening is under-reported in the media (200,201), and it is relatively less controversial than prostate cancer screening. Thus, it is not surprising that we retrieved less than a third as many articles about colonoscopy as about PSA testing.

Our measures of expert and lay gist were quite different from each other, by design. Expert gist was continuous and took magnitude of benefits and harms into account, while our measure of lay gist was dichotomous and thus by its nature did not factor in magnitude. Furthermore, the different scaling of the two variables prevented any explicit comparison of the two variables. Keeping the limitations of these data in mind, our findings related to expected expert and lay gist of PSA articles contradicted each other qualitatively: while

expert gist decreased after 2008, indicating that PSA articles were increasingly discussing harms with greater magnitude, the gist a lay person might have taken away from the same articles was positive toward screening. This suggests that while reporters may have described the potential harms of PSA testing in greater technical detail than its benefits, the overall takeaway message of these articles was that men should be screened. A past study of newspaper coverage of the two major randomized trials of prostate cancer screening (44,45) found that newspapers portrayed prostate cancer screening as a negative endeavor (195). This past finding is consistent with our findings for expected expert gist but not expected lay gist, which may reflect this previous study's focus on coverage of randomized trials, which are likely to have included technical details about harms. Overall, our findings related to gist suggest that expert consumers may be receiving more balanced information on prostate cancer screening than lay consumers. Research assessing consumers' gist of screening would be helpful in testing this speculative discussion of our findings.

We found that from 2005 to 2012 the Chicago Sun-Times and Daily News (NY) mentioned fewer harms, more benefits, and published more articles that had positive expected lay gist relative to the other eight newspapers in our sample. During the study time period, a majority of articles published in the Chicago Sun-Times and Daily News (NY) promoted their free PSA testing clinics (with headlines such as "It can save your life! Deadly scourge of prostate cancer is often curable if caught on time" and "Do the right thing, men: Take our prostate test") (202,203), which may explain why so many articles published in these papers were "pro" PSA testing. Together, these two papers produced 42% of the sample of articles included in this study. If 42% of what is being said about prostate cancer screening in the top 10 U.S. newspapers over the past eight years has been predominantly

positive about the PSA test, this may in part contribute to high PSA testing rates (46,204) and enthusiasm for prostate cancer screening in the U.S. (205). Furthermore, these clinics may not offer men the opportunity to discuss harms and benefits with their providers, a significant aspect of making an informed decision about screening.

While the juxtaposition of PSA to colonoscopy was illuminating, these two screening tests are qualitatively different in ways that make this comparison an imperfect one. PSA testing and colonoscopy involve different procedures (i.e., blood test versus internal exam) that have different harms that occur at different stages of the screening process. However, we wanted to compare the harms and benefits of PSA testing over time to a relatively effective screening test, making colonoscopy (the other major cancer screening test that men regularly receive) the most appropriate comparator. A related trade-off was that we chose to compare two screening tests rather than to compare PSA testing to all USPSTF-recommended screening tests for colorectal cancer screening (e.g., sigmoidoscopy, FOBT). Thus, our study is limited to colorectal cancer screening articles that primarily address colonoscopy. This study was also limited to newspaper coverage and did not include online news sources. However, online versions of print newspapers typically replicate what is in the print versions, with the exception of blogs. Thus, our analysis of newspapers may also reflect online versions of the top 10 U.S. newspapers and therefore an additional source of news with potential for impact on public knowledge, attitudes, and beliefs. Moreover, to our knowledge, it is not currently possible to conduct systematic, replicable retrospective searches of online news sites. This is because Internet search engines act as information "gatekeepers," limiting searches of their content via their application programming interfaces (206). Search engines rapidly trim news from their search results, making retrospective searches of online content

difficult, if not impossible, to replicate. As well, since our study examined only the 10 most popular U.S. newspapers, generalizability to local newspapers remains to be established. However, many people across the country subscribe to newspapers such as the New York Times and Wall Street Journal or access them online. Thus, many of the newspapers in our sample have a broader impact than just the area within which the print editions are distributed.

This study documents an increased discussion of the harms of PSA testing in the most popular U.S. newspapers without a corresponding decrease in the discussion of its benefits. By emphasizing certain topics and events, the news media has the potential to affect the availability of information, the public's risk perception related to screening (21,98,106), screening decisions (188) and other behavioral health outcomes (188). Findings may be of particular interest to clinicians, who may be interested in how the media could be influencing their patients' perceptions of screening. Given recent efforts to raise awareness about the harms of clinical preventive services (e.g., the Choosing Wisely campaign) (207) and extensive media attention to breast cancer screening with mammography (208,209), future research is needed to establish whether our findings are limited to PSA testing or whether they are part of a broader trend in media coverage of cancer screening harms.

Table 6.

Characteristics of Newspaper Articles (n=287)

Article Characteristics	**%**
Year	
2005	9
2006	12
2007	12
2008	14
2009	11
2010	10
2011	18
2012	14
Newspaper	
Chicago Sun-Times	17
Chicago Tribune	7
Daily News (NY)	25
LA Times	7
New York Post	1
New York Times	22
San Jose Mercury News	4
USA Today	7
Wall Street Journal	7
Washington Post	5
Screening Test	
PSA Testing	77
Colonoscopy	23
Article Length in Words, Mean (SD)	615 (424)

Table 7.

Harms and Benefits of PSA Testing and Colonoscopy Mentioned in Newspaper Articles

	% of PSA Testing Articles (*n*=222)	**% of Colonoscopy Articles** (*n*=65)
Harms		
"Harm" (or synonym)	35	4**
Bleeding	4	3
Discomfort of "prep" for colonoscopy	N/A	15
False negatives	12	7**
False positives	17	0**
Financial cost	1	17**
Follow-up procedures	27	3**
Impotence	44	0**
Incontinence	38	1**
Increased Mortality	7	1
Infection	7	1
"Other" harm	19	14
Overdiagnosis	41	0**
Pain	11	1*
Perforation	N/A	13
Psychological Effects (e.g., anxiety)	18	7*
Unnecessary Treatment	40	3**
Benefits		
"Benefit" (or synonym)	34	13**
Convenience	18	1**
Diagnosis/detection	60	51
Early treatment	7	1
Knowledge/having more information	24	26
Lifesaving/reduced mortality	44	50
Longevity	5	3
Low cost	30	12**
"Other" benefit	11	12
Prevent cancer	0	42**
Psychological effects (e.g., peace of mind)	4	3
Rule out cancer	1	4

*$p<.05$, **$p<.001$

Table 8.

Changes in Newspaper Coverage of PSA Testing and Colonoscopy over Time, 2005–2012

	Correlates			
Outcomes	**Year, 2005-2008 β**	**Year, 2009-2012 β**	**Length of Article β**	**Newspaper[a] β**
PSA Testing Benefits	.14	.05	.30**	.42**
PSA Testing Harms	.12	.19*	.31**	-.46**
PSA Testing Expected Lay Gist	.11	.00	-.16*	.57**
PSA Testing Expected Expert Gist	-.04	-.17*	-.13*	.62**
Colonoscopy Benefits	-.19	.26	.24*	.36*
Colonoscopy Harms	-.10	-.06	.52**	-.11
Colonoscopy Expected Lay Gist	-.32	.18	-.03	.18
Colonoscopy Expected Expert Gist	-.15	.32	-.20	.33*

Note. Each row of the table presents results from a separate model of PSA articles (*n*=222) or colonoscopy articles (*n*=65).
[a]Daily News (NY) & Chicago Sun-Times vs. other newspapers
*p<=.05, **p<.001.

Figure 4.

Flow diagram

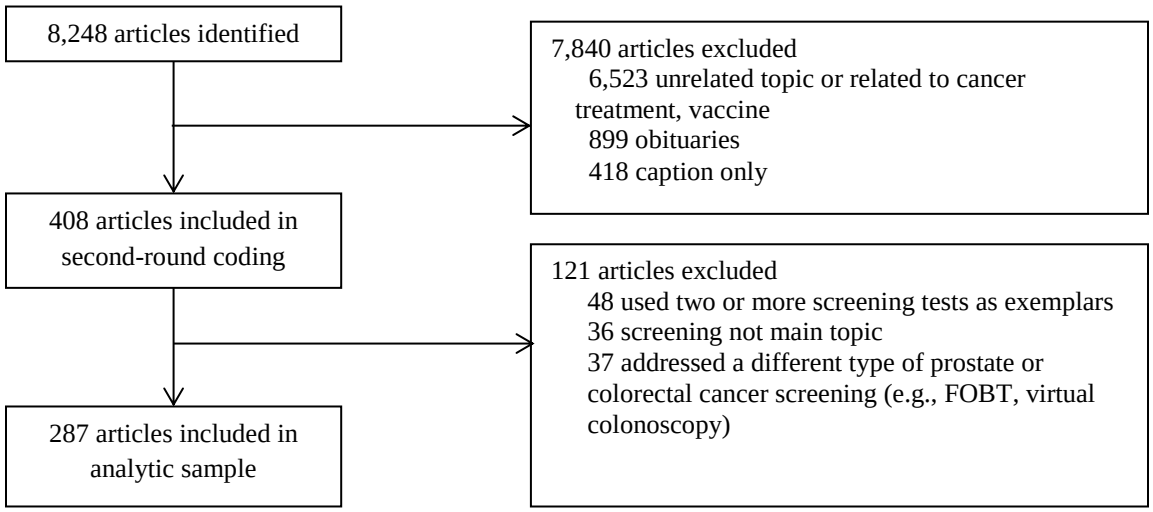
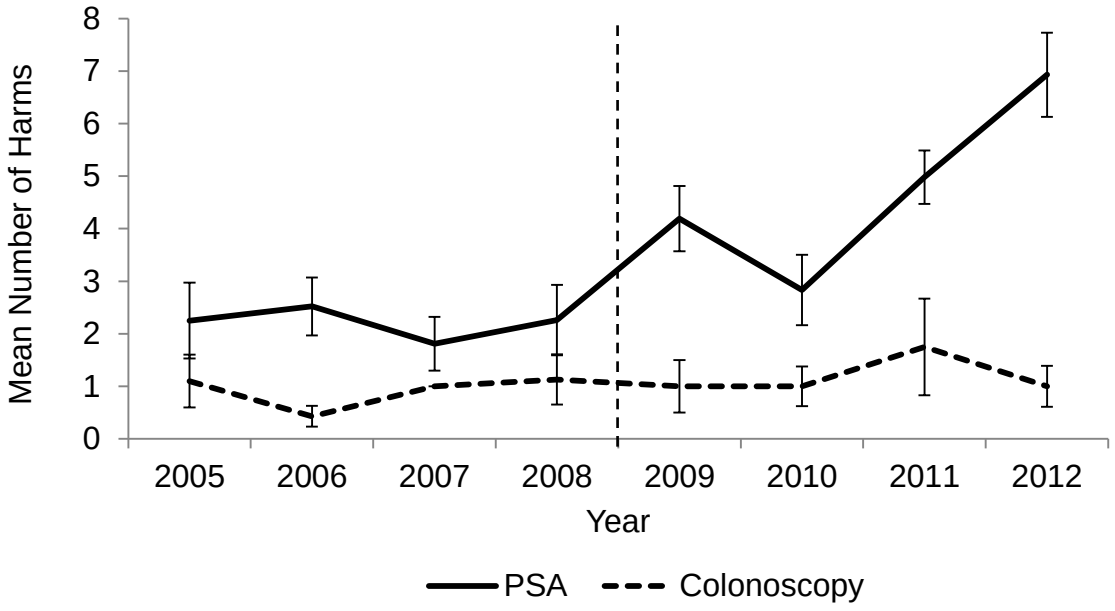


Figure 5.

Number of PSA testing and colonoscopy harms and benefits mentioned in newspaper articles over time



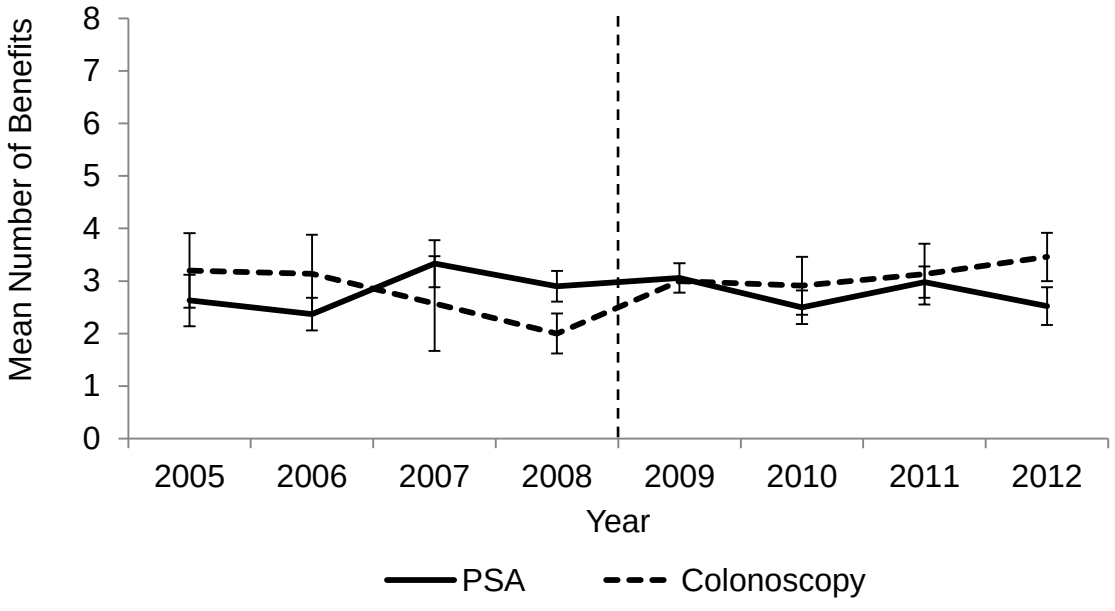


Table 9.

Online Supplement A: Top 10 U.S. Print Newspapers by Daily Circulation, August 2012

Rank	Newspaper	Location	Daily Circulation	Sunday Circulation
1	The Wall Street Journal	New York, NY	2,118,315	2,078,564
2	USA Today	McLean, VA	1,817,446	N/A
3	The New York Times	New York, NY	1,586,757	2,003,247
4	Los Angeles Times	Los Angeles, CA	605,243	948,889
5	San Jose Mercury News	San Jose, CA	575,786	690,258
6	The Washington Post	Washington, DC	507,615	719,301
7	Daily News	New York, NY	530,924	584,658
8	New York Post	New York, NY	555,327	434,392
9	Chicago Tribune	Chicago, IL	414,590	779,440
10	Chicago Sun-Times	Chicago, IL	422,335	434,861

Note. Data are from the Audit Bureau of Circulations (210)

Table 10.

Online Supplement B. Average Magnitude of PSA Testing and Colonoscopy Benefits and Harms as Rated by Clinicians

	Average Magnitude Rating
Harms	
Word "harm" (or synonym) mentioned	2.83
Bleeding	2.64
Discomfort of "prep" for colonoscopy[a]	2.17
False negatives	2.88
False positives	2.92
Financial cost	2.23
Follow-up procedures	3.11
Impotence[b]	3.20
Incontinence[b]	3.41
Increased Mortality	4.00
Infection	3.25
"Other" harm	1.50
Overdiagnosis	3.08
Pain	2.40
Perforation[a]	3.48
Psychological Effects (e.g., anxiety)	2.61
Unnecessary Treatment	3.05
Benefits	
Word "benefit" (or synonym) mentioned	2.94
Convenience	3.00
Diagnosis/detection	3.45
Early treatment	3.45
Knowledge/having more information	3.11
Lifesaving/reduced mortality	3.12
Longevity	3.31
Low cost[b]	3.00
"Other" benefit	2.94
Prevent cancer	3.50
Psychological effects (e.g., peace of mind)	2.60
Rule out cancer	2.57

Note. Data are from a 2012 survey of *N*=112 clinicians (32). Ratings were averaged across PSA testing and colonoscopy, except where otherwise noted.
[a] Averaged for colonoscopy only.
[b] Averaged for PSA testing only.

CHAPTER 5: DISCUSSION

Clinicians' recommendations play a critical role in shaping patients' screening decisions (29-31), yet we know little about how clinicians perceive screening benefits and harms or how they formulate their risk perceptions associated with screening. The media's portrayal of screening can also shape consumer behavior (108,188,191), but to date no research has assessed media coverage of prostate and colorectal cancer screening in the time immediately before and after the 2008 USPSTF recommendations changes. The overarching aim of this dissertation was to explore two areas of importance to patients' screening decisions: clinicians' perceptions and news media portrayal of the benefits and harms of cancer screening. This chapter provides a general discussion of Studies 1 and 2, provides implications for policy and practice, and identifies avenues for further study.

Gist of Screening

Gist played a central role in both studies. According to fuzzy trace theory, gist memories are vague, qualitative representations that capture bottom-line meaning. In contrast, verbatim memories are precise, quantitative representations that capture literal details (71). Verbatim memories fade over time, but gist memories are durable and frequently form the basis of subsequent judgments and decisions (71). Gist memories are so strong that even when verbatim memories are available to us, we rely upon gist to make decisions (211). According to fuzzy trace theory, people's gist understanding of something (e.g., screening),

rather than the verbatim facts they know about it, impacts judgments and decisions (71). Dissertation findings were broadly consistent with fuzzy trace theory in several ways.

In Study 1, the clinician study, I found that screening tests elicited different gist meaning (negative gist for PSA, positive gist for colonoscopy), and clinicians' gist of screening went on to shape their likelihood estimates. This finding is consistent with fuzzy trace theory and is in line with research showing that clinicians rely on gist in their judgments and decision making (72-75). As well, clinicians' gist of screening was specific to beliefs about benefits. The number of harms and difficulty of recall did not predict likelihood judgments, and therefore there was little support for the availability hypothesis (that more easily retrieved or available knowledge about harms and benefits would shape likelihood judgments). Fuzzy trace theory may help explain the lack of evidence in support of the availability hypothesis. Clinicians may more easily extract and remember a gist for screening benefits, but they may struggle to extract a gist for screening harms and rely more often on something closer to verbatim memory. The upshot would be that they rely upon benefits (gist) when making likelihood judgments. Indeed, clinicians perceived more abstract, "gist-like" benefits (e.g., peace of mind, saving lives) and more concrete harms (e.g., impotence, incontinence, colonic perforation).

Using gist in decision making can reduce errors in probability judgment (166,167) and decrease unhealthy decisions (168,169). Therefore, targeting clinicians' gist of screening (for example through pictorial or graphical displays, which allow clinicians to make gist-based relative magnitude comparisons and detect overarching patterns (172)), could be one way to affect clinicians' risk perception and possibly reduce over-recommendation of screening. In some cases, it may be advisable to target a different gist of screening, for

example if clinicians have a positive gist about a screening test (e.g., PSA testing can't hurt and it might help) that results in net harm.

In Study 2, the media study, gist also played an important role. Research on fuzzy trace theory has shown that greater expertise is associated with better discrimination between low and high risks but that these more accurate judgments are due to using fewer dimensions of information (142). Thus, we reasoned that expert readers (e.g., clinicians) would be better equipped to discriminate between and weigh the benefits and harms of screening in news articles than laypeople. We further reasoned that experts would boil the information down to fewer dimensions via an overall gist perception of net benefit/harm. In contrast, we reasoned that laypeople would be less well equipped to weigh benefits and harms and formulate perceptions of net benefit/harm, and that the more qualitative, summative statements that appear in article headlines and ledes would be more likely to form the basis of lay consumers' gist of screening.

Our measures of lay and expert gist were limited in that we did not validate them against the gist that experts and lay people take away from articles. Thus, our coding may, or may not, have captured real differences between the gist that expert and lay people would indeed take away. With these limitations in mind, I found that the gist that experts and laypeople might be expected to take away from newspaper articles on colonoscopy was positive. However, we observed a surprising finding for articles on PSA testing: The gist that an expert might take away from PSA articles was negative, while the gist that a layperson might take away was positive (Table 11). Newspapers increasingly discussed harms with greater magnitude than benefits, at the same time presenting PSA testing in an overall favorable way in article ledes. While articles on PSA testing increasingly discussed harms

after 2008, a powerful, positive "gist" message in article headlines and ledes countered this discussion. Newspaper articles on PSA testing may leave the average reader with the sense that he should be screened for prostate cancer, which goes against some screening recommendations (e.g., (39,149)). The disconnect between lay and expert gist for PSA screening may exacerbate the gulf between experts' opinion that PSA screening is harmful and the lay public's enthusiasm for the test.

Table 11.

Valence of Expert and Lay Gist by Screening Test

Screening Test	**Expert Gist**	**Lay Gist**
PSA	Negative	Positive
Colonoscopy	Positive	Positive

There is a gap in the literature on clinicians' news media consumption, so it is not currently possible to estimate the proportion of clinicians in Study 1 who might have received media messages similar to those addressed in Study 2. To address this lack of evidence, I added an item on media consumption to the follow up clinician survey, administered in winter 2014. The link between media consumption and clinicians' screening-related gist, risk perception, and decision making remains to be established.

Harms of Screening

Dissertation findings suggest that clinicians and the news media are broadly aware of the harms of cancer screening but both fall short as sources of information for patients and consumers in several ways. As a group, clinicians in Study 1 were able to list harms at all levels of the "screening cascade" of harms proposed by Harris and colleagues in their

taxonomy of screening harms (139). For PSA testing, clinicians listed mostly psychological harms of testing (e.g., anxiety, false positives), physical harms of distal follow up procedures (e.g., impotence, incontinence), and the hassle of unnecessary testing and treatment, suggesting that these types of PSA harms are most available for clinicians. For colonoscopy, clinicians listed mostly physical harms related to the procedure itself (e.g., discomfort of "prep," perforation, bleeding), suggesting that physical harms of colonoscopy are most available for clinicians. However, on an individual-level, few clinicians listed harms from more than two categories in the taxonomy. As well, few clinicians listed anything beyond physical harms of colonoscopy, and even fewer noted financial strain or opportunity costs for either screening test. If clinicians are unaware of some kinds of screening harms or do not think them worth enumerating on the survey, this information may not be passed on to patients (212). Messages to clinicians to increase awareness of different types of screening harms and improve patient-provider communication should emphasize the full scope of harms Harris et al outline in their taxonomy (139).

Study 2 showed that mentions of PSA harms in newspapers increased after 2008, but that newspapers' portrayal of colonoscopy harms did not change over time. Colonoscopy can effectively detect and prevent cancer among adults ages 50-75; however, it is recommended only conditionally for adults ages 76-85, and it is not recommended for adults over 85 (32). Thus, by emphasizing colonoscopy's benefits and underemphasizing its harms, newspapers may expose older adults and clinicians to unbalanced or misleading information on colorectal cancer screening. Public health messages to counteract unbalanced media messages on screening should emphasize that both "bad" and "good" screening tests have harms, and that the benefit-to-harms ratio of some screening tests decreases as people age. It is possible that

the thin discussion of colonoscopy harms in the media contributed to clinicians' perception of decreased likelihood of harm and increased likelihood of lengthened life from colonoscopy relative to PSA testing, the harms of which received relatively more media coverage. However, we need further research to draw any links between media coverage and clinicians' perceptions.

Screening decisions based on benefits alone are unbalanced and may lead to overuse (3,205,207). We know that exposure to a concept increases the likelihood that this concept, rather than another one, is subsequently used in decision making (213). Thus, increasing people's awareness and understanding of the different types of harms among clinicians and patients could potentially increase the likelihood that they consider harms in screening decisions. For example, by finding and publicizing men who have experienced harms of PSA testing, public health and media messages could potentially shape peoples' gist of screening (e.g., such that a person's positive gist of PSA testing becomes negative), an important step towards influencing their risk perception and screening decisions.

Benefits of Screening

Benefits were a driving force in both dissertation studies. In the clinician study (Study 1), early detection and treatment was the most commonly mentioned benefit, and clinicians rated saving lives as one of the largest benefits of both screening tests. This finding is not surprising given that the primary goal of cancer screening is to reduce deaths due to cancer and curtail the development of symptomatic metastatic disease (32,149). Clinicians considered the benefits of PSA testing, a low efficacy screening test, to be as large as the benefits of colonoscopy, a high efficacy one. Developing a parallel framework of screening benefits similar to the taxonomy of screening harms developed by Harris and colleagues

(139) might help researchers better understand and study screening benefits across screening tests and ultimately facilitate patients' and laypeople's comparison of screening benefits to screening harms.

Also in Study 1, benefits, but not harms, mediated the relationship between screening test and clinicians' likelihood estimates. This finding is perplexing and deserves further exploration. One possible explanation for it is that clinicians as a group may associate screening with benefits but not harms in a categorical, gist-like way. Messages to clinicians to decrease over-recommendation of screening may need to focus on benefits, rather than harms. Future research based on fuzzy trace theory might assess whether patients and providers formulate risk perceptions in this gist-like way. For example, it is possible that risk perceptions about certain health behaviors widely thought to be beneficial, such as screening, elicit benefits-based decisions while classically harmful things such as drug use elicit harms-based decisions.

Risk is traditionally defined as the probability of an event times its severity. It is possible that we inadvertently cued likelihood estimates when we asked clinicians to rate the magnitude of the benefits they listed. Cuing likelihood could have caused clinicians' perceived magnitude of benefits to correlate with their likelihood estimates. That the relationship held for benefits but not harms suggests that this alternative explanation may not be correct. That said, perceptions of magnitude may influence likelihood estimates through the affect heuristic (112,113), providing a theoretical basis for this relationship.

In the media study, newspaper coverage of PSA and colonoscopy benefits did not change from 2005-2012, despite the USPSTF recommendation changes in 2008. This finding

suggests that potential benefits of PSA testing such as cancer detection and reduced mortality are newsworthy irrespective of test efficacy or balance of benefits to harms. This unwavering media exposure of PSA testing benefits (e.g., in newspapers that ran screening campaigns) may have contributed to clinicians' perceptions of the magnitude of PSA benefits. It is also possible that this exposure of PSA testing benefits contributed to clinicians' reliance on benefits when making their likelihood judgments. Further research is necessary to better understand how clinicians develop their perceptions of and reliance on screening benefits.

Strengths and limitations

This dissertation has several strengths. Both dissertation studies are timely given nascent research on harms of screening. The clinician study (Study 1) is theory-driven and uses a strong study design. The within-subjects design reduced error variance associated with individual differences, increasing statistical power and decreasing the chance of a Type II error. Although some might perceive the sample size to be modest, this is a relatively large sample compared to typical studies of clinicians. Achieving an 80% response rate is notable given that surveys of clinicians typically achieve lower rates (e.g., (214-216)).

The media study (Study 2) addresses an important gap in the literature by increasing our understanding of how newspapers covered prostate and colorectal cancer screening before and after the USPSTF recommendation changes. Further, Study 2 examined both expected expert and lay gist of articles, thus providing a sense for which group was most likely to receive unbalanced information on cancer screening from the media. Using an innovative approach, I calculated expert gist by weighting benefits and harms with clinicians'

magnitude ratings from Study 1. In this way, the measure of expert gist is likely to closely approximate the gist clinicians would take away from newspaper articles.

In addition to limitations discussed in the manuscripts, several limitations bridge both studies. Both research efforts rely on a comparison of PSA testing to colonoscopy, which are different screening tests with qualitatively different harms. This comparison, however, allowed me to draw meaningful conclusions about a test that has net harm compared with a test that has net benefit for many adults (32,149). As well, both research studies relied on cross-sectional data with no behavioral outcomes. As a result, I cannot conclude that likelihood estimates lead to screening recommendations or that newspaper portrayal caused changes in screening uptake. Both of these studies draw upon fuzzy trace theory. While I tested some predictions suggested by this theory, I did not test many of the theory's other postulates including developmental changes and multiple gist memory traces. Studies of how clinicians develop expertise in the benefits and harms of screening tests could add to the line of research on fuzzy trace theory and provide firmer direction to public health efforts to decrease screening overuse.

Future Research

Findings from this dissertation suggest that perceived benefits are a crucial factor in clinicians' likelihood estimates and in the media's portrayal of cancer screening. Future research might attempt to further explain why benefits, but not harms, predicted clinicians' likelihood estimates. Along these lines, the relationship between clinicians' perceptions of screening test, likelihood estimates, and screening recommendations is weak and requires

further exploration if we are to identify junctures where we can improve patient care and strategies for doing so.

As a mediator of the association between screening test and clinicians' likelihood estimates, gist understanding is a potential point of intervention to impact clinicians' risk assessments and screening recommendations. Future research might test different approaches to communicating gist-like screening information to clinicians to determine which ones are most effective, or to provide verbatim information but with suggested take-away gist messages. Furthermore, it may be helpful to study patients' gist of screening, which may be less accurate than clinicians'. Information on patients' gist of screening could help target areas for improvement in patient knowledge and decision making, or be used to inform policy by adding the patient perspective (217). Additionally, since we know that experts increasingly rely upon gist in their decision making as their expertise increases (72-75), examining whether clinician experience moderates the relationship between gist and clinicians' likelihood estimates could help target messages to clinicians differentially by their level of experience.

Findings from the media study also suggest avenues for further study. Future research might assess whether media coverage of the harms of other screening tests (e.g., mammography) has increased in recent years. Doing so would help determine whether the observed increase in news coverage of PSA testing harms was an isolated event or representative of broader secular change surrounding screening and detection. We know little about clinicians' news media consumption, and findings from the follow up clinician survey will help fill this research gap and target messages to clinicians based on their media use (e.g., through blogs, social media, etc.).

Conclusion

This dissertation examined two important factors that predict screening behavior: provider perceptions and media coverage. Overall, findings from Studies 1 and 2 increase our understanding of cancer screening benefits and harms, a little studied but emergent public health topic. In sum, I found that media coverage of cancer screening benefits and harms is still unbalanced, although clinicians and the media are aware of the harms of cancer screening, something not true ten, or even five, years ago. Regardless of the increased attention to harms, benefits still appear to be the more salient factor for both clinicians and the media when it comes to screening. Clinicians may be particularly interested in how the media might be influencing their patients. Policy makers may respond more to the potential impact of USPSTF recommendations on media coverage of screening. For public health practitioners, the take-home message may rest with crafting theory-based messages to help clinicians reduce over-recommendation of screening. Overall, this dissertation provides new information on how cancer screening benefits and harms are perceived and portrayed; however, we need further research evidence to improve discussions and decision making about screening.

APPENDIX A: MODERATION ANALYSIS

I conducted moderation analyses to test whether screening test moderated the relationship between gist and perceived likelihood of harm. I also tested whether screening test moderated the relationship between gist and perceived likelihood of life lengthened. I repeated these moderation analyses to test the interaction of screening test with number and magnitude of benefits in predicting likelihood estimates. There were no statistically significant moderation effects (Table 12; all possible interaction terms shown for completeness). In other words, the effects of gist, benefits, and magnitude of benefits on likelihood estimates did not vary by screening test type.

Table 12.

Moderation Analyses

Interaction terms	Perceived Likelihood of Harm *z (p)*	Perceived Likelihood of Life Lengthened *z (p)*
Gist*Screening Test	-.02 (.98)	.94 (.35)
Benefits*Screening Test	-.24 (.81)	.65 (.52)
Magnitude Benefits*Screening Test	-.80 (.42)	.82 (.41)
Harms*Screening Test	-.28 (.78)	.96 (.34)
Magnitude Harms*Screening Test	-.25 (.81)	.23 (.82)
Difficulty of Recall*Screening Test	-.28 (.78)	.22 (.82)

APPENDIX B: SURVEY INSTRUMENT

Survey of Primary Care Clinicians' Cancer Screening

Decisions and Practice

Survey Instructions:

- Most items are multiple choice. Please fill in the circle ● to indicate your answers.
- ***Screening*** is defined in this survey as using tests to find health problems before patients have symptoms.
- ***Benefits*** are any possible good effects that might come from screening for and treating a disease once it is found.
- ***Harms*** are any possible bad effects that might come from screening for and treating a disease once it is found.

Part A. Demographic Information

The questions in the first section will help us to better understand you and your responses.

A1. What is your sex?

- ○ Male
- ○ Female

A2. Do you consider yourself to be Hispanic or Latino?

- ○ Yes
- ○ No

A3. What do you consider to be your race?

- ○ Black or African American
- ○ White
- ○ American Indian or Alaskan Native
- ○ Native Hawaiian
- ○ Asian
- ○ Other (Please specify)_____
- ○ Refused

A4. What is your age?

		Years

A5. How long have you been in medical practice overall?

		Years

A6. What is your degree?

- ○ Doctor of Medicine (MD)
- ○ Doctor of Osteopathic Medicine (DO)
- ○ Nurse Practitioner(NP)
- ○ Physician Assistant (PA)
- ○ Other (Please specify)_____

A7. What is your primary clinical role?

- ○ Clinician
- ○ Clinician-educator
- ○ Clinician-researcher
- ○ Other (Please specify)_____

Part B. Making Decisions About Screening

B1. How much influence does the U.S. Preventive Services Task Force (USPSTF) have on your screening recommendations?

- ○ Extremely influential
- ○ Very influential
- ○ Neither influential nor not influential
- ○ Not very influential
- ○ Not at all influential

B2. Please say how much you agree or disagree with the following statement: I do not see much harm in ordering screening tests even if they are not recommended.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree or disagree
- ○ Somewhat disagree
- ○ Strongly disagree

Part C. Prostate Cancer Screening With PSA

These questions are about screening for prostate cancer using prostate specific antigen (PSA) testing.

> Patient #1: Mr. Morton is a white male with good cognitive status and no fatal disease. He has no family history of prostate cancer and no previous prostate findings or abnormal PSA tests. He had a normal PSA two years ago. His age is below.

Please complete the tables below. Fill in one circle for each block based on patient age and patient screening request (total of 6 answers per table).

C1. Do you *discuss* screening for prostate cancer using PSA for this patient?	**If Mr. Morton's age is…**		
	Age 90	**Age 70**	**Age 50**
a. If patient does NOT request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No
b. If patient does request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No

C2. Do you *recommend* screening for prostate cancer using PSA for this patient?	**If Mr. Morton's age is…**		
	Age 90	**Age 70**	**Age 50**
a. If patient does NOT request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No
b. If patient does request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No

C3. Please say whether you agree or disagree with the following statements:

(FILL ONE CIRCLE IN FOR EACH LINE)	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
a. I would feel like I had done something wrong if I did not recommend that my patients have regular PSA screening for prostate cancer.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
b. I don't feel any special responsibility to recommend PSA screening for prostate cancer.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
c. When it comes to recommending prostate cancer screening with PSA, it is better to be safe than sorry.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
d. Screening for prostate cancer with PSA is just looking for trouble.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
e. I would regret not recommending prostate cancer screening with PSA to a patient later diagnosed with prostate cancer.					

Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○

C4. To what degree would the following factors influence your <u>recommendation</u> for prostate cancer screening for a 70 year old male patient?

Recommendation to screen factor:	**No influence**	**Minimal influence**	**Moderate influence**	**Strong Influence**
a. Short time to spend with patient	○	○	○	○
b. Worried I could be sued	○	○	○	○
c. Clinical reminders or performance measures	○	○	○	○

C5. Please list as many <u>Benefits</u> from prostate cancer screening as you can think of for Mr. Morton, a 70 year old patient. Then indicate how large you believe the benefit to the patient would be for each. Please print. Use only the lines you need.

Benefits of prostate cancer screening:	**Almost no benefit to patient**	**Small benefit to patient**	**Moderate benefit to patient**	**Large benefit to patient**
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○

C6. Please list as many <u>Harms</u> from prostate cancer screening as you can think of for Mr. Morton, a 70 year old patient. Then indicate how large you believe the harm to the patient would be for each. Please print. Use only the lines you need.

Harms of prostate cancer screening:	**Almost no harm to patient**	**Small harm to patient**	**Moderate harm to patient**	**Large harm to patient**
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○

C7. On average, how difficult was it for you to come up with these harms of prostate cancer screening?

- ○ Not at all difficult
- ○ Somewhat difficult
- ○ Moderately difficult
- ○ Very difficult
- ○ Extremely difficult

C8. Think of 100 healthy male patients, like Mr. Morton age 70, whom you screen and find an elevated PSA of 8.0. You continue to follow them for the next 10 years.

a. Having the PSA test will lead to at least moderate <u>physical</u> harm at some point over those 10 years for _____ of these men.

○	○	○	○	○	○	○	○	○	○	○
No men	1-10 men	11-20 men	21-30 men	31-40 men	41-50 men	51-60 men	61-70 men	71-80 men	81-90 men	91-100 men

b. Having the PSA test will lead to at least moderate <u>psychological</u> harm at some point over those 10 years for _____ of these men.

○ No men	○ 1-10 men	○ 11-20 men	○ 21-30 men	○ 31-40 men	○ 41-51 men	○ 51-60 men	○ 61-70 men	○ 71-80 men	○ 81-90 men	○ 91-100 men

c. At the end of 10 years, how many of these men do you think will have had their lives lengthened by having had the PSA test?

○ No men	○ 1-10 men	○ 11-20 men	○ 21-30 men	○ 31-40 men	○ 41-52 men	○ 51-60 men	○ 61-70 men	○ 71-80 men	○ 81-90 men	○ 91-100 men

Part D. Colon Cancer Screening

These questions are about screening for colon cancer using colonoscopy.

> Patient #2: Mr. Lewis is a white male with good cognitive status and no fatal disease. He has no family history of colon cancer and no risk factors or history of polyps. He had a normal colonoscopy ten years ago. His age is below.

Please complete the tables below. Fill in one circle for each block based on patient age and patient screening request (total of 6 answers per table).

D1. Do you *<u>discuss</u>* screening for colon cancer using colonoscopy for this patient?	**If Mr. Lewis' age is…**		
	Age 90	**Age 70**	**Age 50**
a. If patient does <u>NOT</u> request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No
b. If patient does request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No

D2. Do you *recommend* screening for colon cancer using colonoscopy for this patient?	**If Mr. Lewis' age is…**		
	Age 90	**Age 70**	**Age 50**
a. If patient does NOT request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No
b. If patient does request screening	○ Yes ○ No	○ Yes ○ No	○ Yes ○ No

D3. Please say whether you agree or disagree with the following statements:

(FILL ONE CIRCLE IN FOR EACH LINE)	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
a. I would feel like I had done something wrong if I did not recommend that my patients have regular colonoscopies for colon cancer.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
b. I don't feel any special responsibility to recommend colonoscopy					

(FILL ONE CIRCLE IN FOR EACH LINE)	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree or Disagree**	**Somewhat Agree**	**Strongly Agree**
for colon cancer.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
c. When it comes to recommending colon cancer screening with colonoscopy, it is better to be safe than sorry.	○	○	○	○	○
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
d. Screening for colon cancer with colonoscopy is just looking for trouble.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○
e. I would regret not recommending colon cancer screening with colonoscopy for a patient later diagnosed with colon cancer.					
Patient Age 70	○	○	○	○	○
Patient Age 90	○	○	○	○	○

D4. To what degree would the following factors influence your <u>recommendation</u> for colon cancer screening for a 70 year old male patient?

Recommendation to screen factor:	**No influence**	**Minimal influence**	**Moderate influence**	**Strong Influence**
a. Short time to spend with patient	○	○	○	○
b. Worried I could be sued	○	○	○	○
c. Clinical reminders or performance measures	○	○	○	○

D5. Please list as many <u>Benefits</u> from colon cancer screening as you can think of for Mr. Lewis, a 70 year old patient. Then indicate how large you believe the benefit to the patient would be for each. Please print. Use only the lines you need.

Benefits of colon cancer screening:	**Almost no benefit to patient**	**Small benefit to patient**	**Moderate benefit to patient**	**Large benefit to patient**
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○

D6. Please list as many <u>Harms</u> from colon cancer screening as you can think of for Mr. Lewis, a 70 year old patient. Then indicate how large you believe the harm to the patient would be for each. Please print. Use only the lines you need.

Harms of colon cancer screening:	**Almost no harm to patient**	**Small harm to patient**	**Moderate harm to patient**	**Large harm to patient**
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○

D7. On average, how difficult was it for you to come up with these harms of colon cancer screening?

- ○ Not at all difficult
- ○ Somewhat difficult
- ○ Moderately difficult
- ○ Very difficult
- ○ Extremely difficult

D8. Think of 100 healthy male patients, like Mr. Lewis age 70, whom you screen with colonoscopy and find a 1.0 cm adenomatous polyp that is removed. You continue to follow them for the next 10 years.

a. Having the colonoscopy will lead to at least moderate <u>physical</u> harm at some point over those 10 years for _____ of these men.

○	○	○	○	○	○	○	○	○	○	○
No men	1-10 men	11-20 men	21-30 men	31-40 men	41-53 men	51-60 men	61-70 men	71-80 men	81-90 men	91-100 men

b. Having the colonoscopy will lead to at least moderate <u>psychological</u> harm at some point over those 10 years for _____ of these men.

○	○	○	○	○	○	○	○	○	○	○
No men	1-10 men	11-20 men	21-30 men	31-40 men	41-54 men	51-60 men	61-70 men	71-80 men	81-90 men	91-100 men

c. At the end of 10 years, how many of these men do you think will have had their lives lengthened by having had the colonoscopy?

○	○	○	○	○	○	○	○	○	○	○
No men	1-10 men	11-20 men	21-30 men	31-40 men	41-55 men	51-60 men	61-70 men	71-80 men	81-90 men	91-100 men

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