Policy Insights from the
Behavioral and Brain Sciences
2018, Vol. 5(2) 155–162

DOI: 10.1177/2372732218786042
journals.sagepub.com/home/bbs
SAGE

Too Much Medicine: Behavioral Science Insights on Overutilization, Overdiagnosis, and Overtreatment in Health Care

Victoria A. Shaffer[1] and Laura D. Scherer[1]

Abstract

Overutilization—defined as the use of health care services for which the benefits do not outweigh the harms—has been identified as one of the leading contributors to the rising cost of health care in the United States. Although informational interventions designed to address overutilization have had a significant, but modest, impact on the rate of overutilization, they have not been sufficient to solve the problem. Also, various psychological mechanisms contribute to the desire for more medical tests and treatments. To effectively address overutilization, we need to better understand the psychological underpinnings of overuse in medicine. The article reviews recent findings from the behavioral science literature—including reliance on anecdotal evidence, test-related affect, the use of diagnostic labels, and medical maximizing tendencies—that lend insight into why patients sometimes seek, demand, or expect medical tests and treatments that are considered by experts to be low value.

Keywords

medical decision making, affect, cognitive biases, individual differences, health policy

Tweet

When patients want "too much medicine": Insights from behavioral science—reliance on anecdotal evidence, test-related affect, the use of diagnostic labels, and medical maximizing tendencies—provide possible solutions to the problem of overutilization of health care services.

Key Points

- Overutilization is one of the leading contributors to the rising cost of health care.
- Informational interventions have only decreased overutilization by a small amount.
- Psychological mechanisms contribute to the desire for more medical tests and treatments.
- Reliance on anecdotal evidence, test-related affect, the use of diagnostic labels, and medical maximizing tendencies help explain why patients seek low-value medical tests and treatments.
- Policies are needed to mandate the use of transparent risk communication, change the use of diagnostic labels for indolent disease, and create behavioral incentives to reduce the use of tests and treatments that are not efficacious.

Introduction

Overutilization, Overdiagnosis, and Overtreatment

Health expenditures are disproportionately high in the United States (National Center for Health Statistics, 2017), with little evidence that this spending results in better health outcomes. Overutilization—the use of health care services for which the benefits do not outweigh the harms (Morgan, Dhruva, Wright, & Korenstein, 2016)—is a leading contributor to the rising cost of health care (Cassel & Guest, 2012). Estimates of overuse range from 20% to 30% of the total cost of U.S. health care (Berwick & Hackbarth, 2012). Besides being wasteful, overutilization does not improve Americans' health and, in many cases, actually *increases* the risk of harm to patients (O' Donoghue, Eklund, Ozanne, & Esserman, 2014).

Overuse occurs in a number of medical contexts. Since 2012, the Choosing Wisely® campaign has enlisted medical

[1]University of Missouri, Columbia, USA

Corresponding Author:
Victoria Shaffer, Department of Psychology, University of Missouri, 208 McAlester Hall, 320 S. 6th Street, Columbia, MO 65211, USA.
Email: shafferv@missouri.edu

societies to produce lists of commonly used tests and procedures that "physicians and patients should question" because of insufficient evidence of benefit or evidence that harms may outweigh the benefits (Cassel & Guest, 2012). Dozens of medical societies list hundreds of questionable tests, medications, and procedures, including magnetic resonance imaging (MRI) scans for migraine headaches, imaging for low back pain, and antibiotics for ear inflammation in children (Choosing Wisely, 2017).

Although overutilization occurs throughout medical care, discussions about the overuse of both screening and treatment are particularly prevalent in cancer care. Screening programs are based on the assumption that cancers have "an orderly and gradual progression" (Esserman et al., 2014, p. e234). However, cancer is a complex pathologic condition that is fairly heterogeneous (Esserman, Thompson, & Reid, 2013). Cancer includes both diseases that will aggressively metastasize and cause death and diseases that will cause no measurable harm in a patient's lifetime (Esserman, Shieh, & Thompson, 2009). The former category is difficult to diagnose at an early stage (e.g., pancreatic cancer), and, while the latter can be diagnosed easily, health outcomes do not demonstrably improve by identifying and treating this type of disease (e.g., prostate cancer). Therefore, screening is only effective for cancers that are both slow growing and progressive—such as colon and cervical cancers.

Given the majority of most prevalent cancers are faster growing and/or nonprogressive, cancer-screening programs can actually result in unintended negative outcomes for two reasons. First, screening can detect cancers that are not clinically significant ("length-time bias," Esserman et al., 2013). For example, in breast and prostate cancers—among the most frequently diagnosed cancers in the United States (National Cancer Institute, 2018)—the detection and removal of precancerous lesions has not reduced the prevalence of invasive cancers (Welch, 2009). Second, screening can detect indolent disease that will not harm the patient if untreated. This occurs in common cancers, such as thyroid cancer, and may account for 15% to 75% of all cancers depending upon the affected organ (Welch & Black, 2010). While more prevalent for cancer screening, the positive predictive value of other tests will also be low in populations that have low risk.

Overdiagnosis and overtreatment are of paramount concern because they are costly to the health care system and unnecessarily increase the risk of harm to patients (O' Donoghue et al., 2014). The natural first approach to addressing overutilization is providing patients and providers with more information. Unfortunately, while informational interventions are necessary, they are *not* a sufficient solution to solving the problem of overutilization. Addressing this problem requires better understanding the psychological underpinnings of overuse in medicine. This article reviews recent findings from behavioral science that lend insight into why patients sometimes seek, demand, or expect medical tests and treatments that are considered by experts to be low value. This literature suggests recommendations for health care policy targeting overutilization.

Informational Approaches to Screening and Treatment

Efforts to inform patients began in earnest with the rise of patient decision aids—educational materials that balance risks and benefits associated with tests and treatments (O'Connor et al., 2007). Decision aids do effectively inform patients by increasing knowledge and accuracy of risk perceptions (for a review, see Stacey et al., 2017). However, while decision aids slightly reduced interest in the Prostate Specific Antigen (PSA) test to screen for prostate cancer, decision aids largely had no impact on any other screening choices. Thus, in many cases, informed patients still show great enthusiasm for tests and treatments with questionable value (Scherer, Valentine, Patel, Baker, & Fagerlin, in press).

In addition to educational tools targeting patients, national organizations also release guidelines and recommendations about the use of common tests and treatments, based on scientific evidence about the ratio of benefit to harm. The U.S. Preventive Services Task Force (USPSTF)—an independent committee of national experts in preventive and evidence-based medicine—makes recommendations about the use of clinical preventive services in the form of a grade (A, B, C, D, or I; USPSTF, 2018). At the moment, several recommendations argue against certain types of cancer testing. Currently, the USPSTF gives a rating of "D," indicating that providers should discourage this test, to screening for ovarian, pancreatic, thyroid, and testicular cancers for all asymptomatic patients and for *BRCA* genetic testing for patients without a family history of breast/ovarian cancers.

The USPSTF recommendations—and other national attempts to inform physicians, patients, and the general public—have significantly, but only modestly, impacted screening rates for prostate and breast cancers. In 2005, 36.9% of men age 50 years and older reported receiving a PSA test; this number declined to 30.8% of men in 2013 (Jemal et al., 2015). Similarly, in the state of Vermont, mammography rates for women ages 40 to 49 years (for whom the USPSTF recommended against routine screening without a family history) declined from 59.6% screened in the last 2 years in 2009 to 54.9% in 2011 (Sprague et al., 2014). In a separate study focused on informing PSA test screening decisions, 52.3% of males surveyed indicated that they would get a PSA test in the future even after receiving: (a) information about the PSA test, (b) a detailed risk communication intervention, and (c) a narrative intervention highlighting the possible harms associated with screening (Scherer, Kullgren, et al., 2018). Finally, a significant minority (43.6%) of people are even willing to be screened for cancer using a test that is explicitly stated to have no benefits—while accurately

recalling the benefit and risk profile of the test (Scherer, Valentine, et al., in press). Thus, many well-informed men and women annually receive screening tests for which benefits may not outweigh harms.

Contributing Psychological Mechanisms

Because educational interventions and national guidelines have failed to eliminate overutilization, the larger literature on behavioral health may provide insights into this public health issue. Focusing on the psychological literature, broadly three categories of research can further understanding about overutilization: (a) cognitive biases and schemas, (b) affective information, and (c) individual differences.

Cognitive Biases and Schemas

Several elements of human cognitive processing can contribute to the desire to for more medical tests or interventions. First, communicating the benefits and harms associated with tests and treatments necessarily involves probabilistic information. For example, many attributes of a screening test are numerical (e.g., false positive rate, sensitivity, specificity), but people generally have difficulty comprehending and applying probabilistic information, particularly in the medical context ("collective statistical illiteracy"; Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin, 2007).

The failure to understand complex probabilistic information is not simply an academic concern; rather it profoundly affects health care (e.g., Arkes & Gaissmaier, 2012). For example, many patients, physicians, politicians, and news organizations misunderstand survival and mortality statistics, making inaccurate claims about the effectiveness of screening programs in the United States. Survival time, or length of survival after diagnosis, is a biased indictor of screening effectiveness because survival time will necessarily increase if screening leads to earlier diagnosis—even if there is no benefit to the screened group (e.g., fewer deaths due to cancer or increased lifespan). Researchers have termed this the "lead time bias" (e.g., Gigerenzer et al., 2007). Most primary care physicians misinterpret survival data as evidence for screening effectiveness, with more than two thirds of physicians exhibiting the lead-time bias (Wegwarth, Schwartz, Woloshin, Gaissmaier, & Gigerenzer, 2012).

Beyond misunderstanding probabilistic information, additional psychological biases may drive belief in the effectiveness of questionable tests and treatments. For example, the illusion of control is the tendency to believe that two events are causally related and personally controllable—when there is no causal relationship; this illusion may contribute to the belief that screening tests decrease cancer mortality (Casarett, 2016; Langer, 1975). As evidence, physicians generally overestimate the effectiveness of their tools. For example, clinicians overvalue chemotherapy treatments for cancer and interventions for back pain (Cherkin, Deyo, Wheeler, & Ciol, 1995; Schroen, Detterbeck, Crawford, Rivera, & Socinski, 2000).

This highlights a third bias: allowing anecdotal evidence to outweigh statistical evidence (e.g., Betsch, Ulshofer, Renkewitz, & Betsch, 2011). Although national experts found no public benefit to mammography in younger women or to PSA screening, individuals think about their friend or relative who was screened, diagnosed with cancer, treated, and still alive—ostensibly due to the screening test. Although the epidemiological data would conclude that these individuals were likely overtreated, determining whether any individual case represents appropriate treatment or overtreatment is impossible. This—along with misunderstanding the epidemiological data—creates a cycle of support for screening tests that are ineffective at reducing deaths or prolonging life.

Beyond these documented biases, diagnostic labels evoke schemas that may create patient expectation or demand for tests and treatments (Nickel, Barratt, Copp, Moynihan, & McCaffery, 2017). Diagnostic labels serve both a medical purpose (to classify a set of symptoms or pathology) and as communication between the doctor and patient (McPherson & Armstrong, 2006). Diagnostic labels can activate broad schemas about severity, prognosis, expected time course, and appropriate treatments. They may also generate expectations for treatment by activating medical schemas in which a diagnosis (e.g., "cancer") is associated with some kind of medical intervention (e.g., chemotherapy).

For example, when DCIS—Ductal carcinoma in situ or Stage 0 breast cancer—was labeled "noninvasive breast cancer," 47% of women preferred surgical treatment to nonsurgical options (i.e., medication and active surveillance; Omer, Hwang, Esserman, Howe, & Ozanne, 2013). By contrast, only 31% of women wanted surgical treatment when DCIS was referred to as "abnormal cells." In a second study, women changed their preferences from watchful waiting to immediate treatment when the label "abnormal cells" was changed to "preinvasive cancer cells" (McCaffery et al., 2015). Other research has examined the effect of diagnostic labels outside of cancer contexts, including showing greater interest in medicating infants when symptoms were labeled as "Gastro esophageal Reflux Disease" (Scherer, Zikmund-Fisher, Fagerlin, & Tarini, 2013).

Affective Information

In addition to cognitive biases and schemas that generally favor many tests and treatments, affective information—about feelings or emotions—also influences medical decisions. Although the standard approach provides didactic information about test benefits and harms, affective information—beyond risks and benefits—also drives interest in cancer screening (Scherer et al., 2018). That is, how people *feel* about the test and *feel* about cancer more broadly are unique predictors of

their willingness to be screened, above their perception of the test's risks and benefits.

Cancer, in particular, evokes anxiety, and patient choices about screening and treatment seem disproportionate to the objective risk (e.g., Zikmund-Fisher, Fagerlin, & Ubel, 2010). In particular, people prefer invasive treatments for cancer over equally effective noninvasive methods (e.g., medication, watchful waiting; Fagerlin, Zikmund-Fisher, & Ubel, 2005a). This bias for active treatment may be a consequence of the emotional activation associated with a cancer diagnosis, which is perceived as "a call to action." For instance, documented preferences for invasive, often unnecessary, treatment in breast cancer include prophylactic mastectomies and surgical treatment for DCIS (Hawley, Jagsi, & Katz, 2012; Ozanne et al., 2011). Furthermore, cancer anxiety—beyond disease status—significantly predicts the decision to receive active treatment for prostate cancer (Latini et al., 2007).

In addition, affect used as information can advise judgments about the risks and benefits associated with a test or treatment (e.g., Peters, McCaul, Stefanek, & Nelson, 2006). Specifically, the Affect Heuristic predicts that people make these judgments in accordance with their overall positive or negative feeling about that test or treatment (Slovic & Peters, 2006). The use of affect in this way results in a negative correlation between perceived risks and benefits, where tests/treatments with an overall positive evaluation are judged to be high in benefit and low in risk (Scherer et al., 2018). However, in reality, benefits and risks are positively correlated. Therefore, because the public generally has a positive attitude toward screening, people regularly overestimate the benefits and underestimate the risks associated with these tests (Hoffmann & Del Mar, 2015). However, more asymmetric patterns have emerged in recent research, so the relationship between test benefits and risks appears more complex than originally suggested (Scherer et al., 2018).

Relationships among affect, emotion, and medical decision making are nuanced (Ferrer, Green, & Barrett, 2015). Negative emotions, like anxiety and stress, do not always generate a desire for more medical tests or treatments. Negative affect can motivate positive health behaviors in some contexts and maladaptive behaviors in other contexts, often dependent upon the intensity of the negative emotion. For example, in accordance with Protection Motivation Theory (Rogers, 1975) and the Extended Parallel Process Model (Witte, 1992), responses to health threats depend jointly upon the magnitude of the perceived health risk and the perceived efficacy of efforts to intervene (i.e., ability to reduce the threat). If people perceive the risk of cancer to be high, but their ability to control that risk to be low, they will engage in cognitive defensive coping strategies, which will allow them to downplay the risk. In support of this model, (a) people do often overestimate their risk of cancer (Fagerlin, Zikmund-Fisher, & Ubel, 2005b; Hoffman et al., 2010), and (b) providing people with information about lack of benefits and presence of harms in two screening tests actually reduced their cancer anxiety—suggesting the use of defensive coping strategies (Scherer et al., 2018).

Similarly, positive affect does not always help medical decision making and can lead to maladaptive behavior, particularly when positive emotions result in unrealistic expectations about cancer risk or treatment outcomes. Expectations can be generated through affective forecasting—or the attempt to predict future feelings. Medical decisions are often based, at least partially, on how patients *think* they will feel in a future health state (e.g., people with ulcerative colitis often avoid surgery to create an ostomy because they believe it would result in a lower quality of life; Angott, Comerford, & Ubel, 2013). The problem with this approach is that people are poor affective forecasters (Wilson & Gilbert, 2005). Affective forecasts about the physical and emotional experiences associated with a particular test or treatment can affect decisions, such as whether or not be screened for colorectal cancer (Dillard, Fagerlin, Dal Cin, Zikmund-Fisher, & Ubel, 2010). Therefore, the accuracy of these forecasts matters to decisions about screening tests and medical treatments.

Despite research on how emotions influence decision making in other contexts (e.g., financial), much less is known about how emotions influence decision making in health care (Ferrer, Klein, Lerner, Reyna, & Keltner, 2014), and different theoretical approaches to affect and emotion make differing predictions about the effect of emotion on decisions about health (Gross & Feldman Barrett, 2011). Therefore, unpacking the complex relationships and the conditions under which negative and positive affect shape desire for more medical tests and treatments will be critical to curbing overutilization.

Individual Differences—Medical Maximizing

Patient-level individual differences (e.g., numeracy; health literacy) affect the ability to process medical information (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Lipkus & Peters, 2009). Numeracy and literacy help determine the quality of both medical and nonmedical decisions (e.g., Peters, 2012), and this body research has resulted in recommendations for optimal presentations of medical information (Fagerlin, Zikmund-Fisher, & Ubel, 2011). However, individual preferences toward seeking and avoiding health care may play a role in the care that patients receive, beyond their ability to comprehend medical information. The theory of medical maximizing-minimizing proposes that some people are "medical maximizers" who prefer to seek active medical care when possible, whereas "medical minimizers" prefer to avoid health care unless it is absolutely necessary (a distinction proposed by Groopman & Hartzband, 2011; developed as a scale by Scherer et al., 2016). Maximizers are

not necessarily anxious about their health, but instead generally want to actively address their health-related problems. Minimizers are not necessarily distrustful of health care or doctors, but instead want to know that care is necessary before receiving it.

The concept of medical maximizing-minimizing is new, and it may be relevant to overutilization of health care. For example, people with a greater maximizing orientation report taking more medications, visiting the doctor more frequently, receiving more blood draws, and having more hospitalizations than minimizers (Scherer et al., 2016). In addition, maximizers are (a) more likely to want to receive an MRI for migraine headaches with no other neurological symptoms (Scherer et al., 2016), (b) more interested in receiving treatment for incidental findings from diagnostic imaging tests (Kang et al., 2018), and (c) less likely to delay or avoid health care services (Smith et al., 2018). Men with more maximizing orientations wanted prostate cancer screening at high rates both before (92%) and after (80%) receiving information about the harms and low probability of benefit, whereas 59% of minimizers wanted the test before this information and only 25% wanted the test afterward (Scherer et al., in press). Hence, people with minimizing preferences may be more responsive than maximizers to negative information about medical tests and interventions.

Policy Recommendations

Reviewing the behavioral health literature provides some insights into overutilization in health care. First, physicians, patients, and the general public need to be educated about overutilization, overdiagnosis, and overtreatment; therefore, a first step would be a public health campaign that identifies the problem. However, informational interventions have a limited impact on overuse in medicine. Although decision aids, and other didactic forms of health communication, do significantly decrease interest in the use of tests and treatments with uncertain benefits, interventions that target only cognitive information—facts about the risks and benefits of a test—will always be limited in their ability to curb enthusiasm for unnecessary tests and treatments, particularly among medical maximizers.

Although resources should continue to be directed at efforts to develop balanced, up-to-date educational materials, additional resources and policies must target other processes described here. First, better education about probabilistic and statistical reasoning should address all levels of the curriculum, including professional health-related programs (Gigerenzer et al., 2007). Many have called for transparent risk communication in health information produced by government resources and agencies (e.g., Centers for Disease Control and Prevention [CDC], Food and Drug Administration [FDA], etc.). Also recommended are regulations for direct-to-consumer ads and other materials produced by food and drug companies (e.g., Trevena et al., 2013). (This includes the use of frequencies over single event probabilities, absolute risk instead of relative risk, mortality rates instead of survival rates, and natural frequencies instead of conditional probabilities.) Simulated experience paradigms (i.e., the accumulation of natural frequency information over time in a simulated environment) significantly improve understanding of conditional probabilities (e.g., predictive value of a screening test) and decreases interest in screening tests (e.g., Wegier & Shaffer, 2017). Therefore, research on risk communication should seek to promote understanding of complex statistical information, which is necessary for understanding evidence-based reports constructed by organizations such as the USPSTF.

Physicians, public health practitioners, and researchers call for changing disease labels associated with indolent disease (e.g., McCaffrey et al., 2016). Specifically, health communicators and physicians should avoid the use of the term *cancer* for lesions that, if left untreated, are unlikely to be harmful and instead use the phrase "indolent lesion of epithelial origin" or IDLE (Esserman et al., 2013; Esserman et al., 2014). Similarly, practitioners should avoid the use of the term "precancerous" when referring to precursors of cancer as this implies a linear progression to the development of cancer if left untreated.

Affect also influences health-related decisions. For instance, affective forecasting, personal prediction about feelings associated with a future state, is one affective input into decisions about health. Narratives have great promise to improve health-related affective forecasts, which may motivate positive health behaviors by providing a realistic preview (Focella, Zikmund-Fisher, & Shaffer, 2016; Shaffer, Focella, Hathaway, Scherer, & Zikmund-Fisher, 2018; Shaffer, Focella, Scherer, & Zikmund-Fisher, 2016). Creating stories of overdiagnosis and overtreatment also can combat the natural advantage of anecdotal evidence that already exists for screening and treatment successes.

Despite evidence on affect in other decisional contexts, the relationships among affect, emotions, and decisions may be context dependent or, at minimum, different in the medical domain (e.g., Ferrer et al., 2015). Also, attitudes or feelings about tests and treatments are unique predictors of uptake, beyond perceived risk and benefit. Furthermore, information about a test influences test-related affect, which also influences perceived risk and benefit, but not always in ways predicted by current theoretical paradigms (Scherer et al., 2018). Research on affect, emotion, individual differences, and health-related decision making should inform interventions to address affect-related biases (e.g., Ferrer et al., 2015).

Finally, and perhaps most difficultly, the problem of overutilization will not likely be solved through message framing and health communication efforts. Real change in health care is typically only accomplished by changing the choice

environment. Distinctive economic and political forces shape the health policy landscape, and changing deeply entrenched behaviors typically requires coordinated implementation of economic incentives *and* behaviorally informed strategies (Loewenstein et al., 2017). Therefore, motivating physicians to recommend less invasive treatments and less screening—when appropriate—and getting patients to choose the less-is-more approach—only when efficacious—would also require the use of behaviorally oriented incentives.

Discussions will need to thoughtfully balance consumer choice and overutilization of resources, while also considering the multiplicity of payers and variable incentives. A more extreme approach to policy would be to limit reimbursement of tests and treatments for which there is not clear evidence of benefit (e.g., *BRCA* genetic testing for women without a family history of breast cancer). Less restrictive options (like nudges in the behavioral economics framework) could require two physician recommendations for reimbursement of questionable tests and treatments or windfall incentives for patients who choose to forgo tests/procedures where overtreatment is rampant. All policy-related suggestions would require oversight and regular review by a nonpartisan medical group, similar in mission to the USPSTF, so that these policies reflect the current evidence base. Irrespective of the specific approach to policy, a multifaceted approach to address overutilization will be required.

To have a plausible chance of influencing overutilization of low-value services, interventions and health-related policies must acknowledge that people have biased and stable tendencies toward overuse of medical tests and treatments *and* simply providing more information will not be enough to solve the problem. Specific policies that have the potential to provide benefit at little cost include mandates for (a) transparent risk communication from government agencies (e.g., CDC, FDA) and in direct-to-consumer advertisements produced by food and drug companies, (b) utilization of techniques that increase understanding of conditional probabilities in health communication websites, and (c) changing disease labels used to describe indolent disease to decrease cancer-related anxiety. In addition, guidelines/recommendations that focus on reducing the use of questionable tests and treatments should be accompanied by benign action-oriented options (e.g., watchful waiting) to increase the appeal for medical maximizers and reduce public controversy. Government driven health policy will be required to mandate transparent risk communication and the use of tools to improve the understanding of conditional probabilities in the public and private sectors. By contrast, changes in disease labels will need to be driven by medical societies that generate clinical practice guidelines and recommendations. Other efforts to reduce overutilization include the development of Accountable Care Organizations, which are not reimbursed using the fee-for-service model, implementation of policies to reduce provider conflicts of interest (e.g., constraints on gifts from pharmaceutical and medical device companies), use of second opinion programs for tests and treatments of questionable value, and evaluation of the merits of tests and treatments via cost-benefit analyses (see Loewenstein et al., 2017; Shaffer, 2017). Although such policies would likely have a significant impact on overutilization in health care, their implementation would incur greater cost, particularly to consumer choice. Therefore, it would be important to receive input about such policies from relevant stakeholders including patient advocacy groups and medical societies/organizations.

Acknowledgments

We wish to thank Richelle Koopman, David Mehr, and Brian Zikmund-Fisher for their comments on an earlier version of this manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Angott, A. M., Comerford, D. A., & Ubel, P. A. (2013). Imagining life with an ostomy: Does a video intervention improve quality-of-life predictions for a medical condition that may elicit disgust? *Patient Education & Counseling*, *91*, 113-119.

Arkes, H. R., & Gaissmaier, W. (2012). Psychological research and the prostate-cancer screening controversy. *Psychological Science*, *23*, 547-553.

Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low health literacy and health outcomes: An updated systematic review. *Annals of Internal Medicine*, *155*, 97-107.

Berwick, D. M., & Hackbarth, A. D. (2012). Eliminating waste in US health care. *Journal of the American Medical Association*, *307*, 1513-1516.

Betsch, C., Ulshofer, C., Renkewitz, F., & Betsch, T. (2011). The influence of narrative v. statistical information on perceiving vaccination risks. *Medical Decision Making*, *31*, 742-753.

Casarett, D. (2016). The science of choosing wisely—Overcoming the therapeutic illusion. *New England Journal of Medicine*, *374*, 1203-1205.

Cassel, C. K., & Guest, J. A. (2012). Choosing wisely: Helping physicians and patients make smart decisions about their care. *Journal of the American Medical Association*, *307*, 1801-1802.

Cherkin, D. C., Deyo, R. A., Wheeler, K., & Ciol, M. A. (1995). Physician views about treating low back pain: The results of a national survey. *Spine*, *20*(1), 1-9; discussion 9-10.

Choosing Wisely. (2017). *Five things patients and providers should question*. Retrieved from http://www.choosingwisely.org/wp-content/uploads/2015/01/Choosing-Wisely-Recommendations.pdf

Dillard, A. J., Fagerlin, A., Dal Cin, S., Zikmund-Fisher, B. J., & Ubel, P. A. (2010). Narratives that address affective forecasting errors reduce perceived barriers to colorectal cancer screening. *Social Science & Medicine*, *71*, 45-52.

Esserman, L. J., Shieh, Y., & Thompson, I. (2009). Rethinking screening for breast cancer and prostate cancer. *Journal of the American Medical Association*, *302*, 1685-1692.

Esserman, L. J., Thompson, I. M., & Reid, B. (2013). Overdiagnosis and overtreatment in cancer: An opportunity for improvement. *Journal of the American Medical Association*, *310*, 797-798.

Esserman, L. J., Thompson, I. M., Reid, B., Nelson, P., Ransohoff, D. F., Welch, H. G., . . . Black, W. C. (2014). Addressing overdiagnosis and overtreatment in cancer: A prescription for change. *The Lancet Oncology*, *15*(6), e234-e242.

Fagerlin, A., Zikmund-Fisher, B. J., & Ubel, P. A. (2005a). Cure me even if it kills me: Preferences for invasive cancer treatment. *Medical Decision Making*, *25*, 614-619.

Fagerlin, A., Zikmund-Fisher, B. J., & Ubel, P. A. (2005b). How making a risk estimate can change the feel of that risk: Shifting attitudes toward breast cancer risk in a general public survey. *Patient Education & Counseling*, *57*, 294-299.

Fagerlin, A., Zikmund-Fisher, B. J., & Ubel, P. A. (2011). Helping patients decide: Ten steps to better risk communication. *Journal of the National Cancer Institute*, *103*, 1436-1443.

Ferrer, R. A., Green, P. A., & Barrett, L. F. (2015). Affective science perspectives on cancer control: Strategically crafting a mutually beneficial research agenda. *Perspectives on Psychological Science*, *10*, 328-345.

Ferrer, R. A., Klein, W., Lerner, J. S., Reyna, V., & Keltner, D. (2014). Emotions and health decision making: Extending the appraisal tendency framework to improve health and health care. In C. A. Roberto & I. Kawachi (Eds.), *Behavioral economics in public health* (pp. 161-176). Oxford, UK: Oxford University Press.

Focella, E. S., Zikmund-Fisher, B. J., & Shaffer, V. A. (2016). Could physician use of realistic previews increase treatment adherence and patient satisfaction? *Medical Decision Making*, *36*, 683-685.

Gigerenzer, G., Gaissmaier, W., Kurz-Milcke, E., Schwartz, L. M., & Woloshin, S. (2007). Helping doctors and patients make sense of health statistics. *Psychological Science in the Public Interest*, *8*, 53-96.

Groopman, J., & Hartzband, P. (2011). *Your medical mind: How to decide what is right for you*. Penguin. Retrieved from https://books.google.com/books?hl=en&lr=&id=NmCP-QAJrhkC&oi=fnd&pg=PT30&dq=%22your+medical+mind&ots=ibLOOY2_B0&sig=QoRd-SHQ03yOOP3iMGyvgbRl-WQ

Gross, J. J., & Feldman Barrett, L. (2011). Emotion generation and emotion regulation: One or two depends on your point of view. *Emotion Review*, *3*, 8-16.

Hawley, S. T., Jagsi, R., & Katz, S. J. (2012). Is contralateral prophylactic mastectomy (CPM) overused? Results of a population-based study. *Journal of Clinical Oncology*, *30*(Suppl. 34), 26-26. doi:10.1200/jco.2012.30.34_suppl.26

Hoffman, R. M., Lewis, C. L., Pignone, M. P., Couper, M. P., Barry, M. J., Elmore, J. G., . . . Zikmund-Fisher, B. J. (2010). Decision-making processes for breast, colorectal, and prostate cancer screening: The DECISIONS survey. *Medical Decision Making*, *30*, 53-64.

Hoffmann, T. C., & Del Mar, C. (2015). Patients' expectations of the benefits and harms of treatments, screening, and tests: A systematic review. *JAMA Internal Medicine*, *175*, 274-286.

Jemal, A., Fedewa, S. A., Ma, J., Siegel, R., Lin, C. C., Brawley, O., & Ward, E. M. (2015). Prostate cancer incidence and PSA testing patterns in relation to USPSTF screening recommendations. *Journal of the American Medical Association*, *314*, 2054-2061.

Kang, S. K., Scherer, L. D., Megibow, A. J., Higuita, L. J., Kim, N., Braithwaite, R. S., & Fagerlin, A. (2018). A randomized study of patient risk perception for incidental renal findings on diagnostic imaging tests. *American Journal of Roentgenology*, *210*, 369-375. doi:10.2214/AJR.17.18485

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, *32*, 311-328.

Latini, D. M., Hart, S. L., Knight, S. J., Cowan, J. E., Ross, P. L., DuChane, J., & Carroll, P. R. (2007). The relationship between anxiety and time to treatment for patients with prostate cancer on surveillance. *The Journal of Urology*, *178*, 826-832.

Lipkus, I. M., & Peters, E. (2009). Understanding the role of numeracy in health: Proposed theoretical framework and practical insights. *Health Education & Behavior*, *36*, 1065-1081.

Loewenstein, G., Hagmann, D., Schwartz, J., Ericson, K., Kessler, J. B., Bhargava, S., . . . Zikmund-Fisher, B. J. (2017). A behavioral blueprint for improving health care policy. *Behavioral Science & Policy*, *3*, 53-66. doi:10.1353/bsp.2017.0005

McCaffery, K., Jansen, J. Scherer, L. D., Thornton, H., Hersch, J., Carter, S. M., . . . Edwards, A. (2016). Walking the tightrope: Communicating overdiagnosis in modern healthcare. *BMJ*, *352*, i358.

McCaffery, K., Nickel, B., Moynihan, R., Hersch, J., Teixeira-Pinto, A., Irwig, L., & Barratt, A. (2015). How different terminology for ductal carcinoma in situ impacts women's concern and treatment preferences: A randomised comparison within a national community survey. *BMJ Open*, *5*(11), e008094.

McPherson, S., & Armstrong, D. (2006). Social determinants of diagnostic labels in depression. *Social Science & Medicine*, *62*, 50-58.

Morgan, D. J., Dhruva, S. S., Wright, S. M., & Korenstein, D. (2016). 2016 update on medical overuse: A systematic review. *JAMA Internal Medicine*, *176*, 1687-1692.

National Cancer Institute. (2018). *Common cancer types*. Retrieved from https://www.cancer.gov/types/common-cancers

National Center for Health Statistics. (2017). *Health expenditures*. Retrieved from https://www.cdc.gov/nchs/fastats/health-expenditures.htm

Nickel, B., Barratt, A., Copp, T., Moynihan, R., & McCaffery, K. (2017). Words do matter: A systematic review on how different terminology for the same condition influences management preferences. *BMJ Open*, *7*(7), e014129.

O'Connor, A. M., Wennberg, J. E., Légaré, F., Llewellyn-Thomas, H. A., Moulton, B. W., Sepucha, K. R., . . . King, J. S. (2007). Toward the "tipping point": Decision aids and informed patient choice. *Health Affairs*, *26*, 716-725.

O' Donoghue, C., Eklund, M., Ozanne, E. M., & Esserman, L. J. (2014). Aggregate cost of mammography screening in the United States: Comparison of current practice and advocated guidelines. *Annals of Internal Medicine*, *160*, 145-153.

Omer, Z. B., Hwang, E. S., Esserman, L. J., Howe, R., & Ozanne, E. M. (2013). Impact of ductal carcinoma in situ terminology on patient treatment preferences. *JAMA Internal Medicine*, *173*, 1830-1831.

Ozanne, E. M., Shieh, Y., Barnes, J., Bouzan, C., Hwang, E. S., & Esserman, L. J. (2011). Characterizing the impact of 25 years of DCIS treatment. *Breast Cancer Research and Treatment*, *129*, 165-173.

Peters, E. (2012). Beyond comprehension the role of numeracy in judgments and decisions. *Current Directions in Psychological Science*, *21*(1), 31-35.

Peters, E., McCaul, K. D., Stefanek, M., & Nelson, W. (2006). A heuristics approach to understanding cancer risk perception: Contributions from judgment and decision-making research. *Annals of Behavioral Medicine*, *31*, 45-52.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, *91*, 93-114.

Scherer, L. D., Caverly, T. J., Burke, J., Zikmund-Fisher, B. J., Kullgren, J. T., Steinley, D., . . . Fagerlin, A. (2016). Development of the medical maximizer-minimizer scale. *Health Psychology*, *35*, 1276-1287. doi:10.1037/hea0000417

Scherer, L. D., Kullgren, J. T., Caverly, T., Scherer, A. M., Shaffer, V. A., Fagerlin, A., & Zikmund-Fisher, B. J. (2018). Medical maximizing-minimizing preferences predict responses to information about prostate cancer specific antigen screening. *Medical Decision Making*. Advance online publication. doi:10 .1177/0272989X18782199

Scherer, L. D., Shaffer, V. A., Caverly, T., Scherer, A. M., Zikmund-Fisher, B. J., Kullgren, J. T., & Fagerlin, A. (2018). The role of the affect heuristic and cancer anxiety in responding to negative information about medical tests. *Psychology & Health*, *33*, 292-312.

Scherer, L. D., Valentine, K., Patel, N., Baker, S. G., & Fagerlin, A. (in press). A bias for action in cancer screening? *Journal of Experimental Psychology: Applied*.

Scherer, L. D., Zikmund-Fisher, B. J., Fagerlin, A., & Tarini, B. A. (2013). Influence of "GERD" label on parents' decision to medicate infants. *Pediatrics*, *131*, 839-845.

Schroen, A. T., Detterbeck, F. C., Crawford, R., Rivera, M. P., & Socinski, M. A. (2000). Beliefs among pulmonologists and thoracic surgeons in the therapeutic approach to non-small cell lung cancer. *Chest*, *118*, 129-137.

Shaffer, V. A. (2017). Nudges for health policy: Effectiveness and limitations. *Missouri Law Review*, *82*(3), Article 11. Retrieved from http://scholarship.law.missouri.edu/mlr/vol82/iss3/11

Shaffer, V. A., Focella, E. S., Hathaway, A., Scherer, L. D., & Zikmund-Fisher, B. J. (2018). On the usefulness of narratives: An interdisciplinary review and theoretical model. *Annals of Behavioral Medicine*, *52*, 429-442.

Shaffer, V. A., Focella, E. S., Scherer, L. D., & Zikmund-Fisher, B. J. (2016). Debiasing affective forecasting errors with targeted, but not representative, experience narratives. *Patient Education & Counseling*, *99*, 1611-1619.

Slovic, P., & Peters, E. (2006). Risk perception and affect. *Current Directions in Psychological Science*, *15*, 322-325.

Smith, K. T., Monti, D., Mir, N., Peters, E., Tipirneni, R., & Politi, M. C. (2018). Access is necessary but not sufficient: Factors influencing delay and avoidance of health care services. *MDM Policy & Practice*, *3*(1), 1-11. doi:10.1177/2381468318760298

Sprague, B. L., Bolton, K. C., Mace, J. L., Herschorn, S. D., James, T. A., Vacek, P. M., . . . Geller, B. M. (2014). Registry-based study of trends in breast cancer screening mammography before and after the 2009 US preventive services task force recommendations. *Radiology*, *270*, 354-361.

Stacey, D., Légaré, F., Lewis, K., Barry, M. J., Bennett, C. L., Eden, K. B., . . . Trevena, L. (2017). Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews, 2017*(4). doi:10.1002/14651858.CD001431.pub5

Trevena, L. J., Zikmund-Fisher, B. J., Edwards, A., Gaissmaier, W., Galesic, M., Han, P. K. J . . . Woloshin, S. (2013). Presenting quantitative information about decision outcomes: A risk communication primer for patient decision aid developers. *BMC Medical Informatics and Decision Making*, *13*(Suppl. 2), S7.

U.S. Preventive Services Task Force. (2018). *Published recommendations*. Retrieved from https://www.uspreventiveservicestaskforce.org/BrowseRec/Index

Wegier, P., & Shaffer, V. A. (2017). Aiding risk information learning through simulated experience (ARISE): Using simulated outcomes to improve understanding of conditional probabilities in prenatal down syndrome screening. *Patient Education & Counseling*, *100*, 1882-1889.

Wegwarth, O., Schwartz, L. M., Woloshin, S., Gaissmaier, W., & Gigerenzer, G. (2012). Do physicians understand cancer screening statistics? A national survey of primary care physicians in the United States. *Annals of Internal Medicine*, *156*, 340-349.

Welch, H. G. (2009). Overdiagnosis and mammography screening. *British Medical Journal*, *339*, b1425.

Welch, H. G., & Black, W. C. (2010). Overdiagnosis in cancer. *Journal of the National Cancer Institute*, *102*, 605-613.

Wilson, T. D., & Gilbert, D. T. (2005). Affective forecasting. *Current Directions in Psychological Science*, *14*(3), 131-134.

Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communications Monographs*, *59*, 329-349.

Zikmund-Fisher, B. J., Fagerlin, A., & Ubel, P. A. (2010). Risky feelings: Why a 6% risk of cancer does not always feel like 6%. *Patient Education & Counseling*, *81*, S87-S93.