

Behavioral Economics and Public Health

# Emotions and Health Decision- Making

Extending the Appraisal Tendency Framework to Improve  
Health and Healthcare

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**Abstract**

The growth of a robust body of research examining emotions and decision-making (Lerner, Li, Valdesolo, & Kassim, 2015) and an unprecedented societal focus on behavioral prevention of disease suggests that now is the time to leverage emotion science to improve health and health care. Extending the appraisal tendency framework (Lerner & Keltner, 2000), we predict how emotions may interact with situational factors to improve or degrade health-related decisions. We also discuss how policymakers can leverage emotional influences on judgment and decision-making to improve health decisions and healthcare. Our review examines four categories of judgments and thought processes of clear relevance to health decisions: risk perception, valuation and reward-seeking, interpersonal attribution, and depth of information processing. By building on prior research and theory, we illustrate ways in which a better understanding of emotion can improve judgments and choices regarding health.

## **Emotions and Health Decision-Making: Extending the Appraisal Tendency Framework to Improve Health and Healthcare**

In an era of unprecedented focus on health policy and behavioral prevention of disease (e.g., Barry & Edgman-Levitan, 2012),<sup>1</sup> understanding the relevance of behavioral science to health is critical. The decisions that people make about their health and the health of others significantly affect the quality, trajectory, and length of human life. Given that many causes of mortality and reduced quality of life, such as heart disease, diabetes, and cancer, can be prevented with behavioral modifications (Fisher et al., 2002; Ford, Zhao, Tsai, & Li, 2011; Khaw et al., 2008; Pearson et al., 2002; Stefanek et al., 2009), recent findings from the field of behavioral science specifying how emotion alters judgments and decision making (Lerner et al., 2015) may offer a key to better outcomes.<sup>2</sup> Specifically, contrary to the popular view that emotions generally contaminate rational decision-making, converging evidence indicates that they actually can improve decisions (e.g., Damasio, 1994; Lerner & Keltner, 2000; 2001; Loewenstein & Lerner, 2003).

The field of behavioral economics has begun to make important connections between behavioral science and systems-level interventions. Behavioral economic principles are beginning to be incorporated into health policies and interventions at a variety of levels (see Thaler & Sunstein, 2008). These policies have achieved varied success (see Marteau, Ogilvie, Suhrcke, & Kelly, 2011), but are currently limited to leveraging basic research on economic decision-making, and have not yet capitalized on research demonstrating that emotion influences decisions.

In the health domain, research suggests that global affective states – feeling good or bad – contribute to unhealthy behaviors such as smoking (e.g., Addicott, Gray, & Todd, 2009; Perkins et al., 2008), alcohol consumption (e.g., Kelly, Masterman, & Young, 2011; Ostafin & Brooks, 2011), and overeating (e.g., Loxton, Dawe, & Cahill, 2011). Emotions also contribute to health-related risk perceptions (Peters, Lipkus, & Diefenbach, 2006) and health decisions made in response to numeric information (Peters et al., 2009). However, less systematic attention has been paid to discrete emotions such as anger, fear, sadness, or disgust (and positive discrete emotions such as gratitude or pride), despite evidence in other domains demonstrating that emotions of the same valence (e.g., anger and fear) can yield dramatically different decisions and behaviors (e.g., Lerner & Keltner, 2000; 2001).

Integral emotions – those that are normatively relevant to a decision because they are elicited by a component of the decision or would be influenced by an outcome of the decision – can predict health decisions (see DeSteno, Gross, & Kubzansky, 2013).<sup>3</sup> For example, worry about a health threat may trigger preventive behavior (e.g., Hay, McCaul, & Magnan, 2006). From a functional perspective that views the purpose of emotions as means to motivate fulfillment of goals (see Keltner & Gross, 1999), integral emotions may produce adaptive decisions because they highlight threats, motivate mitigating actions, or signal that a goal has

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<sup>1</sup> See also <http://www.pcori.org/about-us/landing/>

<sup>2</sup> We define emotion as a relatively brief affective reaction to a specific person, situation, or sensory stimuli (see Keltner & Lerner, 2010). Unlike moods, which tend to be viewed as less intense positive or negative affective states that are sustained over some period of time, we use the term emotion to refer to discrete categories of feeling state that differ not only in terms of valence but also on a variety of other cognitive appraisal dimensions (e.g., Smith & Ellsworth, 1985). Our use of emotion is closely related to the concept of an “emotion schema” (Izard, 2007).

<sup>3</sup> Research has also examined how health behaviors might influence emotions, such as with exercise and positive affective outcomes (e.g., Hall, Ekkekakis, & Petruzzello, 2002).

been achieved. However, these are not the only affective influences on judgment and decision-making; consumer and decision scientists have also focused on incidental emotions – those elicited by a person, situation, or stimuli not normatively relevant to the decision – can also influence unrelated decisions (Loewenstein & Lerner, 2003; Loewenstein, Weber, Hess, & Welch, 2001). For example, sadness elicited by a prior event has been found to influence eating behavior (Garg & Lerner, in press). The influence of incidental emotions can linger, even when decision makers face substantial incentives to avoid bias (e.g., Lerner, Small, & Loewenstein, 2004) and after the emotion experience itself has ceased (Andrade & Ariely, 2009; Schwarz & Clore, 1983).

Sometimes the influence of incidental emotions may be overwhelmed by integral emotions– for example, a patient’s amusement over a film may dissipate when she receives a disease diagnosis. However, many complex emotions may contribute to affective experiences at any given time (see Wilson & Gilbert, 2003, for a discussion), and incidental emotions may be equal contributors even when integral emotion is powerful, particularly when the incidental emotion is felt intensely or is the result of a very personally relevant event. Thus, the same cancer patient could feel fear at a diagnosis, but not forget – or stop feeling – the anger she feels over a previous argument with her spouse. Objectively, this incidental anger should not factor into a treatment decision, as it is not normatively relevant to the decision (e.g., Han, Keltner, & Lerner, 2007). However, that anger is still meaningful and salient, and may carry over to influence her subsequent cancer treatment decisions. Thus, it is imperative to consider the influence of both incidental and integral emotions on health judgment and decision-making.

Health-related interventions could capitalize on this basic knowledge of the role of emotion in decision-making. Currently, behavioral economics interventions for population-level health behaviors and decisions tend to take a one-size-fits-all approach. For example, some countries have successfully leveraged basic knowledge about human decision-making and defaults to improve organ donation rates by creating conventions where choices to donate are “opt-out” rather than “opt-in” (Johnson & Goldstein, 2003; van Dalen & Henkens, 2014). This suggests that leveraging defaults may be a promising direction for other behavioral economics health interventions. However, emerging evidence cautions against treating defaults as a panacea: in one instance, an opt-out colorectal cancer screening intervention actually *decreased* screening rates (Narula, Ramprasad, Ruggs, & Hebl, 2013).

Contextual factors such as emotion may explain the varying success or failure of defaults and other behavioral economics interventions. As it turns out, individuals lean more toward the default choice when a decision is emotionally laden (Luce, 1998), as is presumably the case with organ-donation decisions. Moreover, emotions such as anger may reduce (or reverse) reliance on defaults (Garg, Inman, & Mittal, 2005), suggesting the possibility that implementing a default that angers individuals – such as imposing a default option on a behavior that people are extremely resistant to – may backfire. Other examples of behavioral economics interventions that have failed or induced unhealthy behaviors (e.g., Cherney, 2011; Wansink & Chandon, 2006) underscore the importance of understanding contextual factors such as emotion that could predispose success or failure.

### **Connecting Emotion Research with Health Decisions**

The Appraisal Tendency Framework (ATF; Han et al., 2007; Lerner & Keltner, 2000; 2001; Lerner & Tiedens, 2006) provides a useful framework for clarifying and predicting how specific, discrete emotions systematically improve or degrade health-related decisions and interventions. The ATF can identify (1) individual differences in the tendency to respond to

situations with certain discrete emotions (Ambady & Gray, 2002; Lerner & Keltner, 2001) and (2) certain health situations that routinely evoke a particular discrete emotion (such as cancer and fear; e.g., Holland, 2003).

We note that the influence of emotion on particular decision-making tendencies depends on the properties of a decision (Lerner & Tiedens, 2006). For example, the fact that anger increases risk taking may lead to increased benefits when the option associated with the most likely benefit is also uncertain, ambiguous, or risky (Ferrer, Maclay, Rim, Litvak, & Lerner, in preparation), as is the case with some treatments for cancer or other diseases. As such, emotions can facilitate or hinder decision-making – or augment or degrade intervention efforts – depending on the circumstances (Reyna, Nelson, Han, & Pignone, in press). Thus, rather than predicting that a specific emotion is always beneficial or deleterious, the ATF may pinpoint how specific emotions interact with certain types of health decisions, thereby shedding light on decisions that would benefit or be hindered by particular emotions.

Our review focuses largely on research on incidental emotions, because such research involves highly controlled paradigms and experimental inductions, allowing us to draw causal conclusions about the general influence of discrete emotions on judgment and decision-making patterns. Notably, some studies have targeted discrete integral emotions (e.g., fear or worry) in a health context, but typically have not isolated the influence of such emotions on subsequent judgment and decision-making. Rather, these inductions often occur in the context of health behavior change interventions that are designed to intervene on many other constructs and processes (e.g., Portnoy, Ferrer, Bergman, & Klein, 2014; Witte & Allen, 2000). When inductions take this inclusive approach, it is not possible to infer mechanism (Suls, Luger, & Martin, 2010).<sup>4</sup> Thus, such studies cannot fully identify systematic ways that particular emotions can influence patterns of health-related decision-making. For this reason, these studies are beyond the scope of this review. Because theory (Han et al., 2007; Keltner & Gross, 1999; Lerner, Han, & Keltner, 2007) and research (Isen & Erez, 1007; Lerner, Gonzalez, Small, & Fischhoff, 2003) suggest that the pattern of judgment and decision-making arising from an emotion will be similar regardless of whether it is integral or incidental, studies of incidental emotion allow us to infer patterns of the general influence of discrete emotions, both incidental and integral, on health-related decision-making.

In this chapter, we consider the effects of emotion on four general categories of judgments and thought processes relevant to health decisions: risk perception, valuation and reward-seeking, interpersonal attribution, and depth of information processing. We discuss ways in which emotions may improve or degrade health decisions through their influence on these judgments and thought processes in two health decision domains: Choices about health promotion and prevention behaviors (e.g., choices about food, tobacco, physical activity) and medical decisions (e.g., decisions about preventive care and treatment). We then discuss broad policy implications of these areas.

We define decision-making broadly, extending beyond single-event decisions (e.g., cancer screening) to include decisions and choices that contribute to behavioral patterns or maintenance (e.g., decisions to quit smoking or food choices as contributors to a pattern of adhering to smoking cessation or weight loss programs), given that similar underlying psychological, affective, and decisional processes contribute to a diverse array of decisions (e.g., Reyna, 2008). Although maintenance choices are made over time and can require frequent

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<sup>4</sup> Although health researchers have advocated for small –scale experiments that isolate and control constructs in isolation (Suls et al., 2010), in practice this has not occurred with emotion inductions.

decision-making (Rothman et al., 2004), behavioral patterns or maintenance initiated by a single decision (e.g., whether to enter a smoking cessation program) can be influenced by emotion. Moreover, frequently experienced emotions (e.g., those repeatedly triggered by a volatile relationship, a frustrating job, or a satisfying friendship) can systematically influence repeated decisions that contribute to patterns of behavioral maintenance.

### The Appraisal-Tendency Framework

The Appraisal-Tendency Framework provides a useful theoretical foundation for understanding how emotions influence health-related decisions. The ATF assumes that specific emotions give rise to corresponding cognitive and motivational processes that are related to the target of the emotion (i.e., the situation, person, or other stimulus that elicited the emotion), which account for the effects of each emotion upon judgment and decision making. In contrast to theories that predict how broad mood states (positive or negative) may influence judgment and decision making (e.g., Bower, 1991; Forgas, 2003; Isen, 1993), the ATF offers specific predictions for how discrete emotions will influence judgment and decision making (See Tables 1 and 2).

Emotion theorists have argued that a range of cognitive *appraisal dimensions*, or categorical dimensions characterizing cognitive tendencies associated with emotion, usefully differentiate emotional experience. In one empirical examination of appraisal dimensions, Smith and Ellsworth (1985) identified six dimensions that categorize patterns of thinking associated with different emotions: *pleasantness/valence* (whether the emotion is pleasant); *certainty* (whether the emotion was elicited by a predictable stimulus); *personal control* (whether emotion was elicited by something under one's personal control); *other or situational responsibility* (whether the emotion was elicited by a stimulus controlled by another person or a situation); *attentional activity* (whether the emotion was elicited by a stimulus that demands attention); and *anticipated effort* (the amount of effort an individual anticipates will be necessary to deal with the emotion or its elicitor).

According to the ATF, patterns of cognitive appraisals along these dimensions provide a basis for comparing and contrasting discrete emotions. For example, certainty and control are the central dimensions that separate anger from fear. Anger is associated with appraisals of certainty about an event and individual control for negative events. Fear, by contrast, is associated with appraisals of uncertainty about what happened and situational control for negative events. Despite its positive valence, happiness, like anger, is associated with an elevated sense of certainty and individual control (Averill, 1983; Smith & Ellsworth, 1985; Weiner, 1986). Therefore, happiness, at least in one respect, resembles anger more so than fear.

Each emotion is also accompanied by a core *appraisal theme* (Lazarus, 1991), which is a mental schema associated with the emotion that summarize the specific harms or benefits associated with the target or elicitor of the emotion. Emotion-specific core appraisal themes affect the likelihood of specific courses of action (Lazarus, 1991; Frijda, 1986; Roseman, Wiest, & Swartz, 1994; Scherer, 1999, 2001). For example, sadness is accompanied by a core appraisal theme or mental schema of loss; anger involves a core appraisal theme of being slighted or demeaned (Lazarus, 1991). The ATF proposes that these appraisal themes systematically trigger a predisposition toward specific *action tendencies*, behavioral patterns aimed at overcoming obstacles or meeting goals made salient by the emotion and its core appraisal theme (Frijda, 1986). These action tendencies are triggered when the appraisal dimensions associated with an emotion are also relevant to a

particular judgment or decision. For example, fear is associated with high uncertainty and reflects core appraisal themes of being threatened; thus, it is relevant to judgments about risk and triggers risk-avoidant behavior (see also Rivers, Reyna, & Mills, 2008). Sadness, by contrast, is characterized by appraisals of experiencing irrevocable loss (Lazarus, 1991) and thus accompanies the action tendency to change one's circumstances, perhaps by seeking rewards (Lerner et al., 2004).

In sum, the ATF predicts that each emotion has motivational properties that fuel carryover to subsequent judgments and decisions. The form of that carryover is termed *appraisal tendencies* – where the *appraisal dimension* and *appraisal theme* are together activated by the properties of a situation to shape behavioral *action tendencies* that predispose certain judgments, decisions, and actions. Although tailored to help the individual respond to the event that evoked an emotion, appraisal tendencies persist beyond the eliciting situation and affect both the content and depth of thought. Broadly speaking, appraisal-tendency influences on judgment and decision making can be divided into two categories: *content effects* and *depth-of-processing effects*.

### Content Effects

The ATF specifies action tendencies that affect the actual content of thoughts related to a decision (Lerner & Keltner, 2000; 2001). Consider the effects of sadness and anger on judgments of blame. Sadness both co-occurs with appraisals of situational control in the immediate situation and also triggers appraisal tendencies to perceive situational control even in new situations. Anger, by contrast, co-occurs with appraisals of individual control and triggers appraisal tendencies to perceive individual control. Consequently, sad people will attribute blame to situational factors, and angry people will attribute blame to other individuals.

Here, we summarize three categories of judgments or thought patterns that are particularly relevant to health decisions: risk perception and preference; valuation and reward-seeking; and interpersonal attributions such as stereotyping, trust, and blame. These content effects systematically predispose advantageous or disadvantageous health decision-making, depending on the context.

Risk perception. Risk perceptions, or judgments about the likelihood of a given outcome, are influenced by emotions (Lerner & Keltner, 2000; 2001; Loewenstein & Lerner, 2003; Loewenstein et al., 2001; Slovic, Finucane, Peters, & MacGregor, 2002). Given that many health-related decisions are made under the threat of disease (e.g., smoking under threat of lung cancer and cardiovascular disease) and involve factors that influence risk perceptions, such as dread and lack of control, research on emotion and risk perceptions is exceptionally pertinent (see Rothman, Kelly, Hertel, & Salovey, 2003). Emotions associated with certainty and control appraisals are directly relevant to risk (Lerner & Keltner, 2001), given that uncertainty about and lack of control over a threat affect risk perception (Slovic, 1987).

More specifically, converging evidence suggests that fear, anger, and happiness can systematically influence risk perceptions. Compared to happiness (Johnson & Tversky, 1983) and anger (Lerner & Keltner, 2001), fear triggers more pessimistic risk judgments and risk-averse choices. Researchers have applied these findings in attempts to determine when persuasive messages will be most well-received. Individuals respond differently to risk information when it is framed in terms of losses or gains (Kahneman & Tversky, 2000), an effect that can be amplified or attenuated by emotional states (e.g., DeSteno, Petty, Rucker, Wegener, & Braverman, 2004a; Wegener, Petty, & Klein, 1994). For example, loss-framed messages have been found to be more persuasive for sad individuals, whereas happy individuals are more persuaded by gain-framed messages (Keller, Lipkus, & Rimer, 2003; Wegener et al., 1994).

Policymakers may be able to leverage these findings when crafting public health messages. Although most research on risk perception focuses on fear, anger, and happiness, other emotions associated with certainty and control, such as pride and surprise, may also yield systematic influences on decisions under uncertainty (see Table 1 for predictions).

Valuation and reward-seeking. A second category of thought processes relevant to the content of health decisions involves the way estimate the value of different choice options, and the general tendency toward reward-seeking behaviors that favor more highly valued options. These effects are particularly relevant to intertemporal choices, or decisions that require us to weigh smaller, immediate benefits against larger, delayed benefits. Valuation and reward-seeking in intertemporal choice are relevant to many health-related behaviors (Critchfield & Kollins, 2001). For example, drinking alcohol, eating non-nutritious foods, and smoking cigarettes are behaviors that result in immediate hedonic gratification, but avoiding these behaviors can bring a substantial delayed benefit: preventing disease and improving quality of life in older age.

Consistent with ATF predictions, research has shown that sadness increases valuation of reward (and reward-seeking), compared to anxiety (Raghunathan & Pham, 1999), happiness (Chuang & Lin, 2007), and disgust (Cryder, Lerner, Gross, & Dahl, 2008; Han et al., 2010; Lerner et al., 2004). Because of increased valuation of reward, sad individuals are willing to forgo greater future rewards to receive immediate gratification (Lerner, Li, & Weber, 2013). Additionally, although individuals tend to forgo delayed benefits to receive less substantial but immediate benefits (intertemporal choice bias), happy individuals are less willing than individuals in a neutral emotional state to forgo greater future monetary rewards in exchange for receiving lesser rewards more quickly (Ifcher & Zarghamee, in press). Most research on valuation and reward-seeking focuses on sadness, disgust, and happiness, but other emotions with core appraisal themes related to valuation (e.g., envy, hope) are potential avenues for future research (see Table 1).

Interpersonal attribution. Emotions can systematically influence interpersonal attributions such as trust, blame, and stereotyping. Attributions influence physicians' perceptions of patients and patients' responsiveness to physicians. Interpersonal attributions may also play a role in health-related behaviors, such as overeating or smoking, particularly given that many such behaviors are influenced by interactions with peers and others (Conner & Norman, 1996).

Because of increased certainty appraisals and subsequent reliance on heuristics, anger increases stereotyping compared to sadness (Bodenhausen, Sheppard, & Kramer, 1994a; DeSteno, Dasgupta, Bartlett, & Cajdric, 2004b) or fear (Tiedens & Linton, 2001). Anger also increases perceived accountability because of its core appraisal theme of being slighted or demeaned (Lerner, Goldberg, & Tetlock, 1998). Happiness and gratitude, associated with the appraisal that others are in control, increase trust as compared to sadness. Anger, however, lowers trust ratings compared to sadness, again because it is associated with an appraisal of being slighted and demeaned, which does not engender trust (Dunn & Schweitzer, 2005).<sup>5</sup> Moreover, gratitude not only increases trust, but, relative to anger, also makes individuals more likely to accept advice (Dunn & Schweitzer, 2005). Other emotions that may affect interpersonal attributions are pride, envy, and shame (see Table 1).

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<sup>5</sup> Guilt and pride had no influence, perhaps because they are not associated with the other-control dimension.



## Depth-of-processing Effects

The ATF also predicts the depth with which decision-makers process information (Lerner & Tiedens, 2006). Evidence suggests there may be two distinct styles of cognitively processing information: System 1 (heuristic-intuitive) and System 2 (systematic-deliberative) – differentiated by the depth with which information is processed (e.g., Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986; but see Reyna, 2012) – and that our emotions influence depth-of-processing (Lerner & Tiedens, 2006). For example, emotions that have a high certainty appraisal, such as anger and happiness, are associated with heuristic processing (System 1), because certainty leads to less motivation to systematically process or be vigilant towards details (Weary & Jacobson, 1997; Bodenhausen et al., 1994a; Tiedens & Linton, 2001).<sup>6</sup> Emotions such as fear and relief, which are endemic in medical decisions, are also associated with depth-of-processing effects (see Table 1).

Depth-of-processing effects are highly relevant to decisions about health, which typically require individuals to process a great deal of information regarding the risks and benefits of a procedure, screening, or treatment. Further, health communications involve conveying complex information about health risks and preventive behaviors, and the depth with which information is processed could affect how persuasive it is to them. For example, given that individuals tend to be defensive against threatening information (Kunda, 1987), they may be motivated to process the information contained in a health message more heuristically if it is personally threatening.

Heuristic (System 1) processing can also lead to decision biases, even (and here, most prominently) among experts (Reyna, Chick, Corbin, & Hsia, 2014). Emotion-triggered heuristic processing may be beneficial (e.g., when an individual uses heuristic cues to correctly identify evidence-based evidence for engaging in healthy behaviors) or deleterious (e.g., when a patient only skims an informed consent form when participating in a clinical trial), depending on the decision and decision-maker. Indeed, research suggests that anger-facilitated heuristic processing can be beneficial if those heuristic cues are valid (Moon & Mackie, 2007), even improving the degree to which information is correctly extracted and maintained from complex documents such as medical informed consents (Ferrer et al., under review).

Notably, depth-of-processing effects can co-occur and interact with content effects; depth-of-processing can influence how risk information is processed, how information about intertemporal choice is processed, and how that available information is processed into attributions. For example, increased stereotyping in an interpersonal setting involve elevated reliance on heuristic information processing strategies (e.g., Bodenhausen et al., 1994a; DeSteno et al., 2004b).

## Decisions about Health Promotion and Disease Prevention Behaviors

Guided by the ATF, the effects of information content and depth-of-processing can be used to identify ways that emotion may systematically benefit or hinder choices about health promotion and disease prevention behaviors. Given that many health behaviors are undertaken to reduce the risk of disease, emotion has the potential to shape decisions about these behaviors

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<sup>6</sup> Research has also shown that generalized positive affect facilitates flexible thinking (Fredrickson, 2001; Isen, 2001), including by physicians (Estrada, Isen, and Young, 1997). These findings are somewhat contradictory to findings that happiness triggers heuristic processing (Bodenhausen et al., 1994a). There are several potential reasons for this discrepancy, including the possibility that positive affect inductions trigger discrete affective states other than happiness (e.g., gratitude). Indeed, in certain contexts, discrete positive emotion states (hope and pride) are associated with higher and lower levels of fluid processing, respectively (Cavanaugh Cutright, Luce, & Bettman, 2011). A complex discussion of these discrepant results is beyond the scope of this chapter.

through its influence on risk perception. Valuation and reward-seeking can be directly related to health behaviors. Many products currently on the market could be classified as healthful (e.g., gym memberships) or unhealthful (e.g., fast food), and emotions influence purchasing behavior. We also know that emotion effects on valuation influence intertemporal choice, or tendencies to seek immediate rewards despite long-term health benefit (e.g., consumption of unhealthy foods, inactivity, smoking, alcohol consumption). The influence of emotion on interpersonal attribution may also play a prominent role in health behaviors, particularly when those behaviors are motivated in part by social norms or take place in a social context. Finally, emotion-driven depth-of-processing can be relevant to health communications and other health behavior interventions designed to target knowledge. Here, we review research to date that addresses these issues, and consider potential gaps in the field.

Risk Perception and Communication. Emotion influences risk perceptions for diseases that could be prevented through healthy behaviors (e.g., Johnson & Tversky, 1983; Lerner & Keltner, 2001). Further, research on emotion and health message framing has demonstrated that fearful individuals are more persuaded by loss-framed messages about the consequences of failing to eat fruits and vegetables (given that fear promotes loss averse behaviors), whereas angry individuals are more persuaded by gain-framed messages about the benefits of consumption (given that anger promotes approach behaviors and behavioral control), demonstrated by an increase of self-reported intake two weeks after the message was presented (Gerend & Maner, 2011). Thus, emotions such as anger should hinder health decisions under risk framed as losses, whereas fear should benefit these types of decisions.

Valuation and Reward-Seeking. Sadness, associated with high valuation and reward-seeking, increases the consumption of hedonic foods, whereas disgust, associated with trading away or disposal, decreases consumption of these types of foods (Garg & Lerner, in press). Individuals induced to a sad emotional state also consume higher amounts of hedonic foods than those induced to feel happy (Garg, Wansink, & Inman, 2007; Wansink, Cheney, & Chan, 2003). Given the high caloric and poor nutritional content in hedonic foods, food consumption is one domain in which sadness could contribute to less healthy decision-making, whereas disgust or happiness could improve it. This knowledge could lead to ATF theory-based interventions to develop emotion regulation skills to decouple the link between sadness and high-calorie eating.

It is likely that emotion could systematically influence other health behaviors that involve reward-seeking and intertemporal choice. It seems likely that sadness and disgust would influence health decisions like smoking, inactivity, and alcohol consumption, all involving intertemporal choice; sadness should increase willingness to risk later health outcomes in service of immediate gratification associated with negative health behaviors, whereas disgust may demotivate these behaviors. The effect of sadness may be exacerbated in adolescents and young adults, where achieving immediate pleasure is a highly prioritized goal (Reyna & Farley, 2006).

Disgust has already been leveraged in smoking policy, in that many cigarette warning labels target disgust (Hammond, Fong, McDonald, Brown, & Cameron, 2004). Although disgust in these labels may be integrally related to smoking, some warning labels in other countries have been effective to the degree that they elicit disgust even when the disgusting images have seemingly no relevance to smoking (Hammond et al., 2004). Extending this hypothesis, sadness could increase smoking, which has potentially important implications, given that some antismoking advertisements may elicit sadness rather than fear by depicting a dying person.

Interpersonal Attribution. Individuals may be more motivated to engage in interpersonally relevant healthy behaviors (e.g., those involving social normative influence, such

as smoking) if they are experiencing pride, an emotion involving attributions about the self in comparison to attributions about others. Supporting this hypothesis, research has demonstrated that pride increases perseverance on effortful and hedonically negative tasks (Williams & DeSteno, 2008). Han and colleagues (2007) hypothesize that pride may reduce binge drinking, because it may reduce social normative influences (Conner & Norman, 1996) by decreasing self-other similarity. Indeed, research suggests that individuals may differentiate themselves from peers by engaging in behavior they think is desirable but *not* normative, such as reducing alcohol consumption as a function of believing that other students drink excessively (Ferrer, Dillard, & Klein, 2011); pride would likely strengthen these effects. These effects may also generalize to related behaviors, such as exercise, healthy nutrition, safer sex, and abstention from cigarette smoking. As such, pride seems an important emotion to leverage in interventions. Moreover, positioning interventions and communications in contexts where pride is facilitated by an outside source (e.g., sporting events or graduations) may increase their effectiveness.

### **Medical Decision-making**

Both healthy individuals and those with illness or disease are faced with many decisions in a clinical encounter. All patients make decisions about preventive care and screening. Patients with illness or disease also face decisions about diagnostic procedures and treatments, as well as later decisions about adherence to treatment. These decisions, ideally, involve understanding information about risks and benefits, and negotiating those risks and benefits in the context of personal preference, values, and priorities. For this reason, depth-of-processing and risk perception are intimately related to medical decision-making.

Moreover, medical decisions are often highly interpersonal. Clinical encounters can also involve weighing multiple treatment or preventive options, relevant to valuation and reward-seeking. The decision-maker has a team of providers and a network of invested family members, friends, and colleagues, extending the traditional conceptualization of a simpler dyadic patient-provider interaction. This network can actively contribute to decisions, and as such, interpersonal attributions are crucial determinants of the decision process and outcome. As with health decisions, the ATF may be leveraged to make predictions about which emotions may systematically influence particular medical decisions, allowing for a broad picture of which types of emotions help and hinder specific types of medical decisions.

**Risk Perception and Communication.** Because emotion influences perceptions related to disease risk (e.g., Lerner & Keltner, 2001; Peters, Burraston, & Mertz, 2004), anger and happiness should decrease, and fear increase, perceived susceptibility to disease risk in the context of medical decision-making. Consistent with this prediction, basic research has demonstrated that mammography messages framed in terms of gains are more persuasive for happy, compared to sad, individuals (Keller et al., 2003; Wegener et al., 1994).

In practice, risks in medical decision-making are relatively complex. Screening decisions involve weighing the risk of not detecting disease early when it is potentially easier to treat versus the risk of a false positive or of finding disease that would not be fatal (e.g., finding cancer in someone who will likely die of another cause before cancer could progress). Similarly, not undergoing genetic testing means a missed opportunity to address modifiable risk factors among those at high risk (e.g., more frequent mammograms or prophylactic mastectomy to reduce breast cancer risk), whereas testing means a risk of physical or psychological consequences associated with a positive result (e.g., dread associated with having the gene for

Huntington's disease). Treatment decisions also carry risks that are difficult to equate and weigh – risks of drug side effects versus risks of the consequences of failure to adhere (e.g., disease progression or death). Emotions relevant to risk perception may influence these types of decisions differently depending on which risks are salient (e.g., risk of cancer vs. risk of side effects). Often, these trade-offs involve weighing overall risk and benefit rather than systematically integrating such information into the decision (Reyna, 2008; 2012).

In situations in which choosing a risky option is advantageous (e.g., a risky but high reward treatment in absence of other options), the ATF would predict that anger would facilitate risk taking, whereas fear would hinder it. Similarly, in situations where the risk of a false positive screening or detecting disease is salient and *not* screening is rendered a risk-averse behavior, anger would be more beneficial than fear. In contrast, in situations where choosing a risky option is not recommended (e.g., a risky treatment when other effective treatment options are available) or the risk of disease is salient in the context of a screening decision, fear should facilitate decision-making, whereas anger should hinder it.

Valuation and Reward-Seeking. Different types of treatment and preventive care can be subject not only to financial valuation, but also to valuation of the treatment itself – that is, the features of the treatment, including potential benefit and fit with personal priorities and values. Thus, emotions that influence choices involving valuation, such as sadness and disgust, are relevant. Sadness decreases susceptibility to the status quo bias, compared to anger (Garg, Inman, & Mittal, 2005), ostensibly because sadness may trigger the action tendency of seeking a reward to fill a loss – essentially, an extension of demonstrated tendencies to trade away a current product for a new one (e.g., Lerner et al., 2004). This may have implications for treatment-related trade-offs between the status quo (e.g., living with disability) and undertaking treatment (e.g., having surgery). Similarly, some types of screening, such as colorectal cancer screening, can be done using multiple methods that involve tradeoffs between invasiveness and accuracy (e.g., fecal occult blood test vs. colonoscopy); emotion may influence the ways in which these types of options are weighed, and decisions made in these contexts.

In decisions that involve choosing between types of treatment or screening, sadness may hinder decision-making when the status-quo is recommended, and optimize decision-making when there is not a status-quo option. Extending this research, disgust could bias decisions towards refusing *any* treatment; as such, disgust could be anticipated to hinder treatment decision-making (see Reyna et al., in press).

Interpersonal Attribution. Evidence on emotion and attribution suggests that emotions can systematically improve or degrade patient-provider interactions. Anger increases stereotyping (compared to sadness and fear; Bodenhausen et al., 1994a; DeSteno et al., 2004b; Tiedens & Linton, 2001), and attributions of accountability (Lerner et al., 1998). Anger also decreases trust, whereas happiness and gratitude increase it (compared to sadness). Gratitude also increases advice-taking (Dunn & Schweitzer, 2005). Thus, angry patients may be least likely to trust a physician and accept advice (e.g., adhere to recommended treatment) due to increased trust; however, a competing prediction would be that angry patients may be more likely to rely on the expertise of the physician as a heuristic. Patients experiencing gratitude or happiness should be most poised to make the best decisions in situations where the course of action is fairly straight-forward, given high levels of trust and increased reliance on expertise, which could lead to adherence to physician recommendations. Conversely, sadness or fear would enhance decision-making when recommendations are ambiguous and depend on personal values and priorities.

Emotions experienced by the provider during a clinical encounter can also bias patient decisions. This has implications for clinical encounters involving a patient with a condition that can be attributed to behavioral causes (e.g., lung cancer attributed to smoking or diabetes related to poor eating behaviors). Although healthcare providers are trained to avoid conveying blame to patients (e.g., Cegala & Broz, 2003), a provider may be more likely to attribute responsibility to a patient if the provider enters the clinical encounter in an angry state, which has the potential to lead to lower quality of care, poorer outcomes, and less satisfaction in the clinical encounter for those patients. Emotion also influences perspective-taking; shame decreases perspective-taking ability compared to guilt, perhaps because shame is more self-focused (Yang, Yang, & Chiou, 2010). Hence, guilt should enhance, and shame attenuate, a provider's ability to empathize with a patient's situation or best understand the type of care or treatment plan for a given patient.

**Depth-of-Processing.** Given the tendency to process information more heuristically (System 1) and less systematically (System 2) depending on emotional state (Bodenhausen, Kramer, & Susser, 1994b; Mackie & Worth, 1989; 1991; Schwarz & Bless, 1991; Schwarz, Bless, & Bohner, 1991; Tiedens & Linton, 2001), individuals in emotional states that predispose processing styles influence health-related information in a clinical encounter. Although heuristic processing can be adaptive, in that it allows individuals to integrate more perceptual and cognitive information than would be possible with systematic processing, it can also lead to cognitive biases (Tversky & Kahneman, 1974), which can be detrimental when a decision is important. Thus, predisposition towards heuristic or systematic processing could have significant implications for health-related judgment and decision-making, in that it could lead to less careful scrutiny of risks and benefits in informed consent, biasing treatment decisions. Indeed, research shows that emotion can induce heuristic information processing, particularly among men (although note that anger-induced heuristic processing can actually improve understanding and retention of information, as previously discussed; Ferrer et al., under review).

Clinical decision-making offers an interesting context for examining the systematic influence of emotions in an ecologically valid context. For example, some clinical care decisions, such as colorectal cancer screening, can evoke disgust, which could systematically bias individuals in unrelated or tenuously related follow-up decisions. If screening is made salient immediately prior to a treatment decision, and disgust is elicited, it could lead to lower uptake of or adherence to that treatment given that disgust promotes disposal or pushing away. Similarly, Han et al. (2010) speculate that a cancer patient nauseated by chemotherapy might be too inclined to switch therapies, motivated by the disgust appraisal and disposal action tendency, rather than by intolerance for the nausea itself.

### **Policy Implications**

Given the empirically and theoretically supported influence of emotion on health judgment and decision-making, it is critical that research on this topic be considered in public policy. Advances in shaping health policy have recently benefited from behavioral economics (e.g., Johnson et al., 2012; Thaler & Sunstein, 2008), and incorporating emotion research into policy development may further these advances. In an era of rising healthcare costs, changing healthcare policy, and increased regulation of health-related products (e.g., tobacco products), research on emotion and judgment and decision-making needs to be incorporated into policy development. Because of the importance of these connections combined with the dearth of available research, we consider here possibilities for future research.

Importantly, research on emotion offers insights not only for policy development, but for understanding judgment and decision-making among those who are contributing to policy.

Research suggests that differences in political ideology may be due largely in part to individuals' moral judgments (Graham, Haidt, & Nosek, 2009), and that moral judgments have a strong affective component (Haidt, 2001). As such, policy decision-making, particularly as it relates to policies that involve moral foundations, such as universal healthcare, are likely influenced by emotions.

Risk Perception. Many policy-level decisions are informed by expert risk evaluations. For example, experts within the Food and Drug Administration (FDA) inform decisions to approve various drugs based on evidence of efficacy and safety. Similarly, healthcare policy can be informed by decisions made by the U.S. Preventive Services Task Force (USPSTF), a government-appointed expert panel that makes recommendations for screening and other medical guidelines, based on thorough analysis of risks and benefits. Although previously summarized research demonstrates that discrete emotions influence risk perception and judgment under uncertainty, existing research has examined such judgments in the general population. Little is known about the role of emotion in expert risk judgments. For example, expert risk perceptions may be vulnerable to influence by fear or anger, with beneficial or deleterious consequences to the degree that policies are intended to be risk-averse (or vice versa).

Emotion research may also hold the key to effectively implementing regulatory policy. The FDA's regulatory authority over tobacco<sup>7</sup> prohibits any use of terminology to imply tobacco products are lower risk, given that these claims are unsubstantiated (i.e., there is no evidence to suggest that smoking light cigarettes is less risky than smoking other types of cigarettes). Identifying explicit terminology (e.g., the use of "light," "low," and "moderate" as cigarette product descriptors) is relatively simple, but implicit strategies for conveying low risk are more difficult to identify. Research on emotion could help to identify advertisements that leverage visual or linguistic features to elicit emotions associated with certainty (e.g., happiness) that decrease risk perception.

Valuation and Reward-Seeking. FDA's regulatory authority over tobacco products also includes a mandate for graphic warning labels on cigarette packages. Research on emotion, valuation, and choice can lend insight into graphic labels that would be particularly effective (e.g., disgust, reducing valuation and subsequent consumption) versus counterproductive (e.g., sadness increasing valuation and subsequent consumption).

Research on emotion's role in intertemporal choice has lessons for policies facilitating behavioral prevention by identifying which communications and interventions have the most potential for effectiveness, as well as which modes of dissemination would work best. This could maximize government investments such as ongoing healthcare reform efforts in the U.S.<sup>8</sup> that include a \$15 billion fund for prevention and public health programs. Health communications supported under this fund could be strategically matched with television programming that elicits emotions that would potentiate the effectiveness of advertisements (Garg et al., 2007). For example, messages promoting physical activity could be strategically placed to follow a pride-invoking scene (e.g., a scene in which a character reaches his or her full potential professionally or athletically). Conversely, such public health messaging may be less effective when disseminated during television programs that elicit sadness, given that reward-seeking action tendencies (e.g., Garg & Lerner, in press) could override any health behavior intentions generated by health messaging.

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<sup>7</sup> see <http://www.fda.gov/tobaccoproducts/default.htm>

<sup>8</sup> see <http://www.healthcare.gov/>

**Depth-of-Processing.** Given that emotion influences depth-of-processing, emotion research could be leveraged to better communicate health recommendations and policy to the public. For example, better communication strategies for screening guidelines could decrease suspicious reactions to USPSTF recommendations (e.g., recommendations against screening tests such as prostate-specific antigen tests), which could have downstream implications for how the guidelines are implemented in policy. Particular visual cues (e.g., pictures used to prime affective states) could be embedded in such information to trigger emotions associated with improved processing, or such information could be strategically communicated in television programming known to elicit these emotions (e.g., sadness, triggering System 2 processing). Naturally, given the concern for decision autonomy, consumers should be informed about the use of such cues.

Evidence supports the possibility that emotion influences healthcare policy decisions, particularly as they relate to universal healthcare mandates. Sadness increases (and anger decreases) welfare given to hypothetical recipients (Small & Lerner, 2008), an effect driven by depth-of-processing; that is, thinking more in depth about the hypothetical welfare recipient triggered an increased willingness to lend aid in sad compared to angry participants. Thus, sadness and anger experienced by policymakers would be expected to influence healthcare reform policy decisions, such that sad (compared to angry) policymakers could be more likely to vote for policies mandating universal healthcare coverage policies.

### **Broad Future Directions**

Broad research questions related to emotion and health-related decision-making span prevention and promotion choices, as well as medical decision-making. This research has the potential to inform health-related research and policy moving forward. A significant example of such a research question involves examining what happens when integral and incidental emotions conflict (e.g., when an individual enters an anxiety-provoking medical decision-making situation after feeling envious of someone in the waiting room), or when emotions are experienced in concert (e.g., sadness and fear; see Larsen, McGraw, Mellers, & Cacioppo, 2004; Peters et al., 2004). In instances in which mixed emotions arise, *both* emotional states may influence behavior concurrently or interactively (Lerner & Tiedens, 2006). However, there is a dearth of research on mixed emotions – such as sadness and anger as a result of a cancer diagnosis, or the meta-emotional state of being happy about the ability to express sadness (i.e., “to have a good cry,” Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008). Preliminary research has suggested that inducing a contradictory emotion subsequent to an earlier induction is difficult (i.e., sadness blunted subsequent anger and vice versa, Winterich et al., 2008). Moreover, research is necessary to examine how emotions interact with other social psychological or self-related constructs to influence health behavior. For example, fear and anger may reduce the effectiveness of health interventions that rely on bolstering self-integrity (Ferrer, Koblitz, Klein, & Graff, in preparation). Additional research on the influence of blended emotions on health judgment and decision-making is necessary.

In a separate line of inquiry, research is necessary to examine how emotions contribute to habitual or repeated behaviors (e.g., eating choices, smoking, medication adherence). Health behavior offers many promising avenues for extending the ATF to examine complex, real world behavioral decisions potentially influenced by emotion. Further, ecologically valid health-related decision-making research could examine whether emotions influence familiar decisions in the

same way they do novel decisions. Examining repeated choice would also allow for a better understanding of habituation to emotional influences themselves (e.g., repeated disgusting images on cigarette warning labels).

Another question concerns developmental differences in the influence of emotion. Research has demonstrated that individuals rely on affective processes increasingly in later stages of life (Peters, Diefenbach, Hess, & Vastfjall, 2008, Peters, Hess, Vastfjall, & Auman, 2007), potentially due to age-related deficits in the deliberative system that motivate increased reliance on affect and a learned reliance on affective or intuitive processing, which may be more efficient and advanced than deliberative processing (Peters et al., 2007; 2008; Reyna & Brainerd, 2011). Another line of research indicates that emotional influences on judgment and decision-making may also be particularly salient in adolescence (Rivers et al., 2008; Steinberg, 2008), suggesting that the trajectory of emotional influence on decisions may take a U-shaped pattern, where influences are strongest earlier and later in life. Although research in these areas has focused largely on integral affective influences, it stands to reason that age may moderate the effects of emotion predicted by the ATF, such that emotion effects on judgment and decision-making are stronger in adolescence and older age. Research is necessary to examine this possibility, especially in light of research on prefrontal changes and disinhibition in adolescence and old age. This research is particularly important in a health context, as risky behaviors and related health consequences are common in adolescence, and diseases are increasingly prevalent as individuals age.

A final broad future direction concerns leveraging knowledge about emotion and health decision-making to facilitate personalized recommendations about health behaviors, screenings, or treatments. That is, health decisions can also be guided under a decision architecture that takes into account an individual's emotional profile (e.g., developmental influences, individual differences, and state emotions) currently contributing to an individual's emotional state and the likely patterns of judgment and decision-making that will arise in that context. Knowing whether a person is fearful, angry, sad, or disgusted (or some combination of these) in a medical context, and understanding judgment and decision-making implications for such emotion states, has tremendous potential to improve outcomes by allowing healthcare providers the potential to tailor discussions about health behaviors, screenings, or treatments based on patients' emotional state. This may be particularly important in pain or symptom management, where affective beliefs substantially differentiate how patients approach key decisions (e.g., Falzer et al., 2013).

Taken together, this research synthesis indicates that systematic research on emotions and health-decision making can improve health and healthcare. The ATF provides a useful framework to systematically identify ways that specific emotions interact with the situation to engage decision processes that would improve or degrade decisions. This research has implications for understanding and motivating healthy behaviors and improving process of care and medical decisions, with currently under-tapped future translational potential for improving quality, trajectory, and length of life.



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Table 1. Appraisal Dimensions, Core Appraisal Themes, and Content/ Process Effects of Negatively Valenced Emotions

	<b>Anger</b>	<b>Disgust</b>	<b>Sadness</b>	<b>Shame</b>	<b>Guilt</b>	<b>Fear</b>
<b>Appraisal Dimensions</b>						
<b>Certainty</b>	High	High	Medium	Medium	Medium	Low
<b>Personal Control</b>	High	High	Low	High	High	Low
<b>Other/ situational responsibility</b>	High	Medium	High	Medium	Low	Medium
<b>Attentional activity</b>	Medium	Low	Low	Medium	Low	Medium
<b>Anticipated effort</b>	Medium	Medium	Low	Medium	Medium	High
<b>Core Appraisal Theme</b>	Being slighted or demeaned <sup>a</sup>	Taking in or standing too close to an indigestible object or idea <sup>a</sup>	Feeling irrevocable loss <sup>a</sup>	Failing to live up to an ego ideal <sup>a</sup>	Disobeying a moral imperative <sup>a</sup>	Facing existential threats <sup>a</sup>
<b>Content effects</b>						
<b>Risk perceptions</b>	Perceive low risk	<i>Perceive low risk</i>	-	<i>Perceive low risk</i>	<i>Perceive low risk</i>	Perceive high risk
<b>Valuation and Choice</b>	<i>High valuation and reward-seeking</i>	Low valuation and disposal	High valuation and reward-seeking	<i>High valuation and reward-seeking</i>	-	<i>Low valuation and disposal</i>
<b>Interpersonal Attribution</b>	Decrease trust and cooperation, increase blame	-	Decrease trust and cooperation, <i>increase blame</i>	-	Increase trust and cooperation, <i>decrease blame</i>	-
<b>Information Processing Effects</b>	Employ heuristic processing Perceive low "unknown risk" and "dread risk",	<i>Employ heuristic processing</i> <i>Perceive low "unknown risk"</i>	- Seek rewards even in presence of risk	- <i>Perceive low "dread" risk, Seek rewards even in presence of risk</i>	- <i>Perceive low "dread risk"</i>	Employ systematic processing Perceive high "unknown risk" and "dread risk"

Note: Italics denote untested prediction <sup>a</sup>Adapted from Lazarus (1991) p. 826.



Table 2. Appraisal Dimensions, Core Appraisal Themes, and Action Tendencies of Positively Valenced Emotions

	<b>Happiness</b>	<b>Pride</b>	<b>Relief</b>	<b>Gratitude</b>	<b>Hope</b>	<b>Surprise</b>
<b>Appraisal Dimensions</b>						
Certainty	High	High	Medium	Medium	Low	Low
Personal Control	Medium	High	Medium	Low	Medium	Medium
Other/ situational responsibility	Medium	Low	Medium	High	High	High
Attentional activity	Medium	Medium	Low	Medium	High	Medium
Anticipated effort	Low	Low	Low	Low	High	Medium
<b>Core Appraisal Theme</b>						
	Making acceptable progress toward achieving a goal <sup>a</sup>	Feeling self or social worth advancing due to being credited with a highly valued object or accomplishment <sup>a</sup>	Achieving a goal after expecting the worst	Crediting another with an altruistic gift <sup>a</sup>	Fearing the worst but yearning for better <sup>a</sup>	Unexpectedly having a positive outcome
<b>Content effects</b>						
<b>Risk perceptions</b>	Perceive low "unknown risk"	<i>Perceive low "unknown risk" and "dread risk"</i>	-	<i>Perceive high "dread risk"</i>	<i>Perceive high "unknown risk"</i>	<i>Perceive high "unknown risk"</i>
<b>Valuation and Choice</b>	-	-	-	-	<i>High valuation and reward-seeking</i>	-
<b>Interpersonal Attribution</b>	-	<i>Decrease trust and cooperation, increase blame</i>	-	<i>Increase trust and cooperation, decrease blame</i>	<i>Increase trust and cooperation, decrease blame</i>	<i>Increase trust and cooperation, decrease punitive judgments</i>
<b>Information Processing Effects</b>	Employ heuristic processing	<i>Employ heuristic processing</i>	-	-	<i>Employ systematic processing</i>	<i>Employ systematic processing</i>

Note: Italics denote untested prediction <sup>a</sup>Adapted from Lazarus (1991) p. 826.